# Transforming Chennai

A Research Report on Building Micro, Small, and Medium Enterprise Resilience to Water-Related Environmental Change

**NOVEMBER 2016**



AUTHORS
Idicheria, Charis; Neelakantan, Anjali (Coordinating Author); Graft, Auralice; Banerjee, Ayushman and Kumar, Krishna; with guidance from Jessica Seddon and inputs from Eric Vaughan and L. Somasundaram

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Charis Idicheria led the firm survey and analysis of firm data. Anjali Neelakantan wrote the introduction sections as well as parts of the firm survey analysis and ensured overall consistent and clear compilation of sections from all authors. Auralice Graft led the contextual research on environment, access to finance, and insurance. Ayushman Banerjee led the research on the institutional environment for infrastructure. Krishna Kumar contributed to the firm survey and the analysis of ease of doing business.

# About the organisations

### OKAPI RESEARCH AND ADVISORY

Okapi Research and Advisory is an India-based research and strategy group focused on building ecosystems for collaboration and innovation in delivering sustainable development. They work with policymakers to shape the interface between public and private initiatives, financiers to design channels for financing impact, and system influencers to develop forward-looking, evidence-based strategies for achieving collective purpose. Okapi is incubated by IIT Madras and has offices in Chennai and Delhi.
More about Okapi: www.okapia.co

### MERCY CORPS

Mercy Corps is a leading global organization powered by the belief that a better world is possible. In disaster, in hardship, in more than 40 countries around the world, they partner to put bold solutions into action—helping people triumph over adversity and build stronger communities from within. Their portfolio includes more than fifty urban projects in over twenty countries. They are the implementing partner for the Asian Cities Climate Change Resilience Network (ACCCRN) in Indonesia, an initiative funded by the Rockefeller Foundation, and the coordinator of the regional ACCCRN network that seeks to strengthen the capacity of over fifty rapidly urbanizing cities across six Asian countries to mitigate climate-related risks. For more information on Mercy Corps' urban resilience work, visit www.mercycorps.org/resilience
More about Mercy Corps: www.mercycorps.org

# Acknowledgements


### AKARA RESEARCH AND TECHNOLOGIES PRIVATE LIMITED

Akara Research and Technologies Private Limited builds products and solutions that drive informed decision making and enable smart governance. Their products empower enterprises with robust economic estimations coupled with a secure and interactive map display of their internal data. The customised, real-time, map solutions/analytics provide immense value in monitoring the efficacy of delivery of public services as well as making granular geographic interventions in the distribution network for brands. Akara facilitated primary research for the firm survey.
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### INDIAN INSTITUTE OF TECHNOLOGY (IIT) MADRAS

Indian Institute of Technology Madras is one among the foremost institutes of national importance in higher technological education, basic and applied research. The Institute has sixteen academic departments and a few advanced research centres in various disciplines of engineering and pure sciences, with nearly 100 laboratories organised in a unique pattern of functioning. A faculty of international repute, a brilliant student community, excellent technical and supporting staff, and an effective administration have all contributed to the pre-eminent status of IIT Madras.
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### MADRAS CHAMBER OF COMMERCE AND INDUSTRY (MCCI)

The Madras Chamber of Commerce and Industry was set up in 1836 and is one of the oldest chambers in the country. The Chamber is a non-governmental, industry-led and industry-managed organisation and proactively seeks to influence public policy and practice on issues which impact economy, trade, commerce, and industry as also social processes such as education and health, infrastructure and environment.
More about MCCI: www.madraschamber.in

### NURTURE ENTREPRENEURSHIP DEVELOPMENT TRUST (NURTURE TRUST), IN PARTNERSHIP WITH SRM UNIVERSITY AND FEEDBACK CONSULTING

The focus of Nurture Trust is to nurture the spirit of entrepreneurship and to encourage its practice, by creating the required environment where committed entrepreneurs can flourish. Nurture Trust, founded by Indian Institute of Technology (IIT) and Indian Institute of Management (IIM) alumni with entrepreneurial background, has the following objectives: to nuture entrepreneurship to create a strong backbone for India's growth, To provide guidance to emerging entrepreneurs, To serve as a knowledge sharing platform and to propagate entrepreneurship amidst students and youth, to celebrate entrepreneurship itself, and to conduct events, programs, clinics and other interactions of interest to entrepreneurs and public at large.


### TAMIL NADU SMALL AND TINY INDUSTRIES ASSOCIATION-FRIEDRICH NAUMANN FOUNDATION SERVICE CENTRE (TANSTIA-FNF)

TFSC (TANSTIA-FNF Service Centre), a collaborative venture between Tamil Nadu Small and Tiny Industries Association (TANSTIA) and Friedrich Naumann Foundation (FNST), Germany, was established to render supporting services to Micro, Small, and Medium Enterprises. They have been a pioneer centre in providing the right support services like Training, Consultancy, Information, and Handholding with the objective of promoting entrepreneurship and improving the competitiveness of existing enterprises. TFSC also works at the macro level for the long-term sustainability of the SME sector. Their macro activities include Economic Lectures, Conferences, undertaking studies, and researches for SMEs, acting as a Think Tank for the issues connected with SMEs.
More about TANSTIA-FNF: www.tanstiafnf.com


### ZION RESEARCH AND CONSULTANTS

Zion Research and Consultants (ZionRC) is a registered Chennai-based market research/ social research data collection firm. ZionRC handles all kinds of market research and social research data collection works – quantitative and qualitative surveys. ZionRC has field teams across Tamil Nadu and other South Indian States. Zion provided transcription and translation support for the firm survey.
More about Zion Consulting: www.zionrc.com

In addition, we would like to thank the experts consulted (listed in Annexure 4) for their time and insights.

DISCLAIMER:
While the key organisations and experts consulted listed in the acknowledgements and Annexure 4 provided significant input to the development of this report, their participation does not necessarily imply endorsement of the report's contents or conclusions.

# Foreword

This study was conducted with the support of Mercy Corps' South and East Asia Regional Resilience Hub and funded by its Challenge Fund. The aim of this grant was to increase understanding of the risks and opportunities associated with rapid urban growth in major Asian cities like Chennai, India and help identify appropriate solutions and partnerships for action.

At Mercy Corps, we recognize that the complexity of urban challenges requires multi-scale and multi-sector solutions that focus on resilience and enable new forms of collaboration. Asia's cities are expanding rapidly in some of the most economically attractive but ecologically vulnerable terrain leaving concentrated populations more at risk of climate change and extreme weather events. In places like Chennai, India, public institutions and services have not kept pace with the influx of migration, business growth, and demands on infrastructure. In December 2015, devastating floods in Chennai, India took more than 300 lives, displaced around $1.8 million people, and caused at least $3 billion of damages and losses.

Mercy Corps is committed to working with civil society, government, private sector, and communities to understand the ecological, economic, social, and infrastructure-based vulnerabilities in urban landscapes, and identifying what capacities can help prevent and mitigate risks to sustain long-term growth.

To enable collaboration for urban resilience, Mercy Corps provides technical support in urban systems mapping as part of our Strategic Resilience Assessment (STRESS) methodology. Through practice, STRESS supports our partners and local stakeholders become: proactive—by establishing an evidence-based, "good enough" contextual understanding; and adaptive—by developing resilience strategies that can be tested, measured, and enhanced over time.

By lending our expertise in urban systems and capacities analysis for resilience to our local partner Okapi, our goal is for this study to contribute to shared learning and action for a more resilient Chennai. There are important lessons in this study on the impact of floods on small enterprises for urban planners and business leaders in India and other countries that are facing similar climate-induced risks.

Olga Petryniak
Director, Regional Resilience Initiatives | South and East Asia
Mercy Corps

# Executive Summary

This study analyses the interplay between urban planning and business climate in shaping micro, small, and medium enterprise (MSME) resilience to the effects of a major flooding event in Chennai, India in December 2015. It complements and builds on other groups' evaluations of the magnitude of economic damage from those floods by investigating the mechanisms through which rainfall became flooding, and flooding became social and economic loss. Our hope is that the study will inform urban infrastructure planning as well as targeted interventions in improving the business context to allow smaller firms to not only start up and grow in normal times, but also survive and even thrive after severe shocks. We argue that resilience should become an integral part of evaluating the business environment and the ease of doing business not only in Chennai but in broader business climate evaluation efforts.

The report begins with a comprehensive description of how emergent patterns in urbanisation in and around Chennai affect regional hydrology. Rapid expansion of built-up area to meet housing, commerical, and industrial development pressures over the last few decades has meant that many of Chennai's more flood-prone areas are now in everyday use. Drainage infrastructure has not kept up with the increasing needs to compensate for compromised natural buffer zones. The waterways and micro drainage that do exist are operating below capacity due to accumulated waste and silt. Overall, pressures of and for rapid growth have superseded longer-run investments in maintaining the capacity to channel out-of-the-ordinary rainfall into the sea or for drinking water storage. Institutional fragmentation in water and flood management further impede the city's resilience—in terms of preparedness, management, recovery, and rehabilitation—to floods and other water-related environmental hazards.

Floods around the world often have disproportionately harmful impacts on low-income households and small businesses. The third section in this report highlights the prevalence, importance, and vulnerability of one of these critical groups in the Chennai region: MSMEs. These firms are a vital part of the national, state, and city economy. They were also one of the significantly affected sectors during the December 2015 floods.

The core of this study is the primary research conducted with 35 MSMEs and two large corporations. We apply a resilience framework which highlights aspects in the business and institutional environments that

either amplify (worsen) or dampen (decrease) the impact of water-related hazards such as the December 2015 floods on MSMEs. This section discusses key factors in the business environment that influenced the economic outcomes experienced by MSMEs after the December 2015 floods. Location in vulnerable areas; inadequate, unreliable, and slow finance; difficulties in training and replacing labour; and uninsured, unprotected large stock and inventories acted as amplifiers. Insufficient insurance proved to be a poorly performing dampener in most cases, and unattainable for over a third of the interviewed firms. Employees were key to relief efforts and proved to be the most reliable and consistent dampener in the aftermath of the floods. These factors not only help to explain why the economic impacts were so vast and hard to overcome, but also the importance of cultivating pro-resilience choices and arrangements for MSMEs.

The amplifier/dampener framework helps to unbundle factors that mitigate a firm's ability to absorb and adapt to natural shocks.  Planners can use this tool to devise targeted and collective solutions that enhance strengths and address weaknesses in the multi-stakeholder system that is captured here. We offer recommendations to build resilience through a multi-temporal framework in which firms, industrial associations, financial bodies, insurance providers, and public sector institutions all have roles to play. Immediate and long-term collective efforts on many fronts are required to ease MSMEs' significant distress in the wake of the December 2015 floods, and to prevent further devastation from future hazards.

We conclude the report with our plans to take the research forward. We are committed to creating strategies that improve resilience in the city of Chennai and the larger region around it. And we invite you to join us in this vision.

# Table of Contents

# List of Figures and Text Boxes

## FIGURES



## TEXT BOXES

# Acronyms and Abbreviations

| | |
|---|---|
| **APEC** | Asia Pacific Economic Cooperation |
| **CC** | Cash Credit |
| **CGTMSE** | Credit Guarantee Fund Trust for MSME |
| **CMA** | Chennai Metropolitant Area |
| **CMC** | Chennai Municipal Corporation |
| **CMDA** | Chennai Metropolitan Development Authority |
| **COO** | Chief Operating Officer |
| **ECR** | East Coast Road |
| **EIA** | Environmental Impact Assessment |
| **EMI** | Equated monthly installment |
| **FDI** | Foreign Direct Investment |
| **FSI** | Floor Space Index |
| **GCC** | Greater Chennai Corporation |
| **GCI** | Global Competitiveness Index |
| **GDP** | Gross Domestic Product |
| **GO** | Government Order |
| **GST** | Grand Southern Trunk Road |
| **IDFC-I** | Infrastructure Development Finance Company Institute |
| **IE** | Industrial Estate |
| **IIT** | Indian Institute of Technology |
| **IMD** | International Institute for Management Development |
| **INR** | Indian Rupees |
| **IRDA** | Insurance Regulatory and Development Authority |
| **IT** | Information Technology |
| **ITES** | IT Enabled Services |
| **JIT** | Just-in-time |
| **JNNURM** | Jawaharlal Nehru National Urban Renewal Mission |
| **MCCI** | Madras Chamber of Commerce & Industry |
| **MNC** | Multinational Corporation |
| **MSME** | Micro, Small, and Medium Enterprise |
| **MSMED Act** | Micro, Small, and Medium Enterprises Development Act |
| **NDRF** | National Disaster Response Fund |
| **NH** | National Highway |
| **NITI Aayog** | National Institute for Transforming India |
| **OD** | Overdraft |
| **OMR** | Old Mahabalipuram Road |
| **PAN** | Permanent Account Number |
| **PWD** | Public Works Department |
| **RBI** | Reserve Bank of India |
| **RWH** | Rainwater Harvesting |
| **SEZ** | Special Economic Zone |
| **SIDBI** | Small Industries Development Bank |
| **SIDCO** | Small Industries Development Corporation |
| **SME** | Small and Medium Enterprises |
| **SMERA** | Small and Medium Enterprises Ratings Agency Limited |
| **SPV** | Special Purpose Vehicle |
| **STP** | Sewage Treatment Plant |
| **TAN** | Tax-Deduction Account Number |
| **TANSTIA** | Tamil Nadu Small and Tiny Industries Association |
| **TFSC** | Tamil Nadu Small and Tiny Industries Association-Friedrich Naumann Foundation Service Centre |
| **TIIC** | Tamil Nadu Industrial Investment Corporation Limited |

| | |
|---|---|
| **TN** | Tamil Nadu |
| **TNHB** | Tamil Nadu Housing Board |
| **TNSCB** | Tamil Nadu Slum Clearance Board |
| **Ulip** | Unit linked insurance plan |
| **USD** | United States Dollar |
| **WEF** | World Economic Forum |
| **WRD** | Water Resources Department |

# 1. Introduction

Cities matter. They are complex socio-economic systems, engines of growth and development, and home to an increasing share of the world's population. They are also focal points for new risks and vulnerabilities as the intersection of economic development, increasing population density, and environmental change creates a new range of challenges for policymakers, investors, and citizens alike.

We focus here on floods, one of the most visible, damaging, and pervasive forms of natural disasters. Warmer oceans and melting glaciers are causing sea levels to rise and inundate low-lying areas across the world, threatening coastal populations. These developments, combined with shifts in rainfall patterns, have contributed to an increased number of floods (UNISDR, 2015). Floods account for 47% of all weather-related disasters and have affected 2.3 billion people around the world (UNISDR, 2015). The impacts are rarely uniformly distributed—wealth, social networks, access to finance and insurance, and other features of the socio-economic-institutional environment enable some individuals and businesses to be more resilient than others (Levina and Tirpak, 2006).

Our study site, Chennai, exemplifies these developments. As a coastal city located at the delta of three rivers, it is vulnerable to flooding from the coastal side as sea levels rise and cyclones intensify, as well as from inland, where rainfall patterns and intensity are projected to shift (Bal *et al.*, 2016). Rapid and unplanned economic growth, mixed regulations around land-use, and an ever-increasing demand for housing have altered Chennai's hydrology and led to an overall increase in vulnerability to flooding. The December 2015 floods in coastal Tamil Nadu highlighted these developments in stark ways.

Chennai and its environs got more than double the seasonal average rainfall in the period leading up to December 8, 2015, provoking severe waterlogging and flooding (Narasimhan *et al*, 2016). A record-breaking 272 mm (50% more than the city typically receives in the entire month of December) fell in just 12 hours on December 1. Floods inundated the city, including the airport, major train stations, and roads in and out of the metro area, leaving many citizens stranded (The Financial Express, 2015b; Greater Kashmir, 2015). The rainfall, reported to be the heaviest in 100 years, resulted in the displacement of over 18 lakh people in the city, with economic losses estimated at INR 50,000-1,00,000 crores, making it the eighth most expensive natural disaster in the world in 2015 (Mariaselvam and Gopichandran, 2016; Rana, 2015; Potarazu, 2015). The floods were particularly acute in some of the newly developed residential and commercial areas. Some of Chennai's critical infrastructure, including the airport, some medical facilities, and power stations, is also located in vulnerable areas.

We focus here on a particularly hard-hit subset of stakeholders in the greater Chennai area: Micro, Small, and Medium Enterprises (MSMEs). These small businesses—3.31 million enterprises in the state and 34,358 in Chennai district[1] — are a vital part of the economy in the greater Chennai area, both in terms of aggregate contribution to regional output as well as in terms of employment. They employ over 8 million people in the state, and 0.22 million in the metro area. MSMEs are also critical to local, national, and global supply chains of firms of all sizes (Business Standard, 2015; MSME-DI, n.d.(a); MSME-DI, n.a.(b); Ministry of MSME, n.d.). The rains in December 2015 caused severe economic losses and disrupted much MSME activity. Many are yet to recover almost a year later. A Small and Medium Enterprises Ratings Agency Limited (SMERA) study reported that the MSME sector lost INR 1,700 crores in two weeks of flooding (DNA India, 2015a).

One of the entrepreneurs who participated in this study's firm interviews highlighted some of the business effects on large industrial areas after the 2015 Chennai floods:

> *"Let me share some information with you. In Ekkattuthangal, there are 1200 companies. We have started an association for them and as a step, we helped 100 companies to shift and start their business in Thirumudivakkam. After this flood, almost 25% of the micro industries there lost their business. When I happened to meet one such person, he said, he has sold his machineries, paid all his debt with that and started working in a petrol bunk. Why? Because he cannot repair all the machines and come up from the scratch. Another person who had a fabrication company, started his career as taxi driver in Goa…"*

This quote is telling of the impact of the December 2015 floods in Chennai and the need for greater research and action.

In studying the factors that convert heavy rainfall into floods, and floods into disasters with severe economic impacts, we ask a number of questions typical of the broader literature on resilience studies: What does it mean for a vulnerable group to be resilient? How can we increase the resilience of vulnerable groups? Why is it important for them to be resilient? What are immediate and long-term strategies that can be put in place to protect these vulnerable groups? What roles can government, civil society, firms, and individuals play in building resilience?

In the aftermath of the floods, various studies were undertaken to estimate the losses incurred by MSMEs in the greater Chennai area. Most of them focused on quantifying financial loss, but few delved into the factors that made it easier or more challenging for firms to recover from the damage caused by the floods. This study attempts to fill that gap—to build on the count of losses to uncover the reasons for the losses and, ideally, ways to reduce them.

Taking into account the larger economic, political, and institutional system, this study identifies strategies through which policymakers, industry associations, and businesses themselves can help build MSME resilience to floods. Over the course of the study, Okapi worked with and consulted key stakeholders including industry bodies Madras Chamber of Commerce and Industry (MCCI), the Tamil Nadu Association of Small and Tiny Industries Association-Friedrich Nauman Foundation Service Centre (TFSC), Nurture Trust, government officials at the state and city level, academics at the Indian Institute of Technology (IIT) Madras, banking and insurance specialists, and environment and planning experts.

Our findings on how unusual rainfall became floods build largely on secondary research, supplemented by interviews with key officials and stakeholders involved in India's infrastructure system. Chennai's infrastructure challenges have been well documented over the years, and we compile and analyse this research to set the context. Our findings about the factors in the business environment that affect the economic impact of flooding are the heart of this study. These are based on in-depth interviews with 35 representative enterprises in the MSME sector to understand their general business operations, finance, institutional support received, rationale for various choices (such as location), the extent of disruption and damage caused by the December 2015 floods, steps adopted to resume production, and firm 'asks' in terms of relief measures expected from government agencies, financial institutions, insurance agencies, and industrial associations. We selected the firms to ensure representative locations, size, and cross-sector diversity.

We believe these detailed interviews will enrich the policy discourse, especially in light of the increased attention to MSME support and a likely introduction of a new policy framework in the coming months. MSMEs are expected to be a critical part of the union government's Make in India programme, which aims to transform the country into a manufacturing hub (The New Indian Express, 2015). As of January 2016, MSMEs contributed almost 8% to the national Gross Domestic Product (GDP), 45% to the total manufacturing output of the country, and employed over 80 million people (Ministry of MSME, 2016). Our findings add a new dimension to consider in ongoing national strategies to support MSMEs: building the foundations for business continuity as well as business initiation and growth.

On a deeper level, this study holds lessons for other cities. Neither the drivers of change affecting hydrology nor the challenges of striking a balance between developing land for near-term economic uses and conserving the lakes, rivers, and open spaces that support longer-run sustainability are unique to Chennai. Bangalore, Mumbai, and Hyderabad, for instance, are also built on river basins and water bodies, and have been criticized for ignoring hydrology and broader environmental planning (Nirmal, 2015;

Ravindran, 2015). The governance challenges of integrating water management are also common across India's cities, which are governed by a fragmented set of national, state, and local agencies and political currents. The simple observations of floods in Chennai and other cities have already provided lessons for newer cities. Urban planners are now ensuring that Amaravathi, the new capital of the Andhra Pradesh State, is not built on the flood plains of the Krishna River (Rao, 2016).

[1] State and district figures refer to the number of registered MSMEs in 2014-15.

# 2. Chennai

## A Delta City

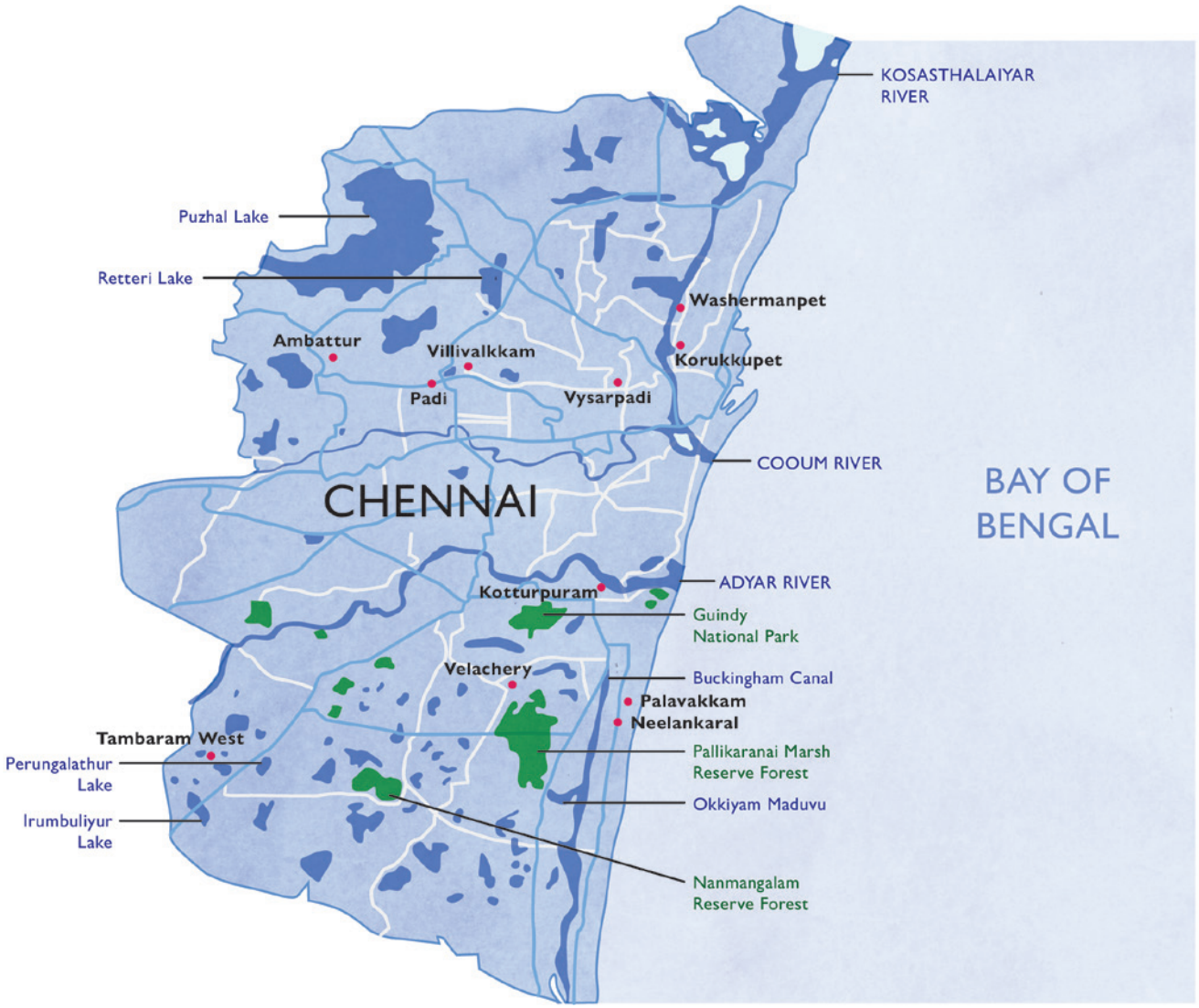



**FIGURE 1:** MAP OF CHENNAI DEPICTING THE COURSE OF WATER BODIES

Adapted from: Subramanian, TS. (2015). *Rain & Ruin.* Frontline Magazine.
Retrieved from: http://www.frontline.in/the-nation/rain-ruin/article7911881.ece

The initial media-led diagnostic of the causes of the 2015 flood focused sharply on infrastructure, in particular the management of the Chembarambakkam Dam in the eastern part of the city. It was alleged that the Public Works Department (PWD), whose responsibilities include flow control from tanks into waterways among other duties, displayed poor judgment in delaying water release until levels had gotten too high to control without inundating homes and businesses along the banks of the Adyar River (Janardhanan, 2015a; Rajendran and Ramanathan, 2015; DNA India, 2015b; Ramani and Srinivasan, 2015; Ramalingam, 2015; The Times of India, 2015a; The Economic Times, 2015).

Stepping back, however, it is clear that this particular set of decisions was just part of a larger system that was not prepared to handle the level of sustained and intense rainfall that the Chennai area experienced. The resulting flooding had deeper roots in the city's hydrology, land-use patterns, and the state of drainage infrastructure. Both the patterns and persistence of inundation indicate the need to take a broader look at how Chennai has evolved (Narasimhan *et al*, 2016).

## A. Nature of Urbanisation in Chennai

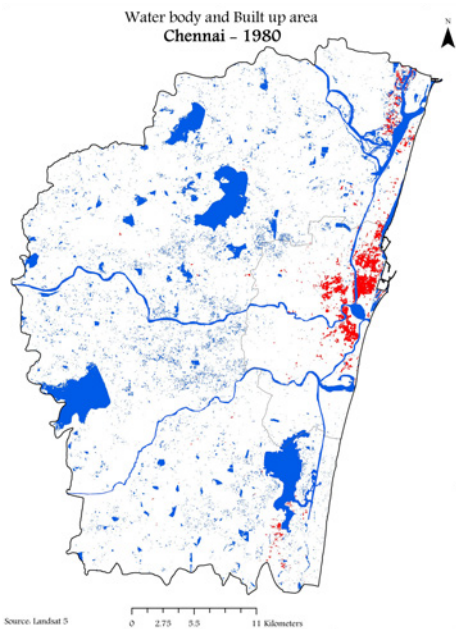
Chennai lies on the Tamil Nadu coast of the Bay of Bengal, in the rain shadow of the Western Ghat mountain range. The city's watershed is defined by two flood plains adjoining two major rivers: the Cooum and the Adyar. The 418 km-long Buckingham Canal, constructed in the early 19th century for navigation, is a third significant water course and a smaller river, the Kosathalaiyar, traverses parts of the city's northern fringes. Chennai's three rivers run west-to-east, and the Buckingham Canal runs north-to-south (Narasimhan *et al*, 2016). Several lakes, about 50 tanks, and a network of canals, creeks, and estuaries, as well as the Pallikarnai Marshland, help drain the watershed.

Most of the city is at a low elevation, averaging 6.7 meters from the mean sea level (Lavanya, 2012), making it inherently vulnerable to water-related hazards. "This means it is at risk to floods, droughts, and sea-originating shocks such as storms, cyclones, and tsunamis", says Jayshree Vencatesan of Care Earth Trust, a conservation and biodiversity organization in Chennai (Dr. Jayshree Vencatesan, Care Earth Trust, personal communication, March 10, 2016). Coastal proximity also means that Chennai is vulnerable to meteorological events such as El Nino, which may have impacted the severity of rainfall during the December 2015 floods, and Bay of Bengal warming, which can increase depressions during certain seasons (Narasimhan *et al*, 2016). In addition to coastal events, sea level is rising along India's eastern coast at an estimated average rate of 1.3 mm per year, and is likely to become an increasing threat to the city in the coming years (Ministry of Environment, Forest and Climate Change, Government of India, 2010).

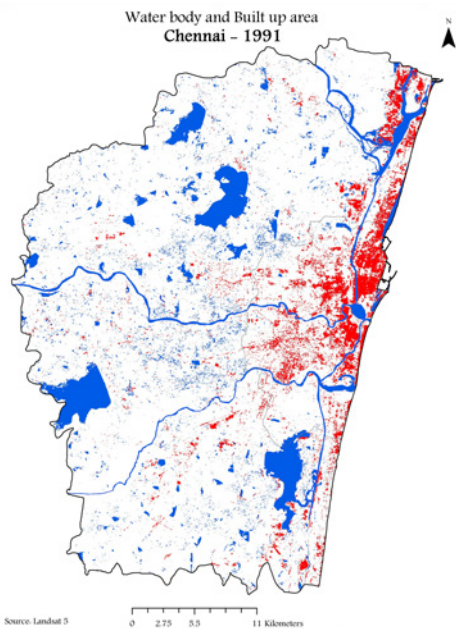
Like many Indian cities, Chennai has grown quickly in recent decades. The greater Chennai area now covers approximately 550 square kilometres of surface built-up area (Dr. Jayshree Vencatesan, Care Earth Trust, personal communication, July 19, 2016), substantially larger than its 176 square kilometre Municipal Corporation boundaries. It is starting to fill out the larger (1189 square kilometre) Metropolitian Development Authority area.[2] According to a recent study conducted by Care Earth Trust, the built-up area in Chennai has increased from 20% to 85% of total area between 1980 and 2010 and the area under wetlands has decreased from 80% to 15%. This rapid expansion was characterised by significant changes in land-use and increasing encroachment of water bodies—both of which translate into reduced natural buffers.

The following four maps indicate some of the changes over the last three and a half decades.[3]

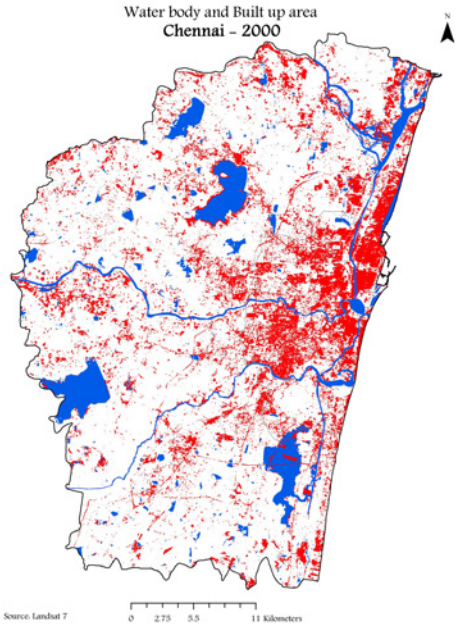
MAP 1: 1980




MAP 2: 1991




MAP 3: 2000




MAP 4: 2010

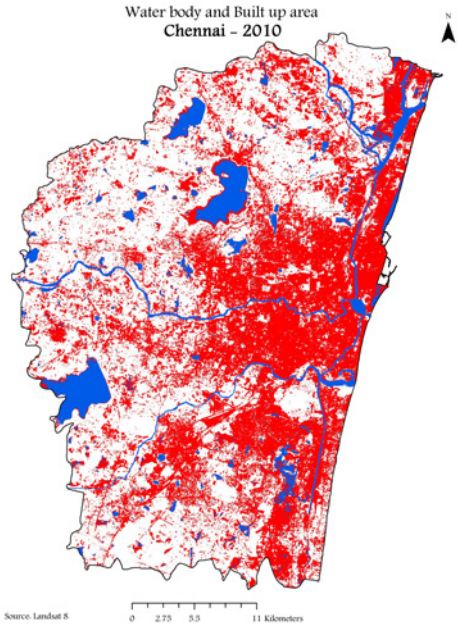



**FIGURE 2:** WATER BODY AND BUILT-UP AREA MAP OF CHENNAI IN 1980, 1990, 2000, AND 2010

Source: Ongoing research program on urban ecology, initiated in 2015, Care Earth Trust, Chennai.

LEGEND

- Chennai Boundary
- Greater Chennai boundary
- Built-up
- Water body / Wetland

The first map (Map 1 - 1980), from 1980, shows development in Chennai City as primarily centred at the mouth of the Cooum River where it meets the Bay of Bengal, in what is now known as Georgetown, Egmore, and Triplicane. Small amounts of additional development extended northwards along the Buckingham Canal, with tiny pockets further north around the mouth of the Kosathalaiyar River in the Ennore region, as well as to the south of the Pallikarnai Marsh, along the Old Mahabalipuram Road.

Eleven years on, in 1991, development began to extend northwards, on land that lies between the coast and the Buckingham Canal, towards what is now known as Tiruvottiyur. Development also extended westward into the spaces that lie between the Buckingham Canal, the Cooum River, and the Adyar River—what are now Egmore, Gopalapuram, and Mylapore. Chennai's flood plains and coastal areas were increasingly built-up, and the mouths of Chennai's rivers increasingly congested with development.

By 2000, Chennai's two flood plains adjoining the Cooum and Adyar Rivers were significantly developed. Neighbourhoods like Ethiraj Nagar and Purasawakkam had emerged, as well as new development to the west of Guindy National Park. The banks of the Cooum and Adyar, as well as those of the Buckingham Canal, the Red Hills, and northwestern Puduvoyal Lakes to the southern Pallikarnai Marshland also experienced encroachment. Around half of the agricultural lands that existed in the 1990s were fully encroached by 2004, with the growth of the city being triggered by economic activities along the Grand Southern Trunk Road (GST), Old Mahabalipuram Road (OMR), and National Highways NH4, NH205, and NH45 (Swamidurai, 2014).

Finally, by 2010, Chennai's two flood plains were almost entirely built-up, and extensive development had spread south and south-eastward, swallowing up most of the Pallikarnai Marshland into areas including Perungudi, Velachery, and Sholinganallur, as well as along the East Coast Road (ECR). Almost all of the city's land area was now built-up, and all water bodies except those on the very outer edges were completely surrounded by development.

## B. Drivers of Change

The maps in Figure 2 (pg. 19) show how much land-use in Chennai has changed over the past three decades. What has driven these changes? What led Chennai to expand its built-up area so dramatically? Why has expansion gone in the directions it has, including into vulnerable zones?

At a very broad level, the reason is accelerating urbanisation. The changes we describe in subsequent subsections—growth-oriented planning, demand for housing, and incomplete implementation of efforts to conserve wetlands, and the ways in which they have contributed to an evolving built-up environment that is at odds with hydrology—are not mutually independent or isolated factors.

The Chennai metropolitan area's population almost doubled between 1981 and 2011, growing from 4.6 million to 8.7 million (Census 2011).[4] This rapid urbanisation can be explained in part by Tamil Nadu's

higher-than-national-average education levels, which enable more people to transition from agricultural to non-agricultural work (Kolappan, 2015). Other factors include improved state-wide transportation, availability of better education facilities within the city, and employment opportunities inside Chennai (Kolappan, 2015).

*Finally, by 2010, Chennai's two flood plains were almost entirely built-up… and all the water bodies, except those on the very outer edges were completely surrounded by development.*

### Growth Orientation in Planning

Chennai's growing economy has also created new pressures to expand the built-up area for housing and commercial use. The metropolitan area is currently India's fourth largest economy, and its GDP per-capita growth was highest in India between 2000 and 2014 (Raghavan, 2015). The World Bank ranked Chennai ninth among Asia-Pacific "super rich" cities, its ranking increasing from 390 to 130 over the last 15 years (India Today, 2016). While an estimated 70% of employment takes place in the informal sector, including in micro and small enterprises and the self-employed (Kennedy, *et al.*, 2014), the major drivers of Chennai's economic growth are its manufacturing sector and its "new economy" —or informational technology (IT) and IT Enabled Services (ITES) —industries.

These industries—and the infrastructure to sustain them—have been encouraged under Chennai's planning framework. The Chennai Metropolitan Development Authority (CMDA) was set up in 1973 to plan for population and economic growth in the metropolitan area through strategic master plans, zoning for specific land-uses, and overseeing and enforcing the development approvals process; among other coordinative and advisory roles. Although the formal documents and particularly the 2006 Master Plan do take note of environmental concerns and designate some areas such as the Pallikarnai Marsh as protected, the overall planning regime has been growth-oriented.

Key measures include a 2009 revised comprehensive development plan that sought to position Chennai to compete for international investment—a move that called for high-quality infrastructure facilities and services (GHK Consultants, 2009). Chennai's Master Plan and City Development Plans also highlight growth and strategic planning while emphasizing the need for improved infrastructure.

IT-related construction is specifically incentivized in Chennai's development plan (Chennai Development Plan, 2006), and is exempt from Environmental Impact Assessment (EIA) requirements (Kennedy, *et al.*, 2014). Large public infrastructure investments such as Chennai's Anna International Airport, the Taramani IT Park, and the new Transit Corridor have also been developed on some of the city's most vulnerable lands (The Quint, 2015; Jayaraman, 2015; Vasudeva, 2015). There have been some efforts to reduce pressure for expansion of built-up area (and thus relieve pressure on surrounding wetlands), but these are not comprehensive. The CMDA expanded its floor space index (FSI) —the ratio of built-up space on a plot to the area of the plot—in 2009 to include a premium FSI, making higher construction possible for the IT expressway along the OMR (The Quint, 2015; Jayaraman, 2015; Vasudeva, 2015; CMDA, n.d.(a); Sivan, 2009). FSI within the city, however, is more restricted (Adlakha, 2015b).

Within this framework, there are norms for land-use planning that include environmental considerations, but these are not fully integrated into infrastructure decision making. The complexities of flooding

and flood management are recognized in the second Master Plan. For example, the CMDA suggests the Public Works Department (PWD) takes on the responsibility as the key nodal agency for all flood related matters. However, this structure complicates prospects for leveraging land-use planning as a substitute for drainage—avoiding build-up of excess water instead of building infrastructure to remove it (CMDA, n.d.(a)).

Many of the so-called "wastelands" (also known as "poramboke lands") have also been encroached and reclassified for commercial and residential purposes (The Hindu, 2010). The designation of wasteland has been applied liberally since the colonial era, when land was categorized as either agricultural or forest, ignoring seasonal land-uses (Menon, 2004)[5]. This means the space around most water bodies was and continues to be classified as "wasteland" and is susceptible to encroachment of all types (Vencatesan, 2006).

It is unclear when the process of converting poramboke lands for commercial purposes began, but the changes in land-use are clearly underway. Wetland rules were tightened in 2011 to protect against indiscriminate development (Sivan, 2011). What once required just the Tehsildar's permission now requires three levels of verification by the District Collector and regulatory agencies like the CMDA and the Directorate of Town and Country Planning (Sivan, 2011). This revision of roles and responsibilities around wetland conversion has been devised based on the government's belief that district collectors are less susceptible to pressure from realtors and business houses (Sivan, 2011). However, despite such efforts, encroachment and reclassifcation of land continues. "The problem with land conversion rules," says Jayshree Vencatesan, "is that certification is required by just one department—the Revenue Department. They can issue the notification unilaterally" (Dr. Jayshree Vencatesan, Care Earth Trust, personal communication, July 19, 2016.). Dr. Vencatesan further stated that in addition to the Revenue Department, involvement of entities such as the Department of Environment or Forests would help limit encroachment and unchecked development.

Even after changes have been made to empower the District Collector to review any conversions, lands are still insufficiently protected from encroachment, dumping, or other human activity that causes environmental degradation (Sengupta, 2015). The recent Tamil Nadu State Wetland Authority constitution—a multi-stakeholder body designed to comprehensively review the management of wetlands, and empowered to address encroachment—reflects continued efforts to reconfigure institutional arrangements to increase efficacy of protective interventions (Environment and Forests Department, 2016; Oppilil, 2016).

## Housing Demand

Chennai's rapid urbanisation has translated into an increase in housing demand and price appreciation in the core parts of the city. Overall, 80% of Chennai's real estate development is reported to be for residential purposes (Swamidurai, 2014). Demand for housing is seen across all income groups, including those living in slums. The Tamil Nadu Housing Board (TNHB), Cooperative Housing Society, and the Tamil Nadu Central Cooperative Bank are involved in efforts to provide housing to Chennai's growing slum population, which currently stands at 35% of the city's

population (Department of Environment, Government of Tamil Nadu, n.d.). The result has been significant pressure to expand affordable housing in peripheral areas, where much of Chennai's agricultural land and many of its water bodies once existed.

Developers and construction companies have seized these opportunities. Estimates from 2013 predicted that demand for housing units from 2011 onwards would be 30,000-35,000 per year (Business Standard, 2013). Chennai's housing shortages were deemed to be the worst in the country that same year (The Times of India, 2011). These numbers spelled enticing profits for builders and housing developers. As a result, projects were implemented across housing sectors—from luxury to affordable—many by large-scale companies deploying hefty investments. For example, large apartment complexes dominate the demand for housing development along Chennai's southern IT corridor (Kennedy, *et al.*, 2014). There is also market willingness to buy units in approved and developed areas even if they lie on flood plains. These areas sometimes even command high rental rates. For instance, areas like Velachery, Saidapet, and Kotturpuram, with construction on lakebeds and flood plains, command relatively high rental rates of INR 9,000-22,000 per square foot (Nirmal, 2015). However, after the 2015 floods, the same areas, which were previously seen by developers as lucrative, experienced a reduction in demand. Instead, housing demand moved to other areas in Central Chennai where floods had had little effect (Jayakumar, 2016).

Demand for housing in northern Chennai, long considered "the backwater region of the city," has also been growing (The Times of India, 2013a). Mahindra Lifespace Developers, Ltd., and Tata Housing Developing Co. Ltd. announced plans just this year to launch several large-scale, affordable housing projects in Chennai's peripheral zones (Nandy, 2016).

The public sector has also seen opportunity in outlying areas. Lakes were reclaimed for housing schemes as early as the 1970s and 1980s (Kennedy, *et al.*, 2014). One such scheme is the 'Eris scheme' funded by the World Bank in the 1960s and 1970s to build housing colonies for low and middle income groups in Ambattur and Mogappair, areas that were some of the worst affected in the December 2015 floods (Coelho, 2016).

At the time of the preparation of the second Master Plan for the Chennai Metropolitan Area (CMA), over 75,000 slum-dwelling families, were living in vulnerable areas, including waterlogged areas and seashores (TNSPC, n.d.).

*Chennai's rapid urbanisation has translated into an increase in housing demand and price appreciation in the core parts of the city.*

## Incomplete Implementation of Planning

The Parliamentary Standing Committee on Home Affairs reported that illegal encroachment of river and lakebeds, along with faulty town planning, contributed significantly to the December 2015 floods. Furthermore, it held the CMDA and the Chennai Municipal Corporation (CMC) responsible for allowing illegal encroachments in the city (Down to Earth, 2016).

Planning framework implementation is challenging in many ways. First, approvals processes have been separated between those for larger institutions (managed by the CMDA) and household construction handled by the Chennai City Corporation (CMDA, 2008a). Second, lack of a clear governance structure for the areas designated as environmentally

fragile makes them susceptible to encroachment. Wetlands, for example, are often not recorded under municipal land laws, leaving them and their respective catchment areas with no legal protection (Narain, 2014). The IT corridors of Velachery, Pallikarnai, and OMR, which have over 5,500 hectares of wetlands, have been developed into commercial real estate. Some of this construction is illegal and encroaches upon riverbanks, leaving little or no space for storm water to drain (India Today, 2015). Governance of land-use and water management is spread between a wide variety of state and local departments, impeding efforts to mitigate the impacts of natural hazards and solve watershed related problems in an integrated way (Roumeau, *et al.*, 2015; Jameson, 2014).

Encroachment cuts across the socio-economic spectrum in Chennai, as it does in other cities around the world. While wealthier groups may add unauthorised lands to approved developments, low income groups with limited options often build on flood plains and other low-value (and ecologically vulnerable) lands in an effort to reduce the risk of eviction (Our common future, as quoted in Gunn, 1998). In cases of illegal wealthier household construction, costly litigation renders a weakly resourced CMDA legal team incapable of pursuing punitive measures, even though it has the legal authority to go as far as demolishing buildings (Janardhanan, 2015b).

There is no systematic approach to evictions of low income residents. "Eviction drives" have sometimes been court mandated and/or conducted by authorities that range from the local police to the CMDA to the Tamil Nadu Slum Clearance Board (TNSCB) (Chennai Corporation, 2014; Daily Thanthi, 2016; Madhavan, 2015a; The Hindu, 2016). Such drives are carried out episodically—for example as a result of a Supreme Court order, or after an extreme flooding event area (Chennai Corporation, 2014; Daily Thanthi, 2016; Madhavan, 2015a; The Hindu, 2016; Chaitanya, 2015). At the same time, it is often the case that new residents set up homes and shops in the same places after a period of time (Chennai Corporation, 2014; Daily Thanthi, 2016; Madhavan, 2015a; The Hindu, 2016; Chaitanya, 2015).

## C. Infrastructure Development: Limited Compensation for Land-Use Changes

Drainage and infrastructure management for channeling excess surface water is addressed separately from longer-term efforts to reduce susceptibility to flooding through land-use planning or wetland maintenance (WMO, 2009). The resulting drainage system has not compensated for the changes in the city's built form. Inadequate storm water drains have made flooding and waterlogging a recurring event during the annual monsoon season.[6]

Chennai has a macro drainage system that consists of rivers, tanks, and surplus channels, and a micro drainage system made up of storm water drains. While tanks are used for flood control during excess rains, they are primarily designed to manage water for drinking and economic uses. The Chembarambakkam Tank and Veeram Reservoir, in addition to the Red Hills and its subsidiary, the Sholavaram Tank, were

constructed and refurbished to supply drinking water to the city's population. The wider network of tanks across the metropolitan area is used primarily to deliver water for industrial use. A few are assigned for irrigation (CMDA, 2008b). Water is eased out either automatically through weirs, or manually through regulators during heavy rains (Baud and Jameson, 2016). Over time, large tanks, particularly those used for water supply, have had their weirs replaced with regulators to have more effective control over the storage and supply of water (Lakshmi, 2015a). Responsibilities for designing and implementing the two drainage systems lie with two different Government agencies: the PWD oversees Chennai's macro drainage system (with some responsibility lying with the CMC and Metro Water), and the CMC, along with the Municipality and local bodies oversee Chennai's micro drainage system (CMDA, n.d.(b); The Gazette of India, Ministry of Law and Justice, Legislative Department, 2013).

Within the macro drainage system, administration of the tanks' multiple functions are divided between the PWD's Water Resources Department (WRD)[7] and the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB, commonly referred to as Metro Water). The PWD, one of the state government's largest ministries, is mandated to formulate and implement "irrigation schemes, operation and maintenance of irrigation systems," and ensure "effective management and distribution of surface and groundwater…for maximising the productivity of all…sectors requiring water." The PWD also owns these tanks (TN WRD, 2005). To the extent that various components of flood management are concerned, sub-departments within the WRD are tasked with conducting a number of functions including mapping of rainfall patterns and approving projects concerned with improving the flood resilience of dams and waterways (TN WRD, 2005; TN PWD, 2015; TN WRD, 2015).

Metro Water is in charge of administration as a single purpose state level body created via statute in 1978, to ensure adequate supply of water to the city and various neighbouring municipalities' residents, but also to develop and maintain area sewerage infrastructure (MAWS, 2015). Metro Water's responsibility for the actual tanks, however, is limited to recording water flows. There is regular but informal communication between the WRD and Metro Water regarding how water flow data should influence the release of tanks.

Turning to the micro drainage system, there are additional complexities. Chennai City Corporation manages micro level storm water drains, but coordination is required with Metro Water, PWD, and others, depending on the project and nature of activity (Storm Water Drains Department, Corporation of Chennai, 2014). Project specific implementation hurdles, for example, in addressing encroachment, securing clearances, and coordinating with the police and other agencies also affect project performance (The Hindu, 2013; Deccan Chronicle, 2014; Achuthan, 2008; The Hindu, 2014; TN WRD, 2015).

Various factors have to be accounted for when constructing storm water drains so they can function efficiently during times of need. For drainage planning in a city, some of the data points used for ensuring proper storm water management include elevation of storm water drain, junctions and other appurtenances, road and street networks along with their height, and maps of catch basins for each storm water sewer (Narasimhan, 2016). Contractors building storm water drains in Chennai are

reported to have ignored some of these aspects, resulting in the construction of storm water drains that do not match standards and consequently do not evacuate the water sufficiently (Janardhanan, 2015b).

The current drainage infrastructure is also considered inadequate. The city's road network of 6,000 kms only has 1,660 kms of storm water drains (Narasimhan *et al*, 2016). The problem is further exacerbated by the poor quality of the existing storm water drains. Lack of maintenance is reported to have reduced the carrying capacity of the existing storm water drains (The Hindu, 2015b).

During Chennai's December 2015 floods, the city's drainage system is reported to have failed because the drains were blocked with garbage and silt (Baud and Jameson, 2016; Mariappan, 2008; Lopez, 2013). Both micro and macro drainage systems are poorly maintained and encounter routine build-up of garbage because of illegal dumping, runoffs from sewage drains into storm water systems, limited enforcement resources, and public apathy towards waste management at the neighbourhood level. With the exception of emergency situations, there are limited efforts to coordinate between key agencies such as Metro Water and Chennai City Corporation in waste and drainage management practices (Senior Official, Metro Water, personal communication, May 2016). Efforts to desilt drains are implemented on an annual basis. However, they are rarely done at a citywide level and do not comprehensively address waste build-up. As a result, persistent waterlogging continues.

Before the rains set in, the Greater Chennai Corporation claimed to have desilted the storm water drain network and that the city was rain-ready (The Times of India, 2015b). However, illegal sewer connections running into the storm water drains meant that sewage mixed with storm water and caused waterlogging (The Times of India, 2015b). In preceding years, contractors cleaned this through manual scavenging but doing so was made illegal after the enactment of the Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act 2013 (The Times of India, 2015b; The Gazette of India, Ministry of Law and Justice, Legislative Department, 2013). A lack of sufficient machines to replace the manual scavengers and delays in procuring those machines prevented contractors from adequately desilting the city's storm water drains (The Times of India, 2015b).

Chennai receives funding to desilt drains from multiple sources. For example, the city received INR 1.44 lakh crores under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) to construct concrete walls on the sides of storm water drains (India.com, 2015). Implementing this project turned out to be challenging: navigating existing utility lines was difficult, and conflicts emerged over public transit system development plans. In addition to JNNURM funds, the City Corporation appears to allocate approximately INR 80 crores to INR 120 crores annually to install and upgrade storm water drains (Deccan Chronicle, 2014). However, this amount is insufficient considering the storm water drainage management needs of several neighbourhoods in the Greater Chennai Area (Chaturvedi, 2016). In many instances, private sector actors or other parastatal agencies such as the Small Industries Development Corporation (SIDCO) take on the responsibility both to raise funds and to construct storm water drainage systems (TN SIDCO, 2013). In fact, cases exist where local politicians were elected specifically because

they made promises to ensure sufficient floods mitigation infrastructure investment and maintenance (Madhavan, 2015b). While initiatives like these do meet important needs, they also add to the fragmentation of responsibility for what should be an integrated network.

Gaps in Chennai's micro drainage infrastructure are exacerbated by neighborhood-level infrastructure. For example, legal compound wall construction can protect a small set of households from flooding but can divert the water to adjacent areas where waterlogging will persist (Narasimhan *et al*, 2016). Also, roads are often relaid without milling so that they block water movement and drainage. The authority to do this lies with the Greater Chennai Corporation (GCC), which engages private contractors through a rigorous tendering process for surface road relaying. The design, thickness, and materials for the new bituminous layer are arbitrarily decided. Without rules mandating old road milling prior to relaying them, and ensuring that needed surface drainage measures are implemented, contractors often relay new layers on top of existing distressed roads. The result is that new road height goes above the plinth level, obstructs water run-off, and exacerbates the impact of floods (Kanthimathi, 2016). This frequent road heightening has become so standard that government bodies plan accordingly: Metro water reportedly builds man hole covers a few inches higher than road height in anticipation of it (Mariappan, 2009). Another problem is that drainage construction is not integrated with road construction. This is because storm water drainage networks and road construction are managed separately within the Chennai Corporation (A. Veeraragavan, personal communication, October 6th, 2016).

Finally, and perhaps most fundamentally for the full range of flood mitigation opportunities, the amalgam of socio-economic, physical, hydrological, and environmental data required to map out an integrated land-use and water management, astrategy is either missing or dispersed across various agencies (CMDA, 2008b; Baud and Jameson, 2016). On the ground, this can play out in a number of ways that aggravate the impacts of flooding.

Interviews with experts familiar with city development reveal that conflicting information about documenting property details between, for example, land registry and city commissioner's office, give an inaccurate picture of the actual development activity taking place (Chennai-based architect, personal communication, August 11, 2016). Fragile legal grounds raise the risk of perpetuating development activity on vulnerable areas. Resolution of such matters is also inhibited by CMDA and other agencies' limited legal resources (Janardhanan, 2015b). In addition, an overall paucity of data obstructs decision makers' ability to accurately account for the scale and dynamics of encroachment both temporally and spatially, including around hazard-prone areas.

A key reason for why available data has not been integrated is because there is no agency empowered to function as a centre for information management. Conflicting priorities of existing public bodies blur incentive structures to harness a broader spectrum of available information for an integrated decision making and risk management framework.

For example, the Chennai City Corporation mapped out 36 areas in the metropolitan area in 2007, demonstrating a level of risk

*Both micro and macro drainage systems are poorly maintained and encounter routine build-up of garbage because of illegal dumping, runoffs from sewage drains into storm water systems, limited enforcement resources, and public apathy towards waste management at the neighbourhood level.*

*Conflicting priorities of existing public bodies blur incentive structures to harness a broader spectrum of available information for an integrated decision making and risk management framework.*

awareness among its decision makers (Achuthan, 2007). However, the locations were chosen primarily based on elevation without any consideration for other factors such as the negative effects of development activity, which the Corporation instead has a role in expediting (Baud and Jameson, 2016). In some cases, where large, state level projects were sanctioned for the purposes of economic development—such as constructing an IT corridor—environmental vulnerabilities in the area, such as the presence of aquifers, have simply been removed from the map (Baud and Jameson, 2016).

In 2003, all Chennai households were mandated to install Rain-Water Harvesting (RWH), primarily as a flood mitigation measure (Gopalakrishna, 2012). This is an example of one entry point for integration, as RWH can mitigate groundwater depletion and allow for recharge, generally functioning as an effective form of urban flood control at the local level. While there have been implementation hurdles associated with this state-wide endeavour, evidenced in poorly trained installation technicians (Gopalakrishna, 2012), small-scale efforts have since been taken to leverage the flood mitigating functions of RWH in an urban setting. The non-profit organisation Rain Centre works with Metro Water to

> *"make RWH a more collective endeavour, using traditional tube wells and phyto-remediation for decentralized grey water treatment and groundwater recharge. They have…successfully managed to prevent flooding at a micro level in a local citizen-led experiment, digging a few holes in sandy soil at the edge of a bus stop in busy Besant Nagar" (Baud and Jameson, 2016, pp.9).*

## D. Fragmented Flood Management Regime

While many aspects of planning and infrastructure strategy touch upon water management for Chennai, there are no formal platforms for sustained strategic and tactical attention. The variegated, oftentimes conflicting purposes and implications of water, both as a long term source of and threat to survival, are not afforded the holistic attention warranted to harness and respond to flow patterns from peak to trough (Roumeau, *et al.*, 2015; Baud and Jameson, 2016). Budget allocations within agencies tasked with specific components of flood management are also limited (Chennai City Corporation, 2015; Industries Department, 2014). There are informal and ongoing means of information sharing between departments, but formal structures for collaboration including pooling funds or institutionalised joint strategies are limited. While there are benefits to this approach in providing some degree of discretion and ability to adapt in some situations, particularly in the short term, the informality impedes systematic efforts around knowledge transfer and resource distribution.

In terms of disaster management, Chennai's regime is evolving. The state's Disaster Management Policy focuses on pre-disaster activities, including developing volunteer resources (NIDM, 2015; CMDA, 2008a). A Disaster Management and Mitigation Department within the Revenue Administration reviews, coordinates, and refines overall policies, ranging from procedural matters around preparedness and relief to strategic endeavours to build capacity and strengthen disaster management systems

(NIDM, 2015). This structure is legislatively backed at the national level via the Disaster Management Act, 2005.

While there were delays in establishing the state's Disaster Management Authority, it has acted systematically to allocate roles and responsibilities. Specific tasks are delegated to various ministries, ranging from the Highways Department who ensure that machinery required for clearances are readily available, to the PWD who monitor tank water flow. The Chief Secretary to Government also chairs annual pre-monsoon meetings to take stock of available resources and established procedures (CMDA, 2008b). Ad-hoc meetings for similar purposes, led by other state ministries and attended by a wide variety of government agencies, buttress these efforts (Mariappan, 2013).

Emergency response on the ground within the Chennai Metropolitan Area is under the ambit of the City Commissioner, while District Collectors perform similar duties in municipalities and panchayats around the rest of Tamil Nadu (NIDM, 2015). The District Commissioner is responsible for coordinating emergency response efforts of state and local level public and private actors involved in flood management (NIDM, 2015). Key actors include the PWD, police and fire fighters, along with a variety of volunteer agencies and healthcare providers (NIDM, 2015). Notably, the City Commissioner or District Collector also has the power to draw from funds under provisions of the General Financial Rules/Treasury Codes to ensure an effective disaster response strategy (NIDM, 2015). In extreme circumstances, such as Chennai's flooding in December 2015, the military takes on a fairly independent role given its unique experience in logistically complex tasks.

Implementation of the Disaster Management Act is criticized on many levels. (Chakravarthy *et al*, 2016; The Times of India, 2013b). First, forecasting is replete with false alarms, and communication problems are compounded by the reality that meteorological and hydrological agencies interact to only a limited extent (Narasimhan *et al*, 2016). Second, roles and responsibilities remain de facto hazy. Much of the narrative that emerged over delays in Chembarambakkam Dam releases was oriented around who was responsible for sounding the alarm (Janardhanan, 2015a; The Hindu, 2015a; DNA India, 2015b; Ramani and Srinivasan, 2015; Ramalingam, 2015; The Times of India, 2015a; Ramalingam, 2015; The Economic Times, 2015). Thus, all of these factors—urbanisation, unplanned physical infrastructure, and a fragmented institutional environment—have changed the nature of the city's hydrology causing rainfall to become floods, as was the case in December 2015.

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[2] Chennai Metropolitan Development Authority. [Online]
Retrieved from: http://www.cmdachennai.gov.in

[3] Ongoing research program on urban ecology, initiated in 2015, Care Earth Trust, Chennai

[4] Census 2011, Government of India.
Retrieved from: http://www.census2011.co.in/census/state/tamil+nadu.html

[5] Poramboke is usually treated as state property, and comes under the purview of the Revenue Department or the Forest Department.

[6] Storm water drain, Greater Chennai Corporation(n.d.)
Retrieved from: http://chennaicorporation.gov.in/departments/storm-water-drain/introduction.htm

[7] The Water Resources Department is also referred to as the Water Resources Organisation.

# 3. MSMEs:

## Vital, but Vulnerable

India's MSMEs have emerged as key players in generating employment and economic progression. In terms of sheer scale and their contribution to the country's industrial sector, MSMEs out-number large companies and account for 80% of India's industrial enterprises (Ali and Husain, 2014).

Tamil Nadu's well-established industrial base has been successful at drawing in investments over the years. The MSME sector has a diversified portfolio of industries including textile, electronics, engineering, auto components, leather, chemicals, and plastics for domestic and international buyers (Balaji, 2016a; Balaji, 2016b). It is also growing: Tamil Nadu consistently had the highest number of Entrepreneurship Memorandum–II filings between 2007-08 and 2013-14. These are filings made by an established enterprise after the commencement of commercial production.[8] Among Tamil Nadu's districts, Chennai and nearby districts Thiruvallur and Kanchipuram top the state in number of new firms entering the fray. Chennai and Kanchipuram registered a 50% MSME growth rate between 2007-08 and 2014-15 (Development Commissioner, MSME, n.d.).

Even as the sector grows, it remains vulnerable. This is partly due to the location of enterprises. Many are located in areas that were hardest-hit by the 2015 floods. Some remain in these locations because they want to remain in an Industrial Estate. Others locate in vulnerable areas because they are affordable. We discuss these choices further in Section IV. The absence of dedicated support for recovery from environmental shocks is a second factor. While a number of agencies are tasked with supporting MSMEs, they tend to focus on other aspects of doing business. Third, MSMEs, by virtue of their small size, often do not have the funds required to invest in continuity plans and contingency options.

## Location of MSMEs

MSMEs in Chennai are seen both in the Industrial Estates (IEs) promoted by the State Government as well as in clusters of different sizes outside of these estates. There are independent export-driven MSME clusters (for instance, the leather and pharma sectors), as well as hub-and-spoke models of many small industries catering to a few large industries, again networked with a larger number of very small players operating in job/contract works suppliers (for instance the auto-ancillary sector). The services sector, which includes financial services and information technology (IT), has also grown (MSME-DI, n.d.(a)).


28
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107
50
26
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NH 716
50A
111
AH 45
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23
18
15
21
7
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9
6
14
NH 4
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19
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3
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57
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AH45
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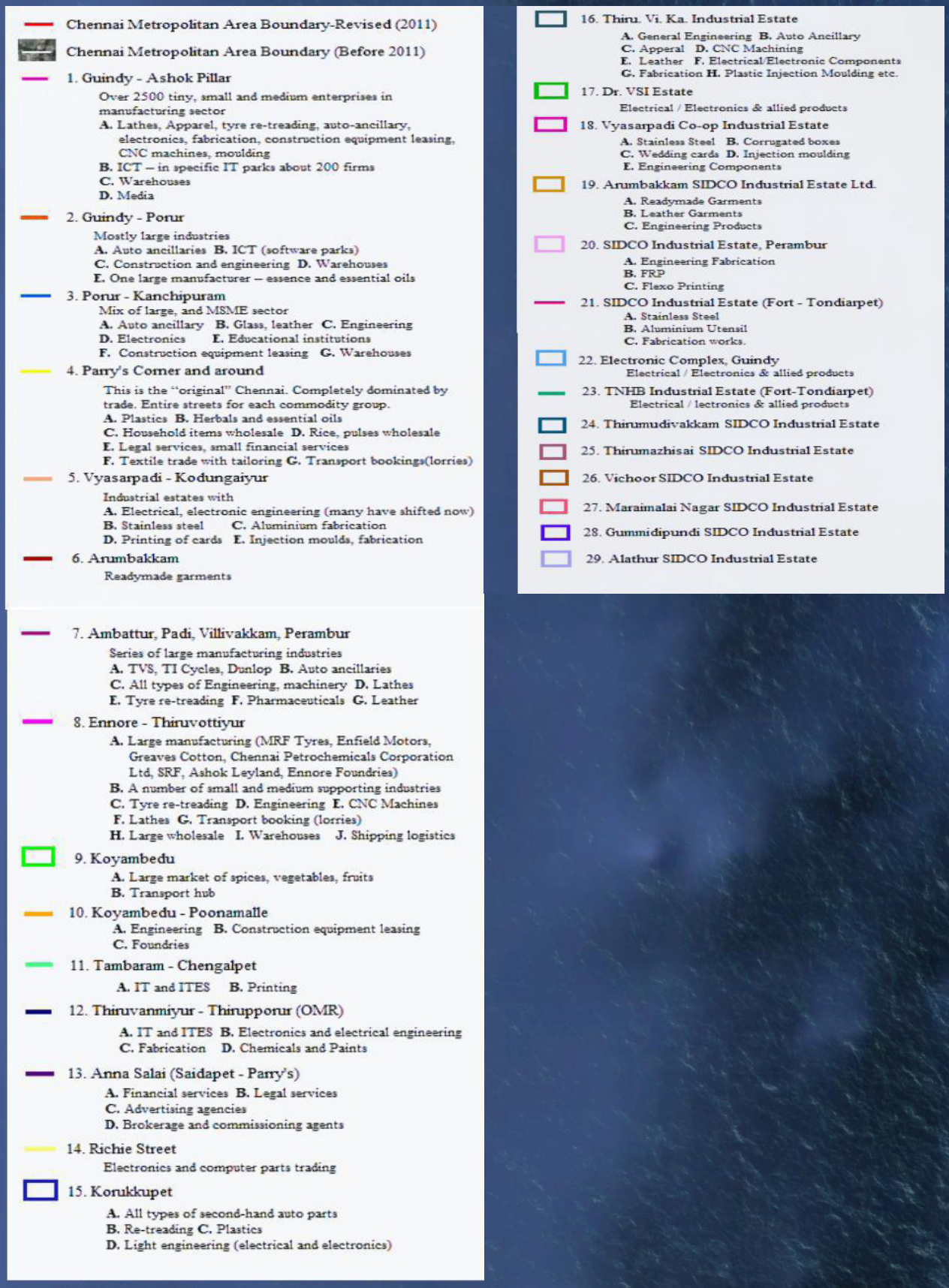
**FIGURE 3:** MAP SHOWING LOCATION OF INDUSTRIAL ESTATES IN CHENNAI



We know why certain industrial estates were established, but there is no well-documented history or rationale for the general business activity clustering outside the estates. For example, Guindy IE, one of Chennai's largest and oldest, was inaugurated in 1958 and acquired at a time when land in that area was relatively cheap compared to other traditional business districts; its proximity to critical infrastructure such as ports and highways was an added advantage (Adlakha, 2015a; Khan, 2013; TN SIDCO, 2015). Similarly, Ambattur IE, formed in 1965, was set up due to the availability of cheap labour and raw materials, and its proximity to waterways and transit infrastructure (Lakshmi, 2015b). These estates are still viewed as favourable locations. In fact, in 2006, to improve the competitiveness of the Ambattur IE, and to upgrade the IE, (through the development of basic amenities like roads, water supply, and sewage treatment) under the Chennai auto cluster programme, a Special Purpose Vehicle (SPV) was formed. The SPV has a revenue-sharing agreement with SIDCO (Kumar, 2006) and was created with the objective of promoting product-oriented clusters.

## Vulnerability of MSMEs

Large companies tend to have sound disaster mitigation strategies and business continuity plans in place. MSMEs, however, tend to lack this level of preparedness. This vulnerability is not restricted to Indian MSMEs or to developing country MSMEs. Emerging economies like Thailand witnessed unprecedented floods in 2011 which cost the country over two million jobs and disrupted global supply chains in the hard disk sector (ADPC, 2014; Fuller, 2011). Developed economies also succumb to natural disasters that cost their economies dearly. For instance, floods in the United Kingdom and earthquakes in Japan affected 1,600 businesses in a metropolitan borough in the UK and over 120,000 MSMEs in the Tohoku region in Japan (Sakai, Holdsworth, and Curry, 2016; BBC News, 2012). In addition to the earthquakes in Japan, a tsunami severely affected 38,000 MSMEs in the country, in addition to 7,000 MMSEs that were located in the nuclear evacuation zone (UNDP, 2013). Across all these countries, small and medium businesses[9] have been more vulnerable than large international companies to natural disasters. In Japan small businesses went bankrupt and in Thailand small and medium businesses had a much larger loss ratio compared to large businesses (APEC, 2014; Tjaardstra, 2014). MSMEs' inherent smallness in terms of resources, as well as the informality of the sector in terms of institutional arrangements necessary for their growth, makes them especially vulnerable to the disruptions that natural disasters create (ADPC, 2016).

Drawing from the developing and developed countries experiences, three factors broadly affect the impact of floods on small businesses:

1. The extent, magnitude, and intensity of the natural shock;
2. The availability of physical infrastructure that mediates land-water interactions; and
3. Social support systems that are often built in to absorb the damages.

Social support systems may not always work in a 'supportive' manner and may at times exacerbate the damages. This will be explored further in the upcoming sections that discuss the findings from the firm survey.

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[8] Department of Industries and Commerce, Government of Tamil Nadu. (n.d.) Entrepreneur Memorandum. [Online]. Retrieved from: http://www.msmeonline.tn.gov.in

[9] For the sake of simplicity and for the purpose of this report, small and medium businesses are viewed as a subset of MSMEs.

# 4. Study Framework

The concept of resilience finds its roots in Crawford Stanley Holling's seminal work that coined the term 'resilience' and drew a distinction between ecological and engineering resilience. While the former refers to the ability of the system to persist and adapt, the latter refers to the ability of a system to return to a steady-state equilibrium (Davoudi, 2012). The point of convergence between these two types of resilience is that both attain a state of equilibrium: either an existing state or a new one. Resilience as a concept has been applied to many fields, including but not restricted to engineering, psychology, economics, urban planning, and ecology (Martin-Breen and Anderies, 2011).

We have aligned this study's resilience framework with Mercy Corps' approach. Mercy Corps' definition of resilience is "The capacity of communities in complex socio-ecological systems to learn, cope, adapt, and transform in the face of shocks and stresses."[10] This definition uses a systems-thinking approach to analyse the behaviours of different elements in a system, the interactions between them, and the elements' influences on each other and the system as a whole. The resilience framework is thus dynamic in nature, taking into consideration all the unexpected and expected system changes that will affect the vulnerability of individual components. The approach has the advantage of highlighting pathways through which not only the individual actor or organisation can reduce their vulnerability to shocks and stresses, but also ways in which the system can support the ability to learn, adapt, and respond to shocks and stressors (Nelson, Adger, and Brown, 2007).

In framing the study, we asked a series of questions:

### Resilience for whom?

The realisation that different target groups need different initiatives and approaches to build resilience has called for a more focused discussion by studying MSMEs in Chennai. The previous section covered experiences of MSMEs in other countries during times of natural disasters. However, there does not seem to be as much emphasis on the deeper roots of vulnerability. For example, why do MSMEs find themselves in harm's way? Why are they vulnerable to disruption? What are factors that amplify or dampen the impact of disruptions on enterprises?

### Who benefits from this resilience building exercise?

Climate change and unplanned urbanisation come at a cost. A top-down approach is often adopted when building resilience, especially through international funding. However, a bottom-up approach is likely to be more beneficial for the identified groups and communities as strategies can be framed according to their needs, to ensure that they enjoy as well as bear the cost of resilience building (Leichenko, 2011). If Chennai's MSME resilience has to be strengthened, who is likely to bear the cost of

this strengthening? Are the incurred benefits likely to be a public good that can be shared with the larger production ecosystem of which these MSMEs are a part? The following sections, based on findings from the in-depth MSME survey, will provide answers to these questions.

## Why is resilience important?

Systems are often stochastic and unpredictable in nature. Resilience is important as it helps identify system vulnerabilities, and people and communities fare better with lesser destruction and damage if cities and communities are resilient (Godchalk, 2003). Identifying vulnerabilities in the system and addressing them can strengthen the production ecosystem. MSME vulnerabilities to system stresses have caused significant losses, affecting people, their jobs, and enterprises' production activities and supply chains. It is important, however, to tailor responses to vulnerabilities based on the historical and geographical context of a region, as vulnerabilities and stresses tend to vary across regions, and each situation would need a unique set of responses.

*It is important to tailor responses to vulnerabilities based on the historical and geographical context of a region, as vulnerabilities and stresses tend to vary across regions, and each situation would need a unique set of responses.*

## Description of the Resilience Framework

Our empirical work seeks to uncover how the effects of variability in the natural environment on MSMEs in the greater Chennai metropolitan area are mediated by physical infrastructure and the policy/legal/regulatory contexts.

There are two broad channels through which the business environment affects the relationship between the natural environment and MSMEs: first, how the business environment affects vulnerability (exposure to risk) directly or indirectly (through incentivizing certain choices); and second, how the environment supports resilience (ability to withstand and/or rebound from risk).

The framework takes into consideration two time horizons: a) short term changes that could reduce the effect of a flood-related work stoppage on the business health, and b) medium-term initiatives that could allow businesses to adapt their physical investments to current patterns of flooding and waterlogging.

The resilience framework created here consists of three layers: nature (environment), the business and institutional environment, and firms. Natural shocks, like the December 2015 floods, have an impact on firms. The intermediate layers between nature and firms, i.e. the business environment and institutional environment can amplify (increase the impact of) or dampen (decrease the impact of) these shocks. The framework helps identify critical areas of strength and weakness across the system, thereby enabling planners to develop and implement actions that will ensure the city's resilience. For example, findings from the MSME survey revealed that employees act as a strong dampener by absorbing some of the impact created by the floods. These employees helped enterprises clean their premises and resume production. On the other hand, location often proved to be an amplifier with enterprises located on flood plains experiencing more than normal waterlogging.

Our framework highlights a new and policy-relevant dimension of the business environment: the ease of business continuity in

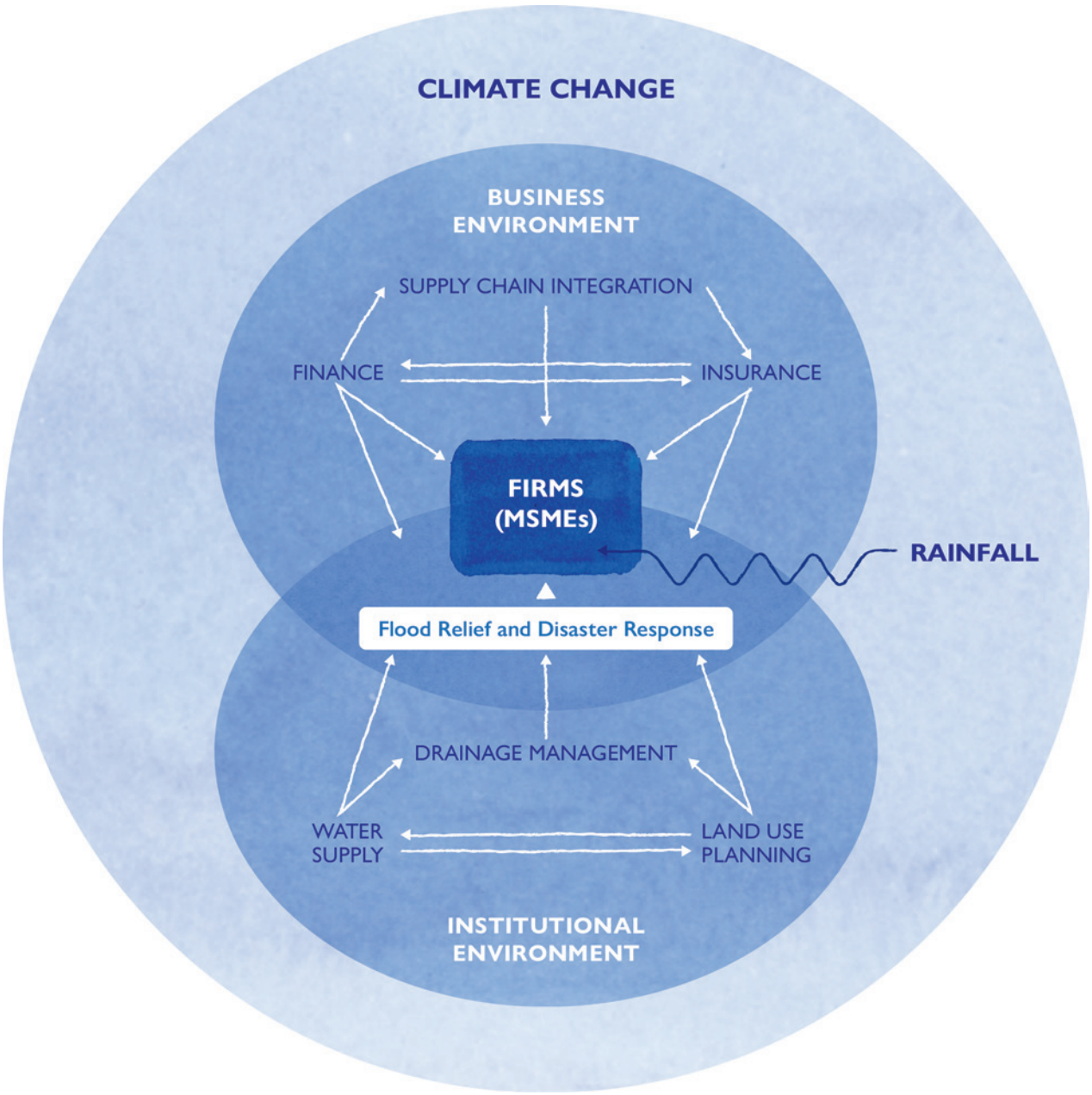



**FIGURE 4:** RESILIENCE FRAMEWORK

*Ignoring resilience indicators is clearly an oversight: natural disasters are economically costly.*

times of environmental shocks. Quantitative measurement of the business environment has become increasingly common—the World Bank Doing Business Indicators, the World Economic Forum's (WEF) Global Competitiveness Index (GCI), and the International Institute for Management Development's (IMD) Competitiveness Scorecard are a few examples. Most of these frameworks, however, focus on regulation of access. One of the first indicators, following Djankov *et al* (2002), focuses on the number of procedures that firms must go through, the official time required to complete the start-up process, and the official cost of complying with the country's laws, rules, and regulations (Djankov *et al*, 2002). Environmental considerations appeared in the index, but only as additional procedures (e.g. sewage permits or environmental impact assessments) to be managed. Its successor, the World Bank Doing Business Report (also developed by Djankov, with Michael Klein and Caralee McLiesh) comprises a set of indicators that helps quantify the law and regulatory environment present in a country for starting a new business and for enforcing contracts once the business is running.[11] Disaster resilience is not specifically considered.

Similarly, the WEF's Global Competitiveness report focuses on competitiveness, without considering resilience or continuity in the face of environmental stressors and shocks. The GCI defines competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country (WEF, n.d). The index is based on twelve pillars: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, efficient goods markets, efficient labour markets, financial market development, technological readiness, market size, business sophistication, and innovation. Compared to the Doing Business Index, the GCI has a more extensive set of variables and components. However, urban resilience towards natural disasters is not measured. Though there is a separate pillar for infrastructure, none of the reports mention mitigation strategies for natural calamities.

Quantitative measurement of the business environment has also gained significant currency in India in particular over the past few years. Earlier this year, the NITI Aayog (National Institute for Transforming India, a replacement for the erstwhile Planning Commission), in collaboration with Infrastructure Development Finance Company Institute (IDFC-I) launched an enterprise survey of manufacturing firms, incuding start-ups, across all states and union territories, to assess the state of the business regulatory envionment and identify challenges faced by these firms.[12] However, most of these indicators focus on assessing the laws, regulations, and policies to determine the ease of doing business or the level of productivity in a country, ignoring environmental considerations like resilience of these businesses to natural shocks and stresses.

There has been some growing recognition of the need to incorporate environmental considerations as can be seen in the themes of the Doing Business case studies. For instance, a case study of Zoning and Urban Planning practices undertaken last year as part of 'Doing Business 2015' stressed the importance of using zoning as a regulatory tool to counter environmental changes, including flooding, rising sea level, and loss of infrastructure (Delion *et al*., n.d.). The highlight of the study were the successful zoning system practices in New Zealand and Guatemala City.

Ignoring resilience indicators is clearly an oversight: natural disasters are economically costly. While doing business indicators were developed at a time when businesses were only concerned about a limited set of factors that affected their business—like competition or access to finance and markets—natural disasters have become a more visible threat to business. According to the International Disaster Database an average of 335 weather-related disasters per year were recorded between 2005 and 2014, an increase of 14% from 1995-2004 and almost two times the level recorded during 1985-1994 (UNISDR, 2015). The annual economic losses due to weather related disasters are estimated to lie between USD $250 billion and $300 billion (UNISDR, 2015).

In order to reduce the impact of disaster, improve disaster preparedness, and augment resilience, several initiatives have been floated in the last few years. The Asian Disaster Preparedness centre, an independent regional organisation, has framed systemic responses to disaster management in the Asia-Pacific region (ADPC, 2016). The SESAME project in UK studies the direct and indirect economic losses associated with flooding on small businesses.[13] The Asia-Pacific Economic Cooperation (APEC) had drafted a step-by-step Business Continuity Planning Guidebook for Small and Medium Enterprises (SMEs) (APEC, 2013).[14]

*Our framework highlights a new and policy-relevant dimension of the business environment: the ease of business continuity in times of environmental shocks.*

"APEC's guidebook" includes three important stages of business continuity plans:

a. Pre-disaster measures,
b. Emergency response during a disaster, and
c. Continuity strategies post-disaster (APEC, 2014).

However, the MSME sector, due to its informal nature and resource-constrained business environment, has failed to incorporate business contibuity plans or bring them to mainstream. We hope that our study will contribute to improved metrics for business resilience among this group.

Our study shows how lack of business continuity plans has in most cases amplified the impact of the floods on MSMEs in Chennai. The study also demonstrates that the key to disaster resilience lies in embedding business continuity as a subset of urban planning. The resilience framework outlined in the previous section demonstrates the need for business environment indicators to look beyond the ease of 'starting-up', and include those factors that are a reflection of the vulnerabilities enterprises are constantly exposed to, especially those related to environmental shocks.

[10] Mercy Corps Resilience Brief, shared with Okapi.
[11] Doing Business, The World Bank.
Retrieved from: http://www.doingbusiness.org/data/exploreeconomies/india/
[12] NITI Aayog – IDFC Enterprise Survey, NITI Aayog website. (n.d.).
Retrieved from: http://niti.gov.in/content/NITI_IDFCSurvey.php
[13] Sesame – Finding Ways of Promoting Better Business Adaptation To Flood risk.
Retrieved from: Sesame.uk.com.
[14] Depending on the economy, APEC has different definitions for SMEs, but broadly it is based on the number of people employed in the sector, which varies from one country to another. (http://www.apec.org.au/docs/iss1.htm)

# 5. Description of Firm Survey

Our field work consisted of a series of consultations and interviews. We interviewed 35 MSMEs and two large enterprises, all of whom had suffered as a result of water-related environmental variability in Chennai. We also consulted with industry and association experts, and with policy makers. The most notable natural shock that firms had encountered was the December 2015 floods. Each of the interviewed enterprises showed different degrees of vulnerability to business disruption, as well as varying means to and periods of recovery. Nine months after the flood, a significant number of surveyed firms had neither recovered their losses, nor been able to resume operations to full capacity. At the same time, a few firms experienced minimal losses and recovered production losses within a month. Why was this the case? What puts some firms at a disadvantage after a natural shock, while others are more readily able to bounce back?

The goal of the fieldwork was to investigate how the floods exposed amplifiers and dampeners that worsened or lessened the impact of natural shocks (rainfall), which became "natural disasters" in the larger infrastructure context. While the previous sections have discussed ours and others' findings on how unusually intense rainfall became a flood in Chennai—up until now the focus of much of the resilience research that has been conducted in Chennai—this section presents new empirical evidence on how the floods translated into economic and social impact.

## A. Methodology

We used detailed structured interviews so as to investigate the compound nature of the amplifiers and dampeners that were the focal point of the fieldwork. Our work builds on and references a large-scale survey of financial losses conducted by Nurture Trust in collaboration with Feedback Consulting and SRM University by offering deeper insight into how losses took place.

The Nurture Trust study was largely quantitative and surveyed 500 firms that were predominantly situated in Chennai's industrial estates. All firms had been affected by the December floods. It included enterprise profiles, financial losses, insurance and claims, and preferred areas for government assistance, among other information.

In conducting our detailed interviews we were able to corroborate the Nurture Trust findings with a broader understanding of the causes and effects of the extent of damages. A few of the respondents were common to both studies, an approach that allowed for this study to build on the findings from the Nurture Trust study. A focus on the manufacturing sector helped to detail some of the losses that were recorded in the

**BOX 1:** HIGHLIGHTS FROM NURTURE TRUST STUDY

AVERAGE DIRECT LOSS*

**INR 1,180,000**

INSURANCE CLAIMS RECEIVED

**50%**

MOST AFFECTED SECTOR

**Manufacturing**

LEAST AFFECTED SECTOR

**I.T.**

WORST AFFECTED SIZE-CLASS IN THE MSME SECTOR

*Firms with annual turnover less than*

**INR 100,000,000**

BIGGEST AREA OF REPORTED LOSS

**Fixed Assets**

INCIDENCE OF INSURANCE AGAINST NATURAL CALAMITIES

**37%**

TOP TWO MOST CHALLENGING RECOVERY AREAS

*Physical Infrastructure* **59%**

*Inputs* **43%**

BIGGEST RESOURCE IN RECOVERY EFFORTS

*Employees* **56%**

* According to the Nurture Trust Study, direct losses do not include "intangible losses including loss of customer confidence and broken supply chain."

most affected sector among Chennai MSMEs. Moreover, detailed questions about banking, finance, insurance, labour, and supply chains further helped to tease out how the business context served to amplify or dampen the effects of the 2015 floods.

Our study provides a number of unique contributions. Respondents provided information on challenges, successes, and arrangements for location, finance, working capital, labour, supply chains, and insurance at all times—not just during the floods. This provides a deeper understanding of factors in the business environment that either amplify or dampen the effects of natural shocks. The December 2015 floods were also linked to impacts of seasonal waterlogging, making this study relevant to water-related environmental hazards that are experienced on a more frequent basis.

In addition to the types and magnitude of losses, we showcase enterprise-specific temporal logs of the impact of the December 2015 floods on property and assets, insurance, finance and credit, production /sales, labour, supply chains, clientele, and access to utilties and public services. Firm-wise recovery times are also recorded for these areas.

This study highlights whether and how firms have adapted and sought to enhance their resilience before and after the December 2015 floods, as well as the extent to which they expected help and intervention from external sources.

Apart from the expertise and experience relayed from the perspectives of the firms in this study, interviews were also conducted with representatives from the public, banking, and insurance sectors so as to incorporate the concerns, motivations, and practicalities that inform responses among actors in these institutions during and after natural shocks.

## B. Sampling Framework

Location and enterprise size were the factors used to ensure that the firms in the sample were representative. While industry type was also considered, desk research made clear that there were no significant institutional arrangements that would render a single industry more vulnerable in the event of a natural shock. For this reason, there is no intentional industry-specific representation in the sample, except to ensure diversity and coverage of the major industries present in Chennai.

Interviews were arranged in partnership with TFSC and MCCI. Both organisations provided invaluable help in securing interviews with MSME owners and managers. Identifying firms— particularly those outside of industrial estates—during an intense period of loss and recovery, and accessing their time for lengthy interviews, would have been very difficult otherwise.

As a result of this chosen approach, the sample consists mainly of enterprises that are members of TFSC and MCCI, and, as such, are mostly formal enterprises in the manufacturing and automobile industries. To some extent, service industries are represented as well. The manufacturing sector in particular was among the worst hit according to the Nurture Trust study. A deeper look at this sector is important given Chennai's reputation as a manufacturing hub, and the relevance of these findings on the business environment of the city as a whole. Detailed interviews were conducted with two larger enterprises to see how they fared in the same locations as MSMEs. Larger enterprises with established and reliable supply chains, credit and insurance arrangements, and detailed business continuity and disaster response plans illustrate some key dampeners. The purpose here was to see the extent to which dampeners in large firms would be applicable and replicable for MSMEs.

The time and budget available did not allow us to develop an independent sampling framework and outreach for informal vendors and enterprises, home-based workers, or own-account workers—all of which fall largely outside the scope of the sample, even though some of the findings and recommendations in this report might speak to their vulnerabilities as well.

*The goal of the fieldwork was to investigate how the floods exposed amplifiers and dampeners that worsened or lessened the impact of natural shocks (rainfall), which became "natural disasters" in the larger infrastructure context.*

### Location

Location served as a primary factor in exposure to the floods and other water-related environmental hazards. The firms that were interviewed represented several key industrial hubs across the city. The newest firm in the sample was established in 2014, and the oldest in 1976. The interviews showed varying priorities for firm location, relocation, and expansion of facilities in this timeframe.

In this study, location was considered both in terms of geographical placement as well as presence within or outside IEs. Approximately half of the enterprises were outside IEs. Apart from differences in infrastructure and utilities, IE and non-IE firms in our sample varied significantly in terms of annual turnovers. The IE enterprises tended to be larger, with a median annual turnover of 150 lakhs per year. Only one had an annual turnover of less than 10 lakhs, with most having between

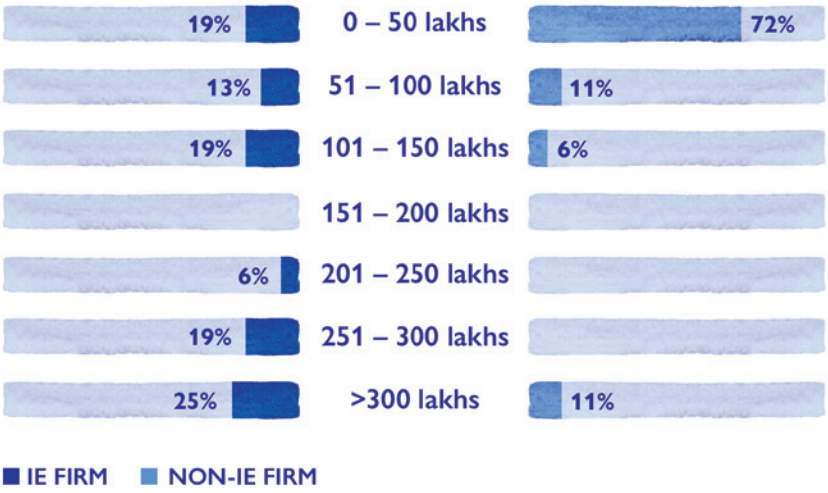



**FIGURE 5:** ANNUAL TURNOVER (IN INR) FOR IE AND NON-IE INTERVIEWED FIRMS

50-300 lakh turnovers per year. The median annual turnover for enterprises interviewed outside IEs was significantly lower: INR 20 lakhs per year.

Among non-IE firms with turnovers that were less than INR 100 lakhs per annum—the majority of the non-IE sample—13 out of 18 firms had less than INR 20 lakhs of turnover per annum. The difference helps to explain why several such firms said that they could not afford to operate in IEs, even though they felt that an IE allotment would significantly advance their businesses.

Initially an even larger representation from enterprises outside IEs was planned, but the sample was modified for various reasons. First, IEs and Special Economic Zones (SEZs) are increasing in incidence and policy relevance. Fifteen new IEs in Tamil Nadu were initiated between 2011 and 2013 alone. The SIDCO 2013-14 Policy Note indicates that twenty-two other sites have also been identified. This is a massive expansion of almost 40%, given that, at the time, SIDCO was overseeing 35 Government of Tamil Nadu IEs and 59 of its own (TN SIDCO, 2013).

Second, IEs appear to be among the most desirable locations for firms. Among many firms, there was a marked desire to re-locate to IEs, predicated on the belief that an IE location would solve many of the quotidian risks and constraints experienced by firms outside IEs. Increasing the sample within IEs helped to contrast these aspirations with the experiences of firms across and within IEs. Many flood-affected MCCI and TFSC members were in fact located inside IEs. Again, this approach helped to highlight inter- and intra-IE disparities and vulnerabilities, and allowed for more granular analysis and recommendations.

Third, IEs are not entrepreneurial islands. Many micro and small enterprises are found in close proximity to but outside the administrative boundaries of the IE, and it is helpful to study them as functional ecosystems of production. An equal balance of IE and non-IE firms lends this more organic perspective.

During the December 2015 floods, a crowd-sourced map was generated to show the incidence and severity of flooding.[15] This map was used to cross-reference areas where entrepreneurs self-reported high damages and losses. More firms were interviewed in areas such as


**FIGURE 6:** MAP SHOWING SAMPLE AREAS FOR THE STUDY

Kandhanchavadi, Ekkatuthangal, and Ambattur[16] for these reasons. They were also areas that have a longer history of industrial activity, with a large MSME presence both inside and outside of IEs. Also of note is Firm 6, which, as the firm farthest away from the city centre, was selected to speak to the aspirations of several small and micro firms that were interested in relocating to Sriperumbudur, an active centre for the automobile industry. Figure 6 shows the areas that were sampled based on these parameters.

## Size

Thirty-five firms represented themselves as MSMEs, particularly in their association with TFSC and MCCI. The analysis in this section pertains to these thirty-five MSMEs, with a few illustrations and comparisons drawn from the two large firms interviewed. The total sample size is thus 37.

The official guidelines for classifying MSMEs according to the 2006 Micro, Small, and Medium Enterprises Development (MSMED) Act was used to cross reference how firms represented themselves for association membership (see text box 2).[17]

India's MSME official classification, as defined in the 2006 MSMED Act, was found to be problematic for a few reasons. First, it does not address core issues of growth, present day value, sector-wise disaggregation, or international comparability. Investment in plant and machinery is not a one-off expense. While almost all the firms were able to assess initial investment[18], many were unable to value total investment[19] —particularly firms that had been operational for decades or had witnessed a change in ownership. Moreover, some firms had grown significantly since their inception, while others had not, making initial investment an inadequate point of reference for a firm's current scale of operations.

BOX 2: DEFINITION AS PER MSMED ACT 2006

**Manufacturing sector (with investment in plant and machinery)**
**Micro :** Does not exceed INR 25 lakhs
**Small :** More than INR 25 lakhs but does not exceed INR 5 crores
**Medium :** More than INR 5 crores but does not exceed INR 10 crores

**Services sector (with investments in equipment)**
**Micro:** Does not exceed INR 10 lakhs
**Small:** More than INR 10 lakhs but does not exceed INR 2 crores
**Medium:** More than INR 2 crores but does not exceed INR 5 crores

The table in Annexure 1 represents each firm by initial investment, the corresponding MSME classification based on the MSMED Act, and also present-day turnovers and number of employees. The last two indicators are more commonly used reference points internationally, and serve as differentiators in the MSME sector. We used the official sector classification to identify the population of firms for this report, keeping in mind the need to match our findings with a defined policy category. However, in disaggregating results within the sector, we use annual turnover and number of employees as indicators of size of the enterprise in order to ensure that the research implications can connect to broader international discussions about small businesses. This will allow better disaggregation within the sector and hopefully provide more granular, policy relevant recommendations for a wider audience.

## C. Findings

The following factors need to be seen in relation with one another in the context of the business environment that they create. It is important to see that a single factor is not a universal amplifier or a dampener. Sometimes a single factor is triggered or offset by another factor. In many cases, some of these factors not only amplified the impact of natural shocks, but also only became apparent to firms during the floods. Conducting detailed interviews helped to shed light on the interplay between amplifiers and dampeners for flooding as well as seasonal waterlogging.

A uniform interview instrument was used as a guideline, but the interviews were semi-structured. This allowed for unstudied and informal arrangements to come to the fore. The method once again confirmed how heterogeneous the MSME sector is, even with a large representation from enterprises in manufacturing and the automobile industries in this sample. Moreover, not all firms were able to speak to every factor that is addressed in the following sections. Lack of familiarity, predictability, and/or awareness was one reason for such ambiguity. Managers found it difficult to recall the specifics of transactions that happened several decades ago, particularly when the owner is no longer involved in day-to-day management. Owners and managers also found it hard to recount finance, supply chains, location, or license arrangements that were and may still be informal. The same was true for firms with inconsistent revenues streams, credit holdings, supply chains, and labour. Many respondents were unaware about the specifics of formal credit and insurance agreements as well. Finally, the floods affected the ability

to recall pertinent information sometimes because of a loss of documentation, and at times because the magnitude of the disaster over-shadowed seasonal waterlogging.

Thus, not all firms were able to speak to each of the sections detailed below. The analysis in each of the following sub-sections includes insights from those firms that could and did, with notes provided on the relevance of knowledge gaps among other firms.

## 1. Locational Choice

Locational choices are recurring, dynamic, and extend beyond the start-up phase of a company. Firms in this study were motivated by many, sometimes common reasons to locate, expand sites, and/or re-locate. Vulnerability to floods, however, was never a large enough impetus or deterrant in the decision making process for firm location.

### Floods and Seasonal Waterlogging: Undervalued Risks

Many firms simply did not know enough about the environmental context when they chose a particular site. Twenty-seven firms did not know that waterlogging was an issue before moving to their current location. However, fifteen firms reported instances of seasonal waterlogging with damages that ranged from a complete prdocution shut-down for a few days to minor transport and power-related delays and inconveniences. Regardless of the severity of seasonal waterlogging, firms were not prompted to move because of it. The owner of Firm 14—who often contends with seasonal waterlogging—explained, "I cannot waste 360 days of business by shifting somewhere else, just for four to five days of waterlogging."

Some firms knew about the prospect of seasonal waterlogging but considered it a risk that could be mitigated. Three firms pre-emptively raised the floor of the entire property. These firms were relatively cash-rich and had started operations in that particular facility within the last decade. Firm 6 is a subsidiary of a company based in Singapore. Once the location was decided in Sriperumbudhur, based on an initial analysis of the site, the managers decided to raise the floor of the entire property by four feet. Access to capital through the parent company allowed for such a large property investment from the very beginning. Firm 33 had also elevated their floor: an investment that was made when the facility was established as the company's fifth production site. Firms 6 and 33 are medium-sized enterprises, for whom access to funds, and volume of investments in the current location was much larger than micro and small firms.

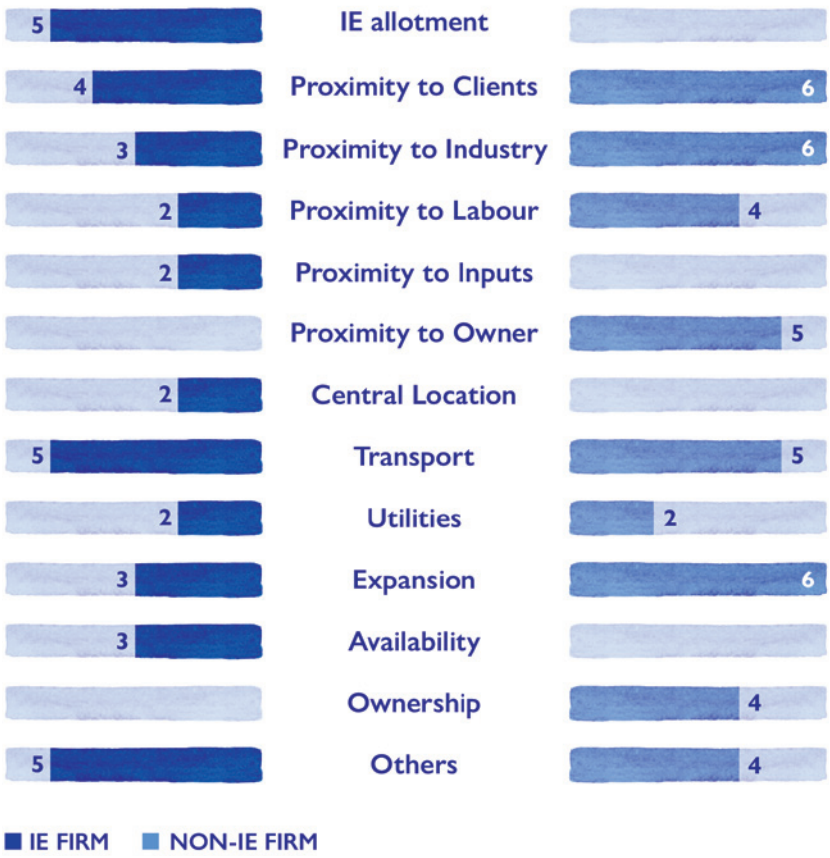
Regardless of degree of awareness or impact of seasonal waterlogging, the possibility of a disaster as damaging as the December 2015 floods was unforeseen by all but one respondents. That one firm, Firm 35, had experienced five other floods in the last 15 years but never moved on account of any of them. Even though this was the most severe flood in Firm 35's recent experience, the respondent said that they would be more likely to shut down than relocate in the event of another disaster of this magnitude.

## Firms Have Other Priorities When Selecting a Location

There were some clear forerunners in the rationale for choosing a business location. While many of them pertained to business potential and continuity, none of the respondents overtly mentioned exposure to natural shocks as a part of the trade-offs that were considered.

Several key factors in deciding a location were common to firms regardless of whether they were inside or outside an IE. In many cases, owners prized proximity to clients, workers, and the relevant industry; ease of transport and logistics; and the need to expand operations. The big differences between IE and non-IE MSMEs had to do with amenities and land ownership. Firms within IEs moved specifically to tap into reliable power sources and the ability to run multiple shifts without impacting neighbors. Five firms moved to IEs just to be in an IE and, by extension, enjoy these allowances. For those that were outside IE, ownership, comparatively low rent, and the proximity of the owner's house to the plant were important considerations in the choice of land. Entrepreneurs who owned the land on which the firm was situated commented on the advantage of being able to make changes to the building and accommodate growth. In a couple of rare cases, renters said they had no desire to move elsewhere because their landlord had given them permission to build and expand the rented premises. This, along with fairly consistent power supply, is why Firm 29 would neither start the business elsewhere, nor move to an IE.

**FIGURE 7:** FACTORS DETERMINING CHOICE OF LOCATION FOR IE AND NON-IE FIRMS



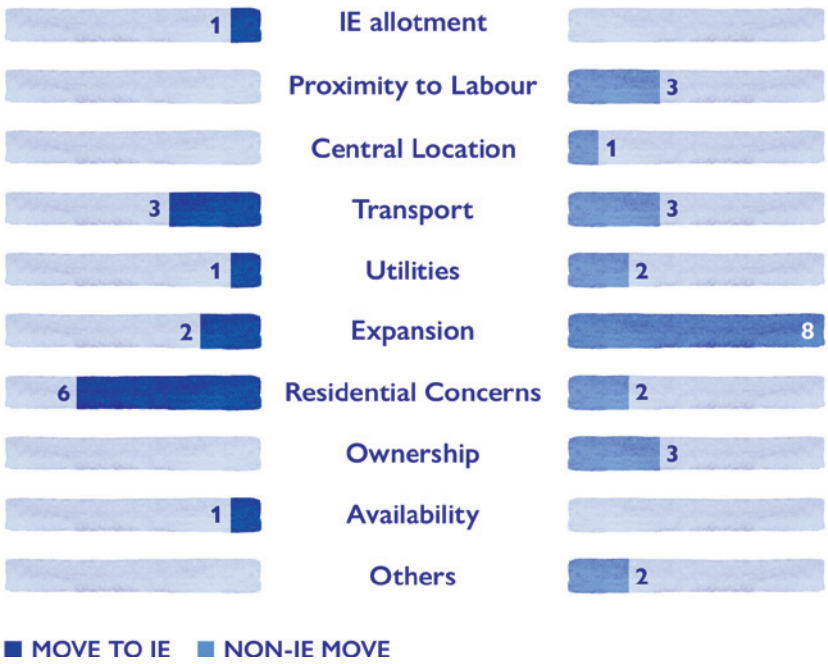
Considerations for firm re-location were pointedly different for IE and non-IE firms. The frequency of shifting locations was much more pronounced among firms operating outside of IEs.

Relocation was a far more common incident for firms outside of IEs, with none of the interviewed firms moving away from IEs after having secured an allotment. Figure 8 shows the reasons that owners and managers provided for shifting from the previous (most recent) location to their present one. Second and third location firms cited IE amenities and residential concerns in previous locations (noise pollution, inability to run multiple shifts) as their primary motivation. Non-IE firms were more prone to move in order to expand. Land ownership, which is also related to the ability to expand, was another big reason. A common concern for relocation between IE and non-IE firms was access to better transport facilities and proximity to labour. Waterlogging, be it seasonal or flood-induced, was never mentioned as part of these considerations.

Seven firms had relocated from residential areas to IEs, while the remaining firms had started and continued their operations in IEs. Here the top two reasons for moving to an IE were to expand, and to escape the constraints of operating in residential areas. The latter includes noise complaints, transport and loading difficulties, and the inability to run multiple shifts. Some firms shifted multiple times before finally settling in an IE. Firm 28 waited eight years to receive an allotment. While some have official allotments, which include a 99 year lease, encouraging more plant and facility investment, some firms take 11-month renewable leases from the original allottees, which means that their tenure is not as secure as those who receive their allotments directly from SIDCO.

There was also a difference in aspirations, with more enterprises in IEs wanting to stay in their current facilities. In stark contrast, while

**FIGURE 8:** REASONS FOR SHIFTING FROM THE PREVIOUS LOCATION TO THE PRESENT ONE



*The big differences between IE and non-IE MSMEs had to do with amenities and land ownership. Firms within IEs moved specifically to tap into reliable power sources and the ability to run multiple shifts without impacting neighbors.*

some enterprises in IEs would have located their businesses elsewhere if they were to start today, none of them want to relocate at present. Moreover, none of these firms relocated away from IEs. The aspirational and actual movement of MSMEs in this sample appears to be unidirectional: toward IEs—although there were indirect hints of movement away from or between IEs since some of the firms in IEs were renting plots from original allottees. There was also mention of firms in IEs that had completely gone out of business as a result of the December 2015 floods.

Significant and long-term investment in the plant and machinery, and established clientele were two of the main reasons that bound entrepreneurs to their current IEs. The owner of Firm 5 said that, even in the face of another, similar event they would not consider relocating. After 30 years of investments in a single location, the owner would rather make in-house adjustments to protect assets from floodwater. Firm 23 was not interested in relocating since the owner was convinced that a central location was critical to tapping into the correct labour pool.

While IE firms did not actively seem to want to move, when asked if they would have started the same business in their current location were they to establish their business this year, six firms said they would not. Two of these firms would prefer not to do business in Chennai but rather maintain a close enough distance to continue to benefit from Chennai's air and sea ports. They would rather establish their plant in Pappadai, Sri City, or Tada in Andhra Pradesh. The other four firms would have located their enterprises in other IEs, particularly Sriperumbudur. Further to these observations, Firm 29 has already added a unit in Sriperumbudur while maintaining operations in Ambattur IE. Only two IE firms overtly said they would have started the business in the same location, even today. A couple of firms found it hard to respond to this question. Having been in business for several years, they valued a central location while also acknowledging that rents in these areas are unaffordable. This question was also of little relevance to very new firms, seeing as how their original criteria for selecting a location was still very fresh and had not undergone much re-evaluation.

With the exception of Firm 29, MSMEs outside of IEs all considered IEs a better choice both in terms of starting a business today and in terms of relocating their current business. Firm 23 also had a slightly different response: they recommended new business locations outside of Chennai—not necessarily within an IE—because of the high costs of running a business in the city, particularly land prices and rent.

### Locational Amplifiers

Despite a clear preference for IE plots, several IE firms were locationally vulnerable. Industrial estates are vast and house varying degrees and types of exposure to hazards. Unequal access to facilities such as transport is one such example of differential locational vulnerability within a given IE. This manifests as a daily constraint, and was all the more prohibitive during the floods. Employees in Firm 26 in Thiru Vi Ka IE contend with poor access to their worksite with the last public bus stop approximately two kilometers away from their factory. Only medium enterprises can afford to offer private shuttles within the estates, making it less likely that employees of small and micro enterprises will come to work during the monsoon season, and even more so during flooding when interior parts of the estate were largely

inaccessible on foot or private transportation.

Firm 6 in Sriperumbudur periodically experiences loss of electricity for up to 12 hours a day. While the situation has improved in the last three months, they still have to run generators for three to six hours a day. During the floods, when diesel purchases were restricted, fuel was procured from 20 kilometers outside of Sriperumbudur so that some degree of production could continue. The infrastructure and roads in this area are also poorly maintained, making it difficult for employees to travel to work, especially when it is raining. The director said that his employees often have small accidents on the way to work when potholes become hard to navigate while the streets are waterlogged.

A couple of IE firms were situated in areas that were below the elevation of the Cooum River. They faced an added disadvantagae as they were waterlogged for a significantly longer period of time since rainwater did not naturally drain out of their property and they had to wait for the water to evaporate. Some enterprises in this IE are just one boundary wall away from the river. In the same IE, the directors at Firm 3 said their street was at a higher elevation than worksites that were as close as two blocks away, rendering Firm 3 less prone to seasonal waterlogging, particularly during heavy rains and monsoons. Clearly, not all IEs are equal, nor are the locational (dis)advantages of the firms within them.

For those at a locational disadvantage within IEs, again, the investments made to develop their plants deters them from seeking another location. They do not want to leave and re-invest elsewhere. Secondly, having received the allotment in an area secured solely for industries like their own, the expectations are that the government will provide and maintain the necessary infrastructure to decrease firm vulnerability in low-lying IEs.

Rather than treating IEs as a composite whole, greater attention needs to be paid to the disparities that are present between and within IEs. Presence within an IE is not enough to determine the extent of exposure to a natural hazard. It is more helpful to consider the amplifiers and dampeners within IEs, particularly in such cases when elevation and relative isolation eclipse business advantages.

Still, all of the non-IE firms who expressed a desire to move to IEs seemed to value business opportunities over flood-proneness. Whether they were aware of the extent of damages that IE firms had experienced as a result of flooding is unclear. They did, however, value the potential to undertake more shifts and have more reliable power: two very big expansion and coping mechanisms that IE firms reported in the recovery efforts, which most non-IE could not undertake.

Apart from low-lying areas proving to be an amplifier, both IE and non-IE firms reported relative road-height as an amplifier. Increasing road height was another example of a locational risk that was acknowledged in some cases, yet deemed manageable. Perhaps the most vivid illustration of how elevation compares to other criteria when deciding a location is Firm 9. As the owner of the property on which he started his firm, the entrepreneur knew the location was prone to seasonal waterlogging, with roads getting 2 to 3 feet higher over time. Still, the cost of monthly rent elsewhere was seen as less affordable than the one-time investment involved in elevating the factory floor, a measure that shielded the firm from on-site losses during monsoons, as well as

*All of the non-IE firms who expressed a desire to move to IEs seemed to value business opportunities over flood-proneness.*

from complete inundation during the December 2015 floods.

Similarly, Firm 12 increased their facility height from 3.5 feet to 4 feet, but the road height also increased from 5.5 feet to 6 feet. This resulted in 2 feet of waterlogging inside their facility premises during the December 2015 floods, which has now prompted the respondent to move the manufacturing process from the ground floor to the first floor.

In a later section on firm recovery, raising properties or elevating platforms for machinery seem to be a common resilience-building response after the floods. Compared to physically moving, affecting wider infrastructure, or compromising on daily costs, the expense of making adjustments to existing facilities was considered to be a more affordable recourse. Everyday survival and costs are simply valued higher, even after the floods. Institutionally led resilience-building efforts need to be mindful of this implicit valuation of location-based costs and priorities, particularly as these might serve as greater amplifiers and dampeners than mere physical location.

Finally, respondents relayed that many locational vulnerabilities were beyond their sphere of influence including drainage, encroachments on canals, improper/infrequent de-silting of drains and canals, and increasing road height. Some of this can clearly be attributed to the institutional fragmentation that was outlined in an earlier section.

## 2. Financial Access, Working Capital, and Credit

Inadequate finance is a significant MSME challenge at all times, not just in times of recovery from floods. Firms in this study reported numerous obstacles in accessing timely and adequate finance, which affected business continuity, growth, and recovery from times of significant financial distress. Financial access proved to be unequal in many cases, with most firms having to tap into multiple and changing sources of finance and credit. This section will show how reliable cash and credit flows helped moderate (dampen) the business impacts of the December 2015 floods. Conversely, slow, unresponsive, and insufficient capital, particularly beyond the start-up phase of the company, severely amplified the impacts of the floods. As highlighted earlier in the report (Pg. 14) one respondent even spoke about how debt and a lack of financial access prompted business owners (not part of this study) to sell all their assets, dismantle the business, and seek wage employment elsewhere.

### As MSMEs Grow, They Become More Dependent on External Sources of Capital

Firm access to credit and finance evolves over time. Figure 9 shows the sources that firms used for their initial investments. Twenty-eight firms self-financed part of their start-up costs, with many citing inability to access bank loans without collateral or a sizeable down payment. This was particularly true for the 15 firms that only used their personal savings, gold, life insurance cash-outs, or final settlements from previous jobs to start their businesses.

Banks were most frequently cited as an external source for initial funds (7), followed closely by friends and family (6). Government grants/

loans (3) and money lenders (3) also supplied start-up finances. The large enterprises that were interviewed had foreign direct investment (FDI) as an external source of funding, as did Firm 6. Entrepreneurs who either already held current accounts at a bank, or were able to use a relative or friend's assets as collateral reported greater ease of access to bank loans for initial investments.

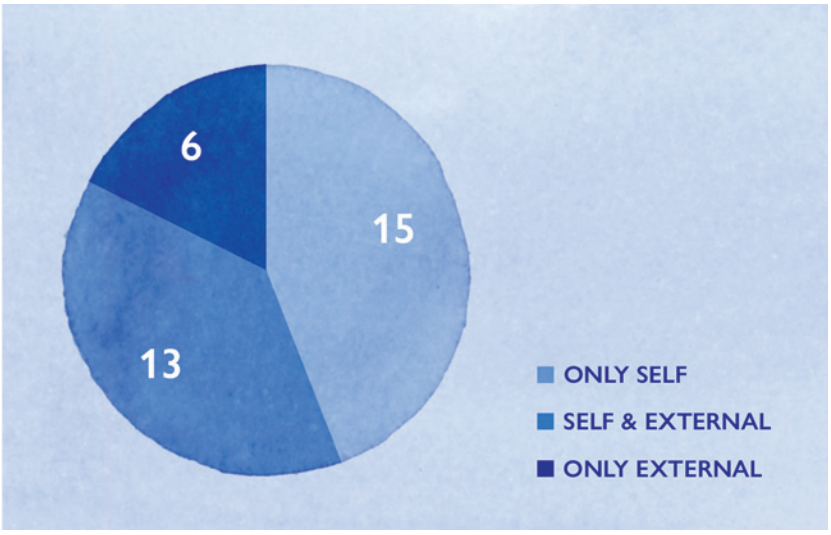
Credit and finance options continued to be elusive for many business owners as they sought to expand operations. Only 11 MSME owners had not expanded their plant and/or equipment in the last five years. For two firms, this is because the business expands only when more products are made with the same machines. Expansion is thus not achieved through more capital but through product diversification and development. Another two had only begun operations a few years prior to the floods, and were still maximising the resources that were purchased through their initial investments. The remaining five companies could not grow their investments because of waning demand or expansion possibilities for their respective products, or because the industry or their clients were also experiencing downturns.

The majority of interviewed firms had invested in new equipment over the past five years. While none had expanded the number of plants or buildings they currently occupied, one firm reported that they were planning to take possession of a new unit by the end of the year.

In this sample, while external funding had more of a presence for normal business operations and expansion than for financing start-up costs, firms remained credit constrained. In stark contrast to initial investments, only eight firms reported that they had, at least in part, self-financed the purchase of new equipment in the last five years. Instead, 20 firms relied on external funding sources in order to purchase machinery (See figure 10). While the presence of bank loans was more pronounced, most notably for companies that were able to provide collateral or demonstrate steady revenues and valid documentation, there was also a marked increase in the reported number of loans that were denied

*Rather than treating IEs as a composite whole, greater attention needs to be paid to the disparities that are present between and within IEs. Presence within an IE is not enough to determine the extent of exposure to a natural hazard.*

**FIGURE 9:** SOURCES OF FINANCE USED FOR ENTERPRISES' INITIAL INVESTMENT



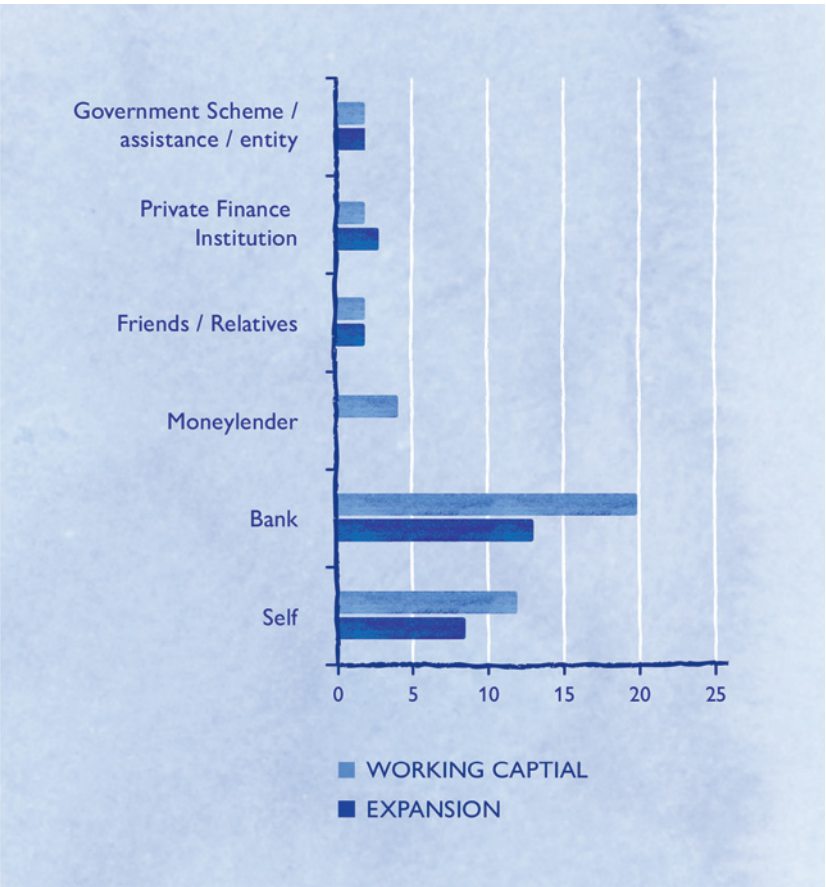



**FIGURE 10:** SOURCES AND PURPOSE OF FUNDING

for reasons such as insufficient documentation, poor profit margins, or no collateral. Apart from loan rejections, some firms without access to formal credit and finance options noted that they had never even approached banks after hearing about the frequency and reasons for loan denials from fellow entrepreneurs.

Some firms were able to meet collateral requirements by pledging land, gold, or property belonging to relatives. Entreprenuers who rented their facilities were at a disadvantage here. Yet the overwhelming gap was for firms engaged in "job work" —an arrangment in which the firm provides a manufacturing or production service for clients. Revenue streams here are unpredictable, making it difficult to commit to monthly payments or demonstrate a reliable source of income.

Also of import are the preference for bank loans for expansion purchases but a reversion to moneylenders for quick cash (see figure 10)—both for working capital and emergencies. While bank loan terms were longer, and harder to procure, the interest rates were predictable and relatively low. Moneylenders on the other hand had shorter loan periods: sometimes just 40-60 days, and required only as few as 1-2 documents to process loans quickly. However, they were also reported to be a lender of last resort, with one firm even citing safety concerns relating to debt collection. Moneylenders were more frequently approached during emergencies and after the December 2015 floods.

Overall, only 20 firms reported some degree of inclusion in formal financial institutions. Many firms in this sample also use informal sources of finance, either to supplement insufficient funding from formal financial institutions, or as the only option when they cannot get bank loans.

## Public Financial Institutions and Schemes are Hard to Access and Slow to Deliver

Very few firms were able to claim public subsidies and benefits for the MSME sector. None of the newer companies reported access to government schemes or subsidies when they first established their firms. They had to rely entirely on personal resources or to secure private loans.

In two cases, public funding came through banks directly, with loans that were connected to a Credit Guarantee Fund Trust for MSMEs (CGTMSE) established by the Small Industries Development Bank (SIDBI) and the Government of India to extend credit facilities to the MSME sector. Additionally, entreprenurs who started their businesses at least a decade ago, and in most cases two decades ago, were the only ones reported to access the Prime Minister's Rozgar Yojana (PMRY), a scheme to assist entrepreneurs in the MSME sector. In fact, two of the firms in this study were able to completely fund the start of their enterprise through government grants.

There were several reasons for poor uptake of public funding schemes and subsidies. One was a lack of awareness. Many firms said that they had not heard about sector-specific subsidies, and one firm involved in printing services claimed (incorrectly) that subsidies were only for the automobile industry.

Applications for subsidies and funding were also rejected. The reasons for rejected applications seemed to be inconsistent with the provisions that should have been made available to MSME applicants. Firms said that even though schemes were not supposed to mandate collateral, banks were still using it as a requirement. When speaking about an equipment loan application, the owner of Firm 2 remarked,

> *"The loan was requested under the Credit Guarantee Scheme and the MSME subsidy scheme. For these there is no requirement of collateral. Yet the bank asks for this. They fixed a profit margin and only above that they are lending for the machine. In job-work such margins are not possible unless we have superior machines – 1 or 2 – which will help us to have more volume."*

Finally, entrepreneurs spoke of significant delays in procuring capital subsidies that were meant to be 15% to 25% of the total cost. Applicants were told that they could apply for subsidies several months after the loan was sanctioned, with some receiving it as late as a year after the date of equipment purchase. Slow capital deterred some firms from applying or following up on subsidy applications.

Slow finance is the main reason that micro enterprises opt for loans from private banks over public financial institutions, even when interest rates are higher. Encounters with the Tamil Nadu Industrial Investment Corporation Limited (TIIC) and some state banks led to significant paperwork, lengthy transaction times, and, at times, no resolution even after 1.5 years—as was the experience at Firm 11.

However, private banks are not a viable option for firms that have some of the lowest, most irregular revenue streams and often no collateral. For these, arguably some of the most financially vulnerable firms, credit is either inaccessible, or too slow to be of use. It acts as a huge amplifier in the time of floods, when documents were often

destroyed, banks were overburdened with queries, and ostensibly a history of loan rejections and pending applications formed the basis of loan application and relief discussions.

## Financial Access During the Floods: Informal and Loss-Heavy Solutions

The accessibility, flexibility, and transaction costs that are mentioned in these regular financial arrangements become all the more pertinent during emergencies and times of natural shocks. "Most of these entrepreneurs have put in their own money or borrowed privately to set up a small business," said CK Mohan, vice president of Tamil Nadu Small and Tiny Industries Association (TANSTIA), in the aftermath of Chennai's 2015 floods. "They operate on slim profit margins and supplier credit. When units shut down, knives are at their throat as lenders come asking for repayment. They have no access to funds. Most entrepreneurs have no idea whom to turn to" (Ravishankar, 2016).

A few companies in this study were able to circumvent difficulties arising from complex or multiple financing sources. Their financial preparedness served as a dampener during the Chennai floods. Only three companies accounted for an annual emergency fund, which allowed them to quickly divert funds to recovery efforts. Many cash-rich companies that self-financed their expansion and working capital were also able to absorb some of the losses and costs that were incurred during the floods. This reiterates our point that cash-poor, financially-excluded companies experienced amplified flood effects as a result of prior financial status.

Figure 11 shows the sources from which companies drew funds during the floods. This figure does not represent the amount of funds, just the number of times the source was mentioned, regardless of the amount or share in total recovery.

Only four companies reported debt relief and reduced interest rates that were part of a state and the Reserve Bank of India (RBI) order right after the floods. Banks seemed to be largely unaware of these provisions. Among this sub-section two companies had to wait for over half a year before they were able to receive debt relief allowances of up to one year.

With production, input, and client shutdowns, many firms reported significant financial distress and inability to pay back loans for several months. Because production was discontinued during and after the floods, Firm 25 had to take out an even more expensive loan from a moneylender in order to meet the monthly bank loan payments. The December 2015 floods exposed an extremely high reliance on informal financing channels including friends, family, and moneylenders proving to be quicker, more flexible sources of capital infusion in emergency situations. While moneylender interest rates were high, some firm owners said that they were able to procure zero-interest loans from friends and family.

Figure 11 also shows that insurance had the highest incidence in financing firm recovery. However, this figure only speaks to the number of times insurance was referenced as a source. Many of the payouts were extremely low, and most firms with some kind of insurance arrangement had to raise funds from other sources. This point is explained in greater detail in the following section, which shows that insurance remittances were slow, marginal, and are, in many cases, still pending.

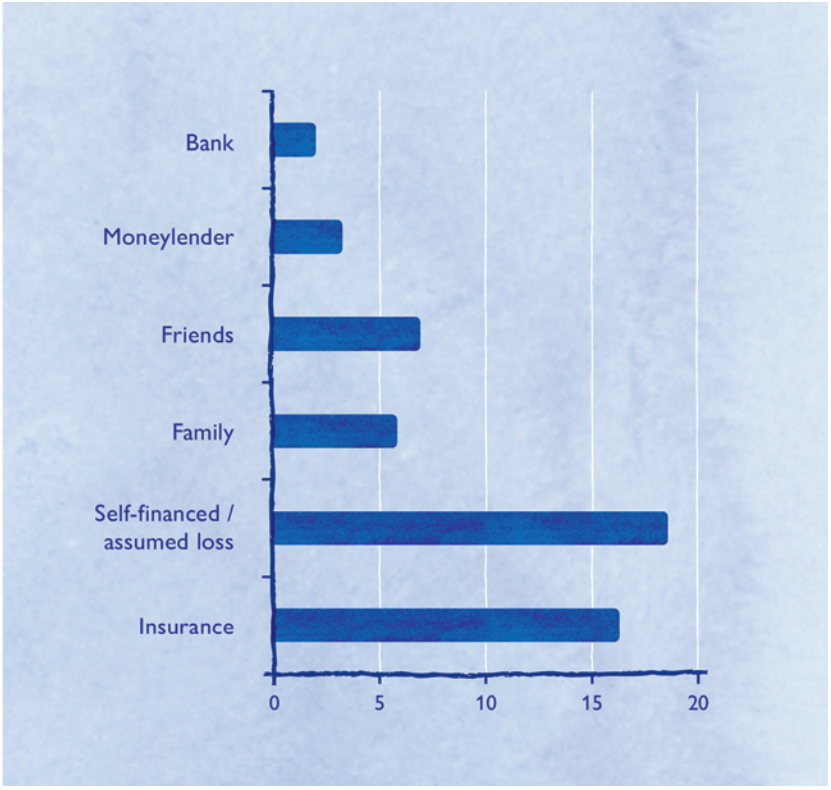



**FIGURE 11:** SOURCE OF FLOOD-RECOVERY FINANCE

## Relevance of These Findings to the Rest of the MSME Sector

The difficulties that firms reported in accessing responsive and sufficient capital is indicative of sector-wide issues in India. This was particularly true for inclusion in formal financial institutions and access to capital for growth and working capital. Numerous reports indicate limited access to financial products such as term and working capital loans as a top MSME constraint to growth. Studies also show MSME access to formal credit is most constrained during early growth stages, when their equity pattern and credit history are less likely to be stable or established, with MSMEs tending to sometimes move towards private banks in later stages of growth (Singh and Wasdani, 2016), as was the case in our study too. However, 67% of India's MSMEs are reportedly not served by the formal financial sector (KPMG, 2014). Other estimates indicate that 78% of MSME finance demand is either self-financed or met through informal sources, meaning that formal sources cater to just 22% of India's total MSME debt financing needs.

Our study departs from these figures when it comes to funding sources for expansion, with firms indicating a strong preference for, and greater reliance on banks, among other external sources. A little over one-third of respondents were unable to access formal funds, even for part of the expansion purposes.

Studies show that accessing formal credit is difficult in the best of times, and even worse during times of distress for several reasons. As coroborrated in this study, informal channels, particularly those who are trusted, offer higher repayment flexibility (Singh and Wasdani, 2016). Informal channels also offer more timely credit availability, including shorter turnaround time. Loss of time in formal channel processing is exacerbated

*Slow finance is the main reason that micro enterprises opt for loans from private banks over public financial institutions, even when interest rates are higher.*

by banks' hierarchical processing structure (Singh and Wasdani, 2016). During shocks, formal channels can sometimes be more expensive because of lengthy loan processing times, sometimes involving fees (Singh and Wasdani, 2016). Accessing informal funds requires a simpler application process, usually not involving detailed financial statements—which some MSMEs prefer to avoid for fear of tax complications or petty bureaucratic harassment (SIDBI, GIZ and M2i Consulting, 2010). Formal sector complex documentation requirements were found to scare away many MSMEs, particularly those who are not registered (Singh and Wasdani, 2016).

Overall, 72% of MSMEs recovering from Chennai's 2015 floods are estimated to have bought informal sector loans at high interest rates to revive flood affected businesses or start afresh (Sphere India, 2015). MSMEs with formal financial sector ties also struggled post 2015 floods: these enterprises urgently requested loan waivers, extensions of loan periods, increases in working capital, term limits and payment moratoriums of banks and the RBI (KPMG, 2016). In some cases, banks did respond by extending overdraft limits by 10-15% as a disaster relief measure, but these were deemed inadequate and inaccessible to many (KPMG, 2016).

Challenges in tapping into public schemes and subsidies are a prevalent problem for MSMEs in Chennai and throughout India. Loans and schemes are seen as generally not designed to cater to MSME needs, particularly those in the informal sector. A study of one MSME cluster in Chennai indicated that as few as 40% of respondents were aware of the CGTMSE scheme mentioned above (Dun and Bradstreet, 2014). An Indian government Ministry of Finance Committee appointed to examine the financial architecture of the MSME sector also determined in 2015 that there is general low awareness about schemes, a problem that is compounded by the large number of schemes available. This large number of schemes also means resources are spread thin, diluted in focus, and complicate overall program delivery and administration (Department of Financial Services, Ministry of Finance, Government of India, 2015). One study finds that bank account holding MSME owners have more awareness about schemes and are more likely to avail of schemes (than non-bank account holders) (Singh and Wasdani, 2016).

MSME financial inclusion may be inhibited by the very definition of MSME as per India's 2006 MSMED Act. This definition doesn't provide information on the financial maturity or scale of the MSME. As a result, lenders find it difficult to identify firms, often doing so on the basis of annual sales, a metric that varies across lending institutions. Inconsistent MSME definitions across government and financial institutions also mean that data on the MSME sector is not uniform, which works against the segmentation of enterprises and the provision of targeted services and products (IFC, 2012). Reconciling data on MSMEs is further complicated by the Indian government's system of maintaining multiple identification numbers for enterprises and individuals. For example, entities are registered according to Permanent Account Number (PAN), Tax-Deduction Account Number (TAN), or Aadhar Number (Unique Identification Number). This makes compiling MSME data from various sources challenging (IFC, 2012).

Most generally, banks and financial institutions tend to lump MSMEs together, viewing them as inherently risky and lacking in credit worthiness. This one-size fits all approach fails to recognize its vast het-

erogeneity, varying widely in size (micro, small, and medium), ownership structure (which determines the form of capital—equity or debt—they can access and/or absorb), area of operation (determining scale and type of operation, natural resource availability) type of industry (manufacturing or services, with tremendous diversity in each category) and stage of the enterprise's development (IFC, 2012). This approach, combined with poor domain knowledge, "perpetuates," in the words of one report, "a cycle of high costs, low credit, and high credit risk" (RBI, 2015).

Banks require that MSMEs are officially registered with the MSME Ministry. However, registration requires that MSMEs follow a series of labor, accounting, and other laws, including the maintenance up to 21 types of ledgers—a challenge, particularly for uneducated or poorly educated owners. Changing these requirements would be difficult: the government and MSME Ministry would have to make such changes at that level (Dr. Charan Singh, RBI Chair Professor of Economics, IIM, Bangalore, personal communication, September 14, 2016).

Finally, the wedge between consumer and lender is partially a result of the Indian banking recruitment system. Officers are recruited through a central recruiting authority and transferred throughout India. Most (80%) of new officer recruits in any given situation are from other states, and are unfamiliar with local context or language. Clerks are hired locally but are often members of formal unions and associations, which means the general trend is to avoid hiring them. This means most bank officials involved in loans dispersal are from somewhere far away, and do not trust or know local MSMEs, and MSMEs in turn do not know or trust them. Bank officers make minimal effort to extend loans to MSMEs and MSMEs less likely to comply (Mr. Umakant Bijapur, retired Chief General Manager of Bank of Baroda, personal communication, September 14, 2016).

## 3. Insurance

During the December 2015 floods, insurance was relatively ineffective as a dampener. Firms had varying arrangements, coverages, inclusions, and exceptions for their insurance policies and claims, with 13 firms having no insurance at all. While many of the firms were at least partially insured, this section outlines why and how in most cases insurance was inadeqaute, and did not rise to the needs of MSME claimants. These findings also clarify why other studies found low post-flood settlements. The Nurture Trust study, for example, showed that an average of only 50% of insurance claims had been received at the time of the survey.

### Three Major Arrangements Capture Insurance Coverage in the MSME Sector

Three categories help to to unbundle the insurance arrangements of the firms that were interviewed. The first, and least prevalent in this study, is direct insurance. This is used to describe insurance policies that a firm independently procures without an intervening party. Six interviewed MSMEs had direct insurance. While there was a difference in the number of employees, they had some of the highest turnovers in the sample. The

second, indirect insurance, refers to insurance that a firm takes through a financing agency in order to fulfil the terms of the loan. Indirect insurance is partial and relevant only to the loan amount. It was by far the most common insurance arrangement among the firms that were interviewed. The third category, uninsured firms, are arguably the worst off. At times firms are uninsured because they are in-between bank loans. Their machinery is older, harder to sell, and would have been difficult to insure even if owners had the means or will to seek direct insurance for it. There were no uninsured small or micro enterprises in our sample that were able to self-finance a complete recovery.

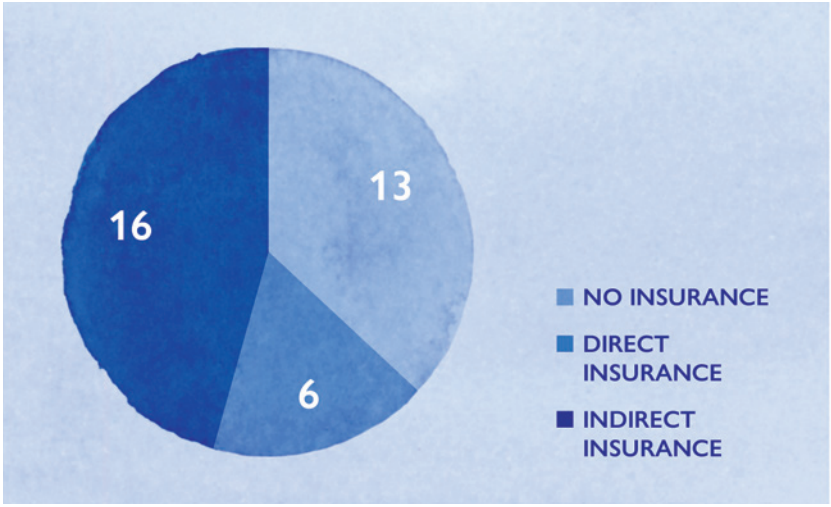
Some firms reported direct insurance arrangements for employee healthcare coverage. To the best of our knowledge, in the context of the December 2015 floods, employee healthcare insurance is not relevant to company loss and recovery. Rather, this functions as part of the benefits and compensation offered directly to employees, and do not affect the business resilience or recovery in the case of natural disasters. The graphs and section below therefore do not account for public or private schemes for employee healthcare.

Most firms with direct insurance have had this kind of policy since inception, in part because of requirements and existing arrangements with parent companies abroad. On average, the annual turnover of firms with direct insurance in this sample was close to INR 9.8 crores, with one firm reporting an annual turnover as high as INR 425 crores. Policies were more comprehensive than for indirect insurance, and included stocks and assets in contrast with loan-specific indirect insurance policies.

With a few exceptions, the firms with indirect insurance had lower average annual turnovers of approximately INR 96 lakhs and one firm reporting an INR 1 lakh annual turnover. Across the board, the indirectly insured firms had far fewer employees as well. The annual premiums for indirect insurance were debited directly from insureds' bank accounts. Given that they were all partial insurance policies, the premiums were generally lower than those paid for direct insurance.

Lack of awareness about insurance and inability to afford regular

**FIGURE 12:** TYPES OF INSURANCE OWNED BY ENTERPRISES



premiums were the two most common reasons cited when owners were asked about their decision not to insure their enterprises. With rent and salaries to pay, the urgency of insurance does not come to the fore—particularly when owners have unreliable, inconsistent cash flows, and are not convinced that they would be able to make payments on time. These are the very reasons for which many owners are unable to access formal credit or working capital.

Uninsured firms in this study reported some of the lower annual turnovers, mostly below INR 20 lakhs. Only Firms 3 and 24 had multi-crore turnovers and still did not think that direct insurance was a worthwhile annual expense.

*A few companies in this study were able to circumvent difficulties arising from complex or multiple financing sources. Their financial preparedness served as a dampener during the Chennai floods.*

### Indirect Insurance: An Unforeseen Amplifier

Several aspects of the procedures and nature of indirect insurance explain some of the poor coverage that was of great concern to respondents in this study. Firms with indirect insurance pointed to two common difficulties. One is the amount of interference that the bank can run in the insurance process, which is against the stipulated role that they are meant to play. All banks require that insurance be purchased along with all loans, regardless of borrower (with a few exceptions such as stone crushing mines or certain steel related works) and regardless of loan type. All financial institution guidelines require this (Mr. Umakant Bijapur, retired Chief General Manager of Bank of Baroda, personal communication, September 14, 2016). However, two firms also reported that banks did not mandate insurance arrangements for cash credit (CC) and overdraft (OD) facilities, which are common sources of working capital.

Borrowers can chose which insurer they want to work with; banks cannot force them to insure with any one particular company. However, banks are often agents for insurance companies and receive a commission for bundling insurance with loans. Insurance agents also have seats in banks (Dr. Ajay Verma, Head – Rural, Weather & Micro Insurance Business, Future Generali India Insurance Company Limited, personal communication, September 22, 2016). Firms in this study reported pressure to purchase insurance from particular companies, as would be expected under such an incentive structure. From the perspective of the entrepreneur the lines between banks and insurance companies are often blurred enough deter the submission or escalation of claims to insurance companies that may pass on unflattering information to banks and affect prospects for credit in the future.

Second, respondents were often unaware of the specifics of their policy, and at times conflated depreciation with uneligibility. Nine firms said that they did not have regular inspections despite multi-year loans, and annual renewals of insurance policies. Most surveyors had not visited the company once, not even to assess the policy, premium, or coverage in the first place. The floods were the first event that brought the insurance surveyors to many firm premises—and surveyors often found claims filed for flood-related damage to be ineligible for cover. Thus, a lack of awareness prevented insurance from acting as a dampener. In some cases the surprises about the actual policy coverage indirectly amplified damage since firms had not thought they had to prepare to recover assets they had considered insured.

*Lack of awareness about insurance and inability to afford regular premiums were the two most common reasons cited when owners were asked about their decision not to insure their enterprises.*

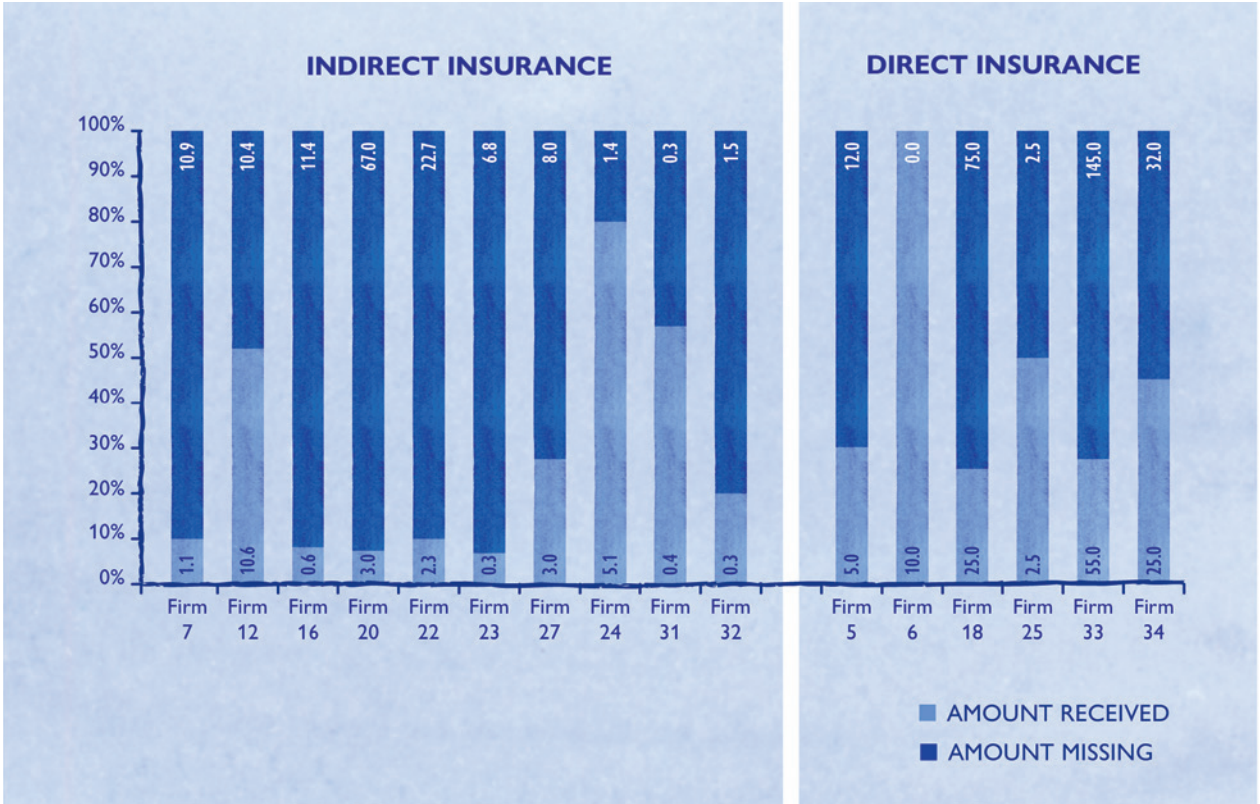
Of the eight firms that confirmed having a copy of their insurance policy, three were handed the document only after the insurance had been filed. In one case, an entrepreneur was told to go back and "read it later", a serious breach between the actual bearer and provider of the insurance policy.

The chasm between firms' expectations and the actual terms of the loan-related insurance they pay for is further evidenced in a number of other instances. A prominent nationalised bank shifted away from a former vendor after having built an in-house insurance wing. Firm 23 consequently had a change in insurance carriers, which the owner had no power to influence. When the owner approached the bank to ask about this shift, he received the same answer each time: "We asked three times and they replied 'we have given loan so it's our duty to take insurance.'"

These instances point to an obfuscation of the banks' role in such insurance arrangements to say the least. In many cases, it seems to work against the best interests of the insured. With little to no prior influence or awareness of terms of insurance, many firms not only received small settlements, they were also powerless to influence the outcome.

Unlike for firms with direct insurance, the numbers in figure 13 represent final settlements, and not advances. Firm 12, which received the highest absolute payout, only did so after the owner opted to have a quick, one-week settlement, rather than go through a longer process of survey and review. In addition to the firms with indirect insurance represented in figure 13 five firms did not present formal claims. Here

**FIGURE 13:** DETAILS OF INSURANCE CLAIMS MADE AND RECEIVED (IN LAKHS) DURING THE DECEMBER 2015 FLOODS



too, banks were reported to overstep their role in discouraging insurance claims. Several respondents reported that banks discouraged firms from applying at all, citing several reasons for why the claim would not be approved. On average, firms with indirect insurance received approximately 16% of the amount claimed, whereas firms with direct insurance received an average of 31.5%—with many outliers in both.

In contrast, all firms with direct insurance had initial and annual premium evaluations with surveyors from their respective insurance companies. The two firms that had submitted claims for fire and flood related events in the past did not seem to expect 100% of their claim to be approved. Delays are also not uncommon, with Firm 33 pursuing legal action against its previous insurance company for an open claim that was filed several years ago.

For directly insured firms, the small but fast financial insurance settlements that firms received acted as a dampener to the devastation of the floods but not to the full extent that it could and should have. Firms had to repurpose their own funds to address the majority of the loss, not to mention those that were not part of the official claim. It could be argued, especially for first-time claimants, insurance was actually an unexpected amplifier with extremely long and unexpected processing delays affecting the speed and financing of firm recovery.

## Insurance Payments Were Mostly Unsatisfactory for Both Directly and Indirectly Insured Firms

Even though there were some advantages for firms with indirect insurance, figure 13 shows that most settlements were marginal.

A big difference is that while figure 13 indicates final settlements for firms with indirect insurance, the amounts reflected here for direct insurance denote advances in some cases, without any disclosure on the date and amount of the full and final payment. Among directly insured firms, only one firm received a full remittance, whereas four had received "ad hoc" advances, with no intimation on when or to what extent the rest of their claim would be processed—even seven months after the claim had first been filed. When asked which items of the claims had been approved in order to release the ad hoc advance, none of the respondents knew. A manager at Firm 5 described it as a response to the "immediate need," with the rest of the claim being subject to "scrutiny of balance sheet and other things."

Incomplete disclosure was a common feature among indirect insurance claims as well. Most did not know why their claims had been partially or fully denied. Sometimes, insurance agents told owners that the insurance had been incorrectly filed in the first place: a process in which most owners did not even partake.

Regardless of the type of insurance, insurance surveyors conveyed three main reasons for a lack of complete insurance coverage. The first was that most policies, direct or indirect, did not have provisions for floods or flood-related damages. One respondent described the interaction as follows:

> *"For claiming the insurance I have to approach the bank, and they gave me the idea that the motherboard problem will not be covered under insurance. If the machine caught on fire, you can show it as damage. But for this kind of problem, they will call it depreciation and it will not be covered under the insurance."*

This leads to the second reason: incorrect valuation or depreciation of equipment. The Chief Operating Officer (COO) at Firm 33 (directly insured) said that the delay was because insurance firms were struggling to estimate the present day value of the insured machines.

Finally, many interviewed claimants noted that insurance surveyors did not seem to appreciate important specifications and nuances of their machinery, industry, or sector. Surveyors told the owner of Firm 23 (indirect insurance) that the motherboard was not covered because it was positioned at a level higher than the maximum height of the floodwater, and would not be covered under the policy. The owner explained that while this might be true, the floodwater still ruined the plugs and electrical components, which in turn affected the motherboard. In addition, because of extended power failure during the floods, the plugs shorted, ruining the electrical components of the machines. Again, since the surveyor could not see a direct link to the floodwater-induced damage, this claim was rejected. Firm 23's experience once again points to how amplifiers are compound and can have a domino effect.

### No Insurance: An Underutilised and Missing Dampener

Among the uninsured, Firm 3 stands out as an outlier in terms of its annual turnover and number of employees (see Annexure 1). It is one among six enterprises in this study whose indirect insurance had lapsed during the time of the floods, and was thus not insured at the time.

Firm 3 reported that their insurance policy was not valid during the floods because the bank failed to debit the premium amount in the second year of the loan. The loan covered 75% of their initial investment on plant and equipment, and the firm had only been operational for three years. While the premium was deducted in 2013-14, it was not dedcuted for 2014-15. This rendered their insurance void. Today, Firm 3 is still waiting to find out who is responsible, and their claim has been officially rejected. What is clear is that the insured party is so far removed from the process that they are not able to identify how the insurance lapsed: whether the insurance company forgot to charge the amount or whether the bank forgot to renew the insurance. The bank manager took a three-month leave of absence and was then replaced by a new manager who was not present in Chennai during the time of the floods. Other companies also reported a change of guard in their banks, making it difficult for them to plead their cases.

*With little to no prior influence or awareness of terms of insurance, many firms not only received small settlements, they were also powerless to influence the outcome.*

Firm 3 experienced a compound amplifier effect because of the link between their loan and insurance. Since the bank was the porthole for both, they not only failed to receive any insurance, but their assets were frozen as well, another complication when the roles of the insurance and the bank become conflated. Other utility-based disruption further added to a compound amplifier effect. As the communication lines in their premises were disrupted, Firm 3 could not reach out to the

insurance or bank personnel. They took photos of the damage to their facilities and waited for 20 days before resuming production. Although there was no major damage to their buildings, their electrical lines were in disrepair. Even today, they have achieved only 70% of their pre-flood production levels. A staggered start to production has cost them INR 2 crores, which is their entire top line. The total damage to their equipment alone was INR 45 lakhs, a figure estimated by their bank surveyor. Due to their slow recovery process, they also lost their third largest client and are yet to recover business from this client.

When asked why additional insurance was not taken, one of the directors at Firm 3 said "RBI says if the bank is doing funding, the bank has to make sure the insurance policy is taken care for the value of the bank's funding. Since the bank has to do it, we were not asked to take insurance. Eventually 25% is my money and 75% is from the bank."

Four other firms were rendered uninsured after they had paid off their loans. Three were not told about processes of renewal, although based on other firms' efforts to insure older machines, it is likely that after the term of the loan, many of the machines would have been too old to insure. Firms 35 and 36 both spoke of a lack of insurance mechanisms for older machines, as well as those purchased second-hand. This is why they do not have insurance. The owner of Firm 36 spoke about the roadblocks he faced when trying to insure existing machinery. A bank official told him there was "no insurance for old machines in our Indian law. It is 0% value. It is equal to scrap according to them."

This presents another huge gap in insurance offerings for older firms or firms with older machinery. Current insurance offerings also seem to largely overlook smaller firms with funds only to expand through second-hand purchases. Finally, and perhaps most problematically, there seems to be no insurance coverage for firms that don't have financial access and thereby no access to indirect insurance.

Many indirectly insured or uninsured firms cannot see the value of making constant payments while receiving insufficient settlements in in the event of a disaster. A respondent from Firm 2 relayed how pallid the trade-off was in his case:

> *"I have INR 60 lakhs worth covered in insurance and have been paying the premium for past 20 years and have never claimed even once. But when I claimed for INR 25 lakhs after this flood, they just gave me INR 2.3 lakhs. I was having finished goods worth of INR 50-55 lakhs that were about to be dispatched. After the flood, I had to dismantle them and assemble again right from scratch, which in turn cost me INR 25 lakhs loss. No one has taken this into account."*

In most cases, financial losses incurred from damage to equipment, building, inventory, and documents is less than half the annual turnover of these enterprises, except in one case. Most of these losses were unanticipated and enterprises are yet to recover from them. A more detailed note on this is available in the subsequent section on firm recovery.

*Many interviewed claimants noted that insurance surveyors did not seem to appreciate important specifications and nuances of their machinery, industry, or sector.*

*Current insurance offerings also seem to largely overlook smaller firms with funds only to expand through second-hand purchases.*

### Findings in the Context of Insurance In India

This study serves to unlock some of the details and constraints or entrepreneur-bank-insurance relations, in a context in which indirect insurance has been known to be broken for some time. In fact, an August 2016 Insurance Regulatory and Development Authority (IRDA) official announcement acknowledged receipt of a series of complaints relating to "compulsory bundling of insurance products with bank's products despite express unwillingness of customers," among other complaints (IRDAI, 2016). Such indirect insurance must be sold by an approved agent—known as "specified person" or SP—working inside the bank, as per IRDA regulations. Insurance is purchased in the borrower's name with the bank name and borrower bank account number specified. Repayments are made directly into that bank account. Ideally, the insured signs all documents and the bank counter signs (Dr. Ajay Verma, Head – Rural, Weather & Micro Insurance Business, Future Generali India Insurance Company Limited, personal communication, September 22, 2016). However, this is not always feasible and banks therefore frequently will simply sign for the insured, a phenonmenon that also had occurred to firms that we spoke to.

Borrower and bank are intended to benefit from this strategy: both benefit from risk mitigation and loan repayment in the event of damage to or loss of the relevant asset, with banks benefiting further if sales commissions are involved and borrowers sometimes benefiting from additional funds to purchase further assets if any remain after loan repayment (Mr. Umakant Bijapur, retired Chief General Manager of Bank of Baroda, personal communication, September 14, 2016; Mr. Sandeep Varma, Consultant in Social Business, personal communication, September 22, 2016). All insurance claims are to be handled by insurance companies, with banks playing no official role at all in claims processes (Dr. Ajay Verma, Head – Rural, Weather & Micro Insurance Business, Future Generali India Insurance Company Limited, personal communication, September 22, 2016). In this study, however, banks had a say in almost all phases of securing indirect insurance, from determining and changing the provider, to informally rejecting claims.

This study also found that banks are important portals of information, financial inclusion, and access to insurance—an arrangement that may be convenient, but also concentrates power and misinformation in a single institution. A study of the Indian landscape finds that commissions-motivated insurance agents frequently provide ill-considered advice and recommend "strictly dominated, expensive products 60-90% of the time" (Anagol, Cole and Sarkar, 2016). In addition to being expensive, these products are also largely unsuitable for customers, and have the most significant welfare impact on customers who are financially illiterate (Anagol, Cole and Sarkar, 2016). Banks who sell third-party products such as insurance are also found not to take time required to determine customers' situation, risk appetite, or details of their existing portfolio. They tend not to mention costs unless specifically asked, and even when asked, to give inaccurate responses. For example, the same study found that 99% of responses about return disclosures on insurance were wrong, as were 100% of disclosures on costs of life insurance products (Halan and Sane, 2016).

The large gaps in insurance coverage and needs are testament to larger, nation-wide gaps in the insurance system that affect MSMEs in particular. Insurance company failure to pay some or all of claims is found to partially be the result of a lack of entity or forum to provide a unified grievance redressal mechanism in such cases, or to establish linkages with other platforms and facilities for MSMEs, or aggregate and utilise complaints for big data analytics on the collated data to determine critical systemic issues that require reform (SIDBI, GIZ and M2i Consulting, 2010). Firms in our study found that once rejected at the bank level, there was no institution where they could systematically make appeals.

The Indian insurance sector is described as governed by opaque disclosures which have contributed to massive mis-selling and losses to customers. One newspaper article states that few buyers among insurance policyholders in urban India "can claim they don't have a rip-off story to tell." For example, life insurance policy products were widely mis-sold in the decade following privatization. The primary product here was the Unit linked insurance plan (Ulip), which was introduced in 2002 (Anagol, Cole, and Sarkar, 2016). Ulips are market-linked insurance policies that are front-loaded, where investor value builds up only after a period of about 7-8 years. Most sellers, however, sold them as three-year money doubling policies, not disclosing accurate information to investors. When many investors decided to sell their plan a few years into having purchased it, they faced large fees and penalties, and wound up losing lots of money, estimated at a minimum total of INR 1.56 trillion between 2004 and 2012. These losses were the direct result of lapsing linked to mis-selling of insurance, with losses experienced across socio-economic sectors (Bhaskaran and Halan, 2013; Halan, Sane and Thomas, 2014). The result has been termed "a textbook case of poor regulation and mismanagement of the transition from state monopoly to free markets" (Bhaskaran and Halan, 2013, 8th paragraph, second line).

Such breakdowns contributed both to widespread insurance customer loss and also to an overall mistrust in finance and a persistent low reach and under development of financial markets in India (Halan, Sane and Thomas, 2014). Generally speaking, India has among the lowest rates of insured companies (of all sizes) in the world: 7% to in 2013 (Sreekantha and Kulkarni, 2013). The IRDA also admitted there were problems with the Ulip product, and changed related rules in 2010, including a reduction in Ulip commissions over time (Bhaskaran and Halan, 2013; Halan, Sane, and Thomas, 2014). However, commissions on traditional endowments plans are still high, and these need to be reduced in order to tackle mis-selling (Prashant and Sane, 2016).

## 4. Labour

Our firm interviews indicate that labour considerations are an integral part of locational choices, production processes, and post-disaster recovery efforts. Employees overwhelmingly proved to dampen the effects of floods. Most recovery efforts, insofar as they did not require external expertise, excess capital, and/or external approvals were employee-led. At the same time, a heavy reliance on labour also amplified flood effects for firms who expected severe labour loss. This specific vulnerability is

part of regular attrition and labour replacement considerations that become more pronounced during a natural shock.

### Access to Labour Guides Several Key Business Decisions

As described in the section on location, access to labour influences many of the location-based choices and aspirations that are relevant throughout the life of the MSME. Respondents further illustrated this connection when they talked about where their employees come from and live. Twenty - three firms only had employees from Chennai, whereas only 12 firms employed workers that were both from Chennai, and had migrated to Chennai to work at the firm. No firms singularly contracted out of state labour. Twenty-one firms confirmed that their employees either lived very close to or on the premises. Only three firms had workers that lived far away or all across the city. As detailed in the section on location, proximity to labour was one of the most prominent reasons for firm location and relocation.

Two managers remarked that they mostly contracted out of state workers for unskilled work, since "local people prefer white collar jobs." Other firms confirmed that hiring agencies were usually contracted for North Indian workers. A partner at Firm 24, which had the most even gender split of all the manufacturing units that were surveyed said that his 10 female employees were from Chennai and were provided accommodation. The remaining 12 male workers were all from North India. Three other companies provided guesthouse or in-house accommodation for their workers—whether they were from Chennai or from out of state.

### Attrition and Replacement Costs are Large and Potential Amplifiers

Across the board, enterprises were found to spend a considerable amount of time training employees. Most firms were not able to convey their attrition rate. As many as seven firms said they had a high attrition rate, often around 10% or more. More firms were able to speak to the processes for replacing lost labour. As many as 17 firms found it very difficult to replace labour, and took between one to four months to recruit new employees. They then took additional time to train the new employees before they could fully contribute to service and production processes.

*Employees overwhelmingly proved to dampen the effects of floods. Most recovery efforts, insofar as they did not require external expertise, excess capital, and/or external approvals were employee-led.*

Only 16 enterprises provided the rate or level of attrition experienced by their enterprise. For these enterprises, the attrition rate varies between less than 2% to a maximum of 10%. A high attrition rate need not necessarily be a challenge for these enterprises if the ease of replacing the lost employees and the time taken for replacement is low. Figure 14 shows the ease of replacement across the sampled enterprises. Almost half the sampled enterprises have stated that they find it difficult to replace lost employees. The factors these enterprises have taken into consideration vary from losing trained individuals to competition; lack of trained professions; and inability to pay competitive wages to name a few. There seems to be a direct correlation between the enterprises' stated level of ease of replacement and the time taken to replace. Any

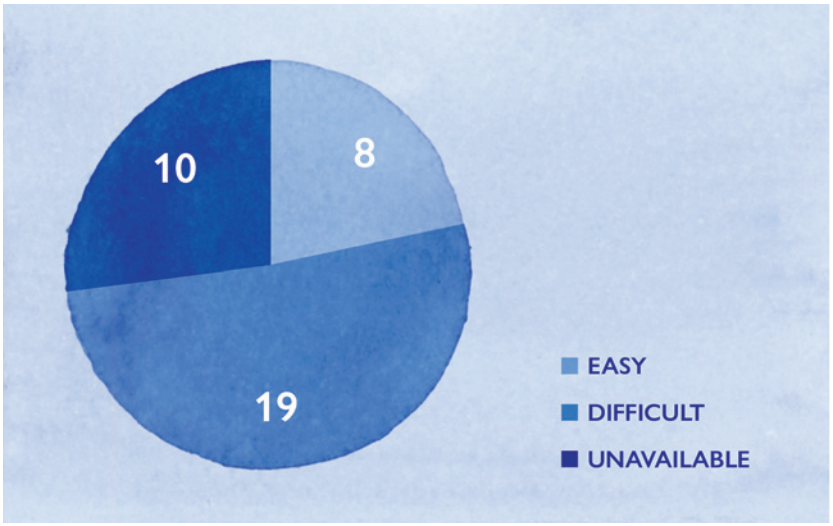


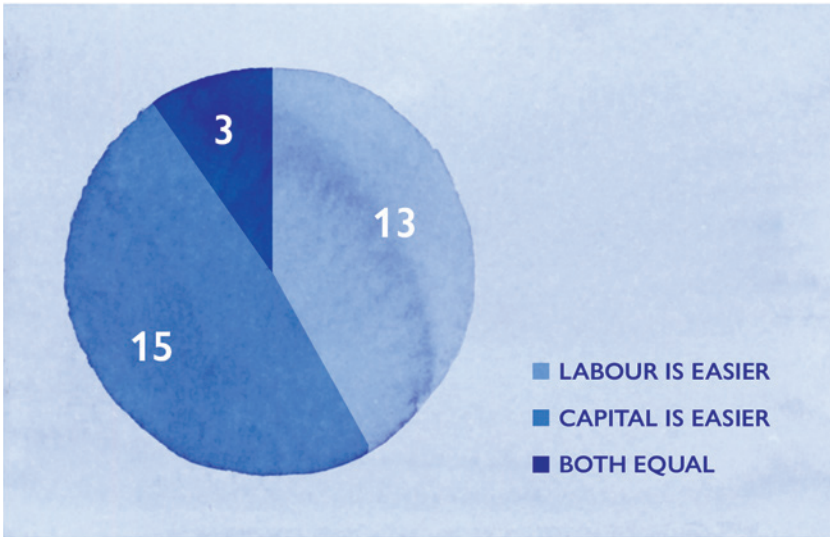

**FIGURE 14:** LEVEL OF EASE OF EMPLOYEE REPLACEMENT

enterprise that has taken four weeks or more to replace their employees have stated that they found it difficult to replace their employees.

These are business-as-usual scenarios that become all the more potent during natural shocks. Replacing lost employees is costly in terms of time spent and additional cost incurred in training them. Regardless of the success in being able to recover from employee loss, employees were still the biggest strength for the enterprises during the recovery process, as discussed in the firm recovery section.

To hone in on this point, firms in this study were asked whether they would be more likely to recover from a complete loss of labour or a complete loss of capital. The question showed that, in general, firms were slightly more vulnerable to labour loss than capital loss, with a few even equating the two. Here again, the top two reasons for vulnerability

**FIGURE 15:** WHICH IS EASIER TO RECOVER FROM - LABOUR LOSS OR CAPITAL LOSS?



to labour loss were recruitment and training time, ranging from several months to two years for one firm.

### Employees are a Key to Resilience Strategies

Whether it was through company-provided housing or not, a close proximity between employees' places of residence and their worksites was a key dampener during the Chennai floods. It allowed workers to participate in the recovery process much faster, particularly when compared with firms in IEs that are not on the main road or close to major bus/rail stops. Other employee-driven recovery efforts are detailed in the section on firm recovery.

Firm 6, with a property-wide 4 foot elevation served as a temporary shelter for employees. Though Firm 6 is located in Sriperumbudur, they have a large presence of contract workers from North India that are housed close to the plant. Production did not shut down completely but neither did access to food, water, or toilets for employees whose homes had been far more compromised. The director noted mutual loyalty in this case, as the company served to protect its employees, and employees continued to work despite the serverity of the floods around them. Firm 34 in Ambattur IE was also able to hasten the recovery process because it is strategically located next to a major railway station, with trains running more frequently and reliably during the floods than buses. Employee access to worksites thus proved to be an important dampener for most MSMEs that were interviewed. Employees were often commended for being first on site, at times even while it was raining, and particularly when owners could reach the premises. In these instances, employee initiative and loyalty is a key to firm resilience. Conversely, several firms also dampened the impact of the floods for their employees by continuing to pay them even when they were unable to come to work.

None of the firms were able to claim labour loss through their insurance, a consideration that becomes all the more relevant when the opportunity cost of timely recruitment is valued as a dampener during natural shocks. In addition, post-flood government assistance seems largely restricted to credit, insurance, and loan repayment—albeit with significant barriers to these forms of relief as well. Assistance with recruitment and training, two very real costs and amplifiers, were never featured as part of a public strategy to alleviate damages that MSMEs incur in water-related environmental variability. This once again shows how far removed relief efforts are from a fundamental enabler of MSME recovery.

## 5. Supply Chains

Supply chains include risks that are arguably the hardest to generalise, since, to a large extent, they involve relationships that are product and firm specific. Supply chain risks present a fuller picture of the losses and assets that amplified and dampened the effects of the December 2015 floods, particularly those that are not usually accommodated in the cost calculus for insurance and credit.

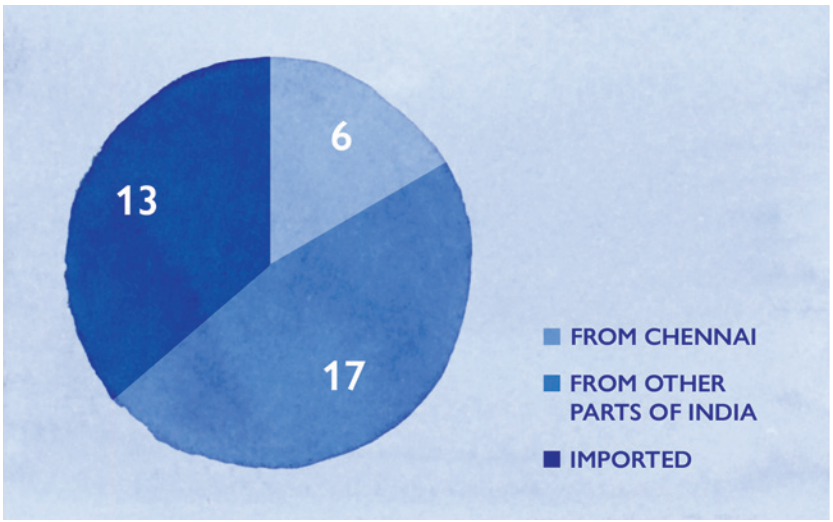



**FIGURE 16:** EQUIPMENT PROCUREMENT

## Equipment

Equipment was procured from both domestic and international sources, with a larger incidence of domestically-procured equipment. In most cases, firms were able to take care of basic repairs themselves. This was crucial to firm recovery strategy, especially when insurance was not an option, and service requests peaked during floods. Firm 6 reported that for imported machines, official vendors would refuse ad hoc servicing requests and demand annual service contracts in the amount of several lakhs. In-house ability to repair machines is thus an important cost-cutting strategy for normal business practice.

Many firms reported quick, one-day response periods to service and repair requests. Here again, the delay in recovery was mostly because of insurance delays and not for want of access to repair services.

## Raw Materials

Inventory and flows were not industry specific; they were dependent on the type of product and line of enterprise activity.

Those who had to store large amounts of raw materials were more vulnerable at the time of the floods. Mostly, self-insured enterprises had policies that covered these assets. The only exceptions were enterprises that had overdraft (OD) or cash credit (CC) bank loans, which were availed for working capital. In these rare cases, the loans covered stock and raw material. Here too, the coverage was partial, since expenditure on travel and excise duty were not included in OD or CC insurance packages, but were nonetheless related losses that that could not be recovered.

A few firms commented on how slow working capital makes procurement and operations hard. In some cases, banks had small credit periods, which were strictly enforced even though CC and OD allowances took months to reach the entrepreneur.

Enterprises that were able to secure advances from customers were able to weather credit and inventory deficiencies better both under normal and flood situations.

Of note are the many firms who are engaged in "job work." These firms do not procure materials themselves. Rather, the customer gives them the exact amount of material for specific orders. During regular business times, this arrangement spares firms credit negotiations and procurement struggles. However, during the floods the arrangement

acted as an amplifier, since firms were even more accountable for goods with a value that was not normally a consideration in day-to-day accounting.

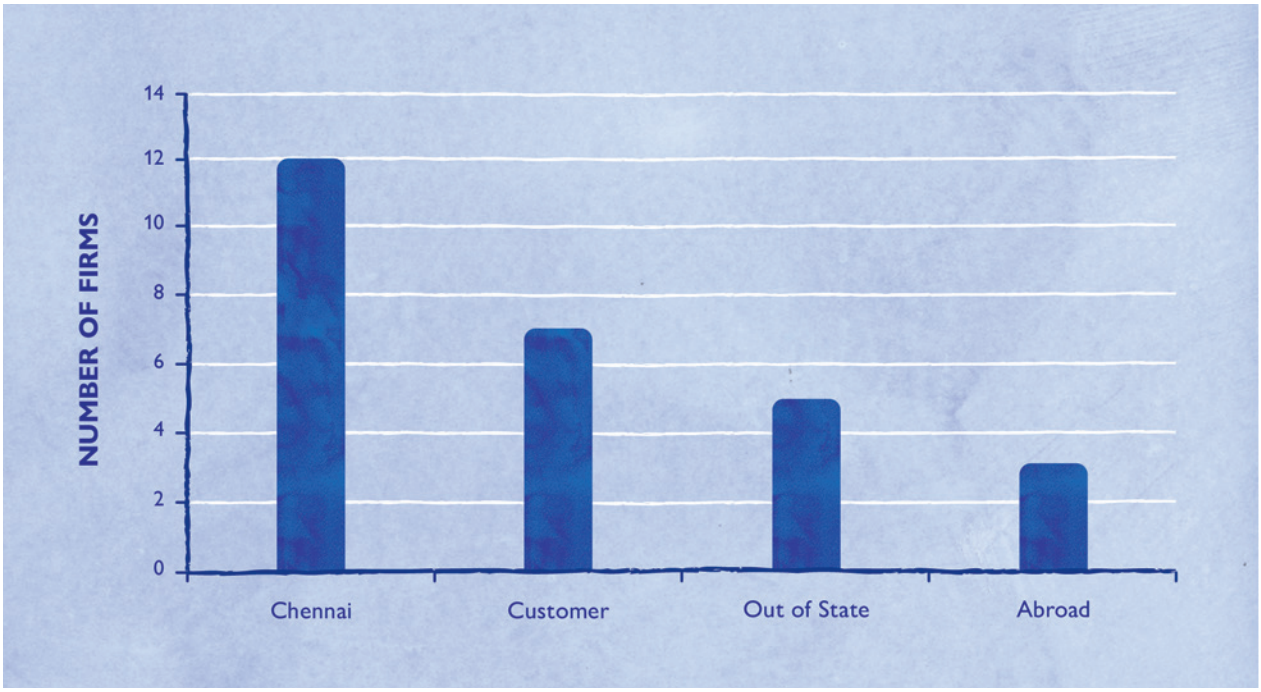
Some clients in Chennai, having witnessed the floods first hand, forgave raw material losses, as did long-standing out-of-state clients that had no alternate suppliers. Some firms had to assume losses, particularly Firm 34, which has both global suppliers and clients, and contracts that hold the firm liable for such losses.

Local sources proved to have both dampening and amplifying effects with some firms able to recover faster and access supplies better than those that required highly specialized or rare raw materials. In other cases, firms were forced to seek inputs elsewhere as their suppliers were also significantly impacted.

Another reason to maintain high inventories was to reduce transportation costs. In some cases, businesses needed to maintain a high stock because suppliers are few, and procurement processes are lengthy, as was the case for Firm C. Finally, firms have a high inventory when they offer walk-in, "on demand", or "just-in-time" (JIT) services. Having the required material on hand is key to daily operations and eventual growth. Conversely, firms with alternate, local suppliers reported no lag in supplies after the floods.

Another noted dampener was the use of external warehousing vendors. Firm 6 contracts a warehouse vendor, who buys in bulk for a number of companies in Sriperumbudur. The enterprise pays a premium for storage and transportation but neither has to interface directly with large suppliers nor worry about availability during the floods and otherwise. It also helps that the area is dominated by the auto industry, and warehousing vendors are able to generate enough demand for their services. No other respondents said that they used such facilities.

**FIGURE 17:** SOURCE OF RAW MATERIAL PROCUREMENT



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### Product Inventory

The effects of maintaining a high product inventory were largely the same. Some firms were more vulnerable to the inventory of finished goods that they stored than raw materials, since flood-affected clients were unable to make payments or pick up goods on time.

### Clients

Again, this factor was largely product-specific and not necessarily industry-specific. Clients have varying degrees of involvement, and also absorb risk in different ways. In some arrangements, the clients interface directly with suppliers and procure raw materials for the enterprise. This is true for large auto companies, who use these methods for quality assurance.

Large international corporations also have JIT clauses that are part of their own production processes. Delays can result in bad reviews, penalties (written into the contract), or loss of contract. Penalty clauses are so far-reaching that one of the interviewed enterprises had to pay the penalty that their customer incurred because of delayed delivery during the floods. Enterprises that are part of global supply chains that ultimately provide parts to large Multinational Corporations (MNCs) are thus vulnerable, even if they have two or three degrees of separation. These were also the enterprises that had a keen eye on international expansion.

On the other hand, enterprises that had a more local clientele, or clients who had been with them for decades, did not experience customer losses. They were also less likely to consider business expansion and seemed more content with a niche market. Some of these processes are outlined in greater detail in the following section on firm recovery timelines.

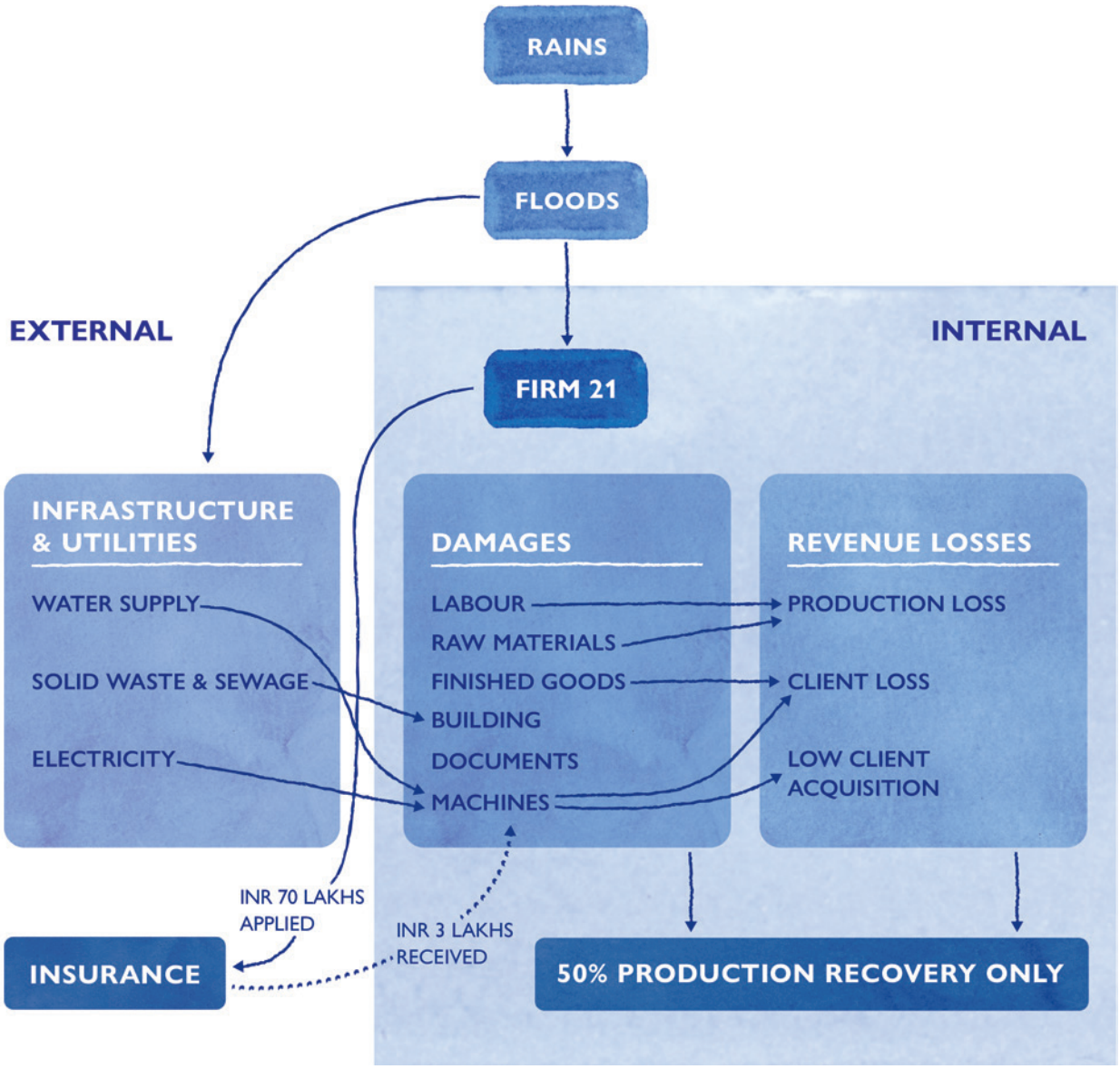



**FIGURE 18:** AN ILLUSTRATION OF COMPOUND AMPLIFIERS IN THE BUSINESS ENVIRONMENT

Figure 18 (above) brings together many of amplifiers that were explained in this section, as experienced by Firm 21. Some of these processes will be explained in greater detail in the following section on firm recovery. Firm 21 had compound amplifiers, since many of the factors in Figure 18 continually and jointly spiralled into worse conditions. After several days of waterlogging with many lakhs worth of damage, Firm 21 had to wait to resume production for several reasons. First, all of their machines were damaged, and it took them almost 30 days to regain access to key utilities. The insurance that they received—a poorly performing dampener—was marginal, and not even enough to fix a single machine. They began to repair machines in part and ran them in varying states of partial disrepair—a process that further worsened the conditions of the machines. In this state, machines also require more manual oversight, but with a severly depleted labour force, this is hard to accomplish. All of these issues contributed to marginal production levels.

The floodwater had damaged finished goods and stocks on Firm 21's premises, which cost them existing clients. They are unable to acquire new clients, who require fully automated, precision equipments,

which Firm 21 had prior to the floods. However, machines are only partially repaired and new clients are not willing to risk an order with an enterprise with damaged machinery.

Additionally, Firm 21 does not have access to formal financial institutions, and has been denied loans on many occasions prior to the flood as well.

## 6. Firm Recovery Timeline

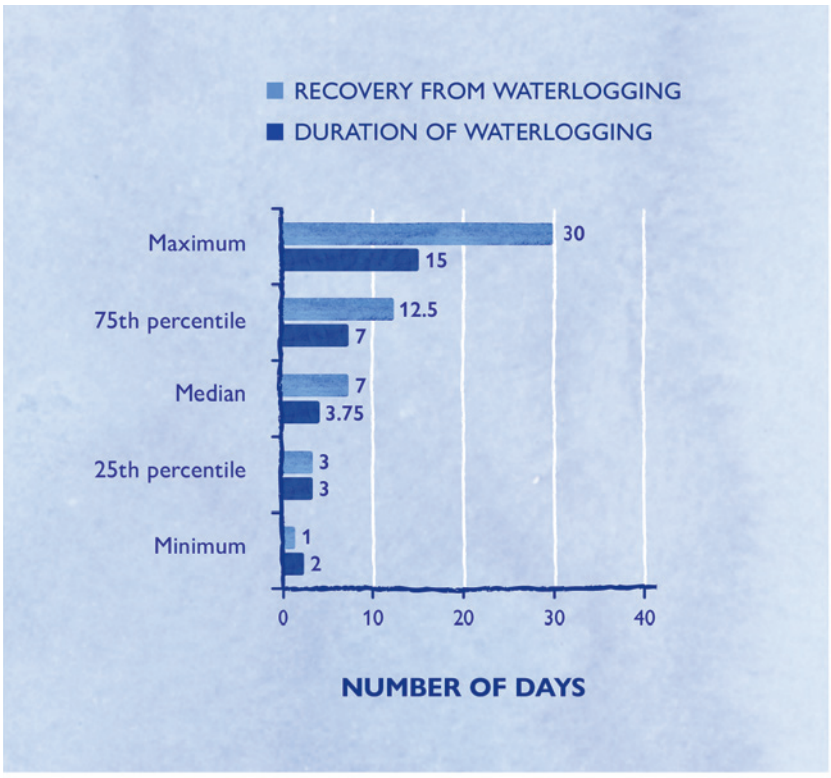
The following section elaborates on the extent and intensity of the impact of the floods on the surveyed firms in Chennai.

### Waterlogging

After the rains in the first week of December 2015, over 75% of the surveyed enterprises were waterlogged. Most of these enterprises experienced waterlogging for an average of five days. Some of these enterprises are situated in low-lying areas, thereby allowing rainwater to enter and collect in their facilities. Those enterprises that managed to drain the water from their premises within a day or two were on a slightly more elevated area than their counterparts. Over three-fourths of the sampled enterprises experienced waterlogging for less than or equal to seven days, and none of the enterprises were waterlogged for more than a month (Figure 19).

Only two enterprises, Firm 4 and Firm 37, experienced minimal or no waterlogging. Firm 4 had raised their facilities by one or two feet

**FIGURE 19:** DISTRIBUTION OF DURATION OF WATERLOGGING AND RECOVERY FROM WATERLOGGING



to prevent rainwater from entering their premises. It is unclear why there was no waterlogging in Firm 37. However, they did experience waterlogging on the roads leading to their facilities, which still affected their production. Employees had to wait for the water from the roads to drain out before they could reach the facilities to resume production.

For enterprises that were waterlogged, it took an average of nine days for the water to completely drain out. Waterlogging outside the facility exacerbated the situation. Storm water drains on the road could not accommodate the large quantities of water during the floods, and firms had to wait for the water on the roads to drain first, before water from their facilities could naturally drain out of their premises.

Firm 1 was the worst affected and took 30 days to drain the water out of its premises. Firm 1's facility is on a low-lying area. With road height increasing every so often around their facility, the facility's floor is at a lower level compared to the road outside, causing water to flow into their facilities during the floods.

Two enterprises, Firm 13 and Firm 25, attempted to pump the water out of their facilities by hiring generator sets, but this proved to be futile for Firm 13 as their buildings were waterlogged until the third week of December 2015. It is unclear if the other enteprise, Firm 25, had any success in pumping out the water. The diesel generator sets that were used were hired for a cost of INR 2,000 per day, adding to the firms' recovery charges.

While most of the enterprises could not immediately resume their operations or production, Firm 36 was forced to start work immediately, as they were under pressure from their customer to deliver.

Apart from the water itself, when the draining process was complete, most enterprises also had to clean mud from their facilities. The water from the roads had eroded the topsoil and pushed it into the facilities, further adding to the cleaning work.

## Operations and Production

Waterlogging caused by the floods and the rains in December 2015 affected the operations and production of all the sampled enterprises, although the intensity of this impact varied by enterprise, with physical infrastructure and institutional factors in most cases amplifying or dampening the effects. As mentioned elsewhere in the report, the time taken to resume production was the result of multiple factors including the time taken to clean premises, access utilities, and for employee and client recovery time, among many others. Each of the factors that have affected the firm's recovery period has been discussed in the following sections.

While three entreprises began their production by mid-December, six other enterprises are yet to achieve 100% production. These six enterprises are likely to take anywhere between two to three more months and a year to return to pre-flood production levels. Firm 32, for instance, lost all its clients to enterprises in the Ambattur area, which according to the respondent was not flooded. They were unable to reacquire these clients. Firm 32 is still operating only one shift and believes it will take a couple of years before they return to operating four shifts, the level at which they were operating before December 2015.

**FIGURE 20:** NUMBER OF MONTHS TAKEN TO ACHIEVE FULL PRODUCTION (RETURN TO PRE-FLOOD LEVELS)

Refers to an unknown and unspecified point in the future

| Firm code | Dec 2015 | | Jan 2016 | | Feb 2016 | | Mar 2016 | | Apr 2016 | | May 2016 | | June 2016 - present | Future |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-15 | 15-31 | 1-15 | 15-31 | 1-15 | 15-28 | 1-15 | 15-31 | 1-15 | 15-30 | 1-15 | 15-31 | | |
| Firm 1 | | | | | | | | | | | | | | |
| Firm 2 | | | | 25% | 50% | 75% | 100% | | | | | | | |
| Firm 3 | | | | | | | | | | | | | 70% | |
| Firm 4 | | | | | | | | | | | | | | |
| Firm 5 | | | | | | | | | | | | | | |
| Firm 6 | n | a | | | | | | | | | | | | |
| Firm 7 | | | | | | | | | | | | | | |
| Firm 8 | | | | | | | | | | | | | | |
| Firm 9 | | | | | 100% | | | | | | | | | |
| Firm 10 | | | 50% | | 75% | | 80% | | | | | | 90% | 3 to 4 months |
| Firm 11 | | | | | | | | | | | | | | |
| Firm 12 | | | | | | | | | | | | | | |
| Firm 13 | | | | | | | | | | | | | 50% | |
| Firm 14 | | | | 25% | | | | | | | 100% | | | |
| Firm 15 | | 50% | | | | 100% | | | | | | | | |
| Firm 16 | | | | | | | | | | | | | | |
| Firm 17 | | | | | | | | | | | | | | |
| Firm 18 | | | 40% to 50% | | | | | | 70 to 100% | | | | | |
| Firm 19 | | | | | | | | | | | | | | |
| Firm 20 | | | | | | | | | | | | | | |
| Firm 21 | | | | | | | | | | | | | 50% | |
| Firm 22 | | | | | | | | | | | | | | |
| Firm 23 | | | | | | | | | | | | | | |
| Firm 24 | | 40% | 100% | | | | | | | | | | | |
| Firm 25 | | | | | | | 50% | | | | | 100% | | |
| Firm 26 | n | a | | | | | | | | | | | | |
| Firm 27 | | | | | | | | | | | | | | |
| Firm 28 | | | | | | | 50% | | | | | | 75% | Months |

Figure continues on the following page

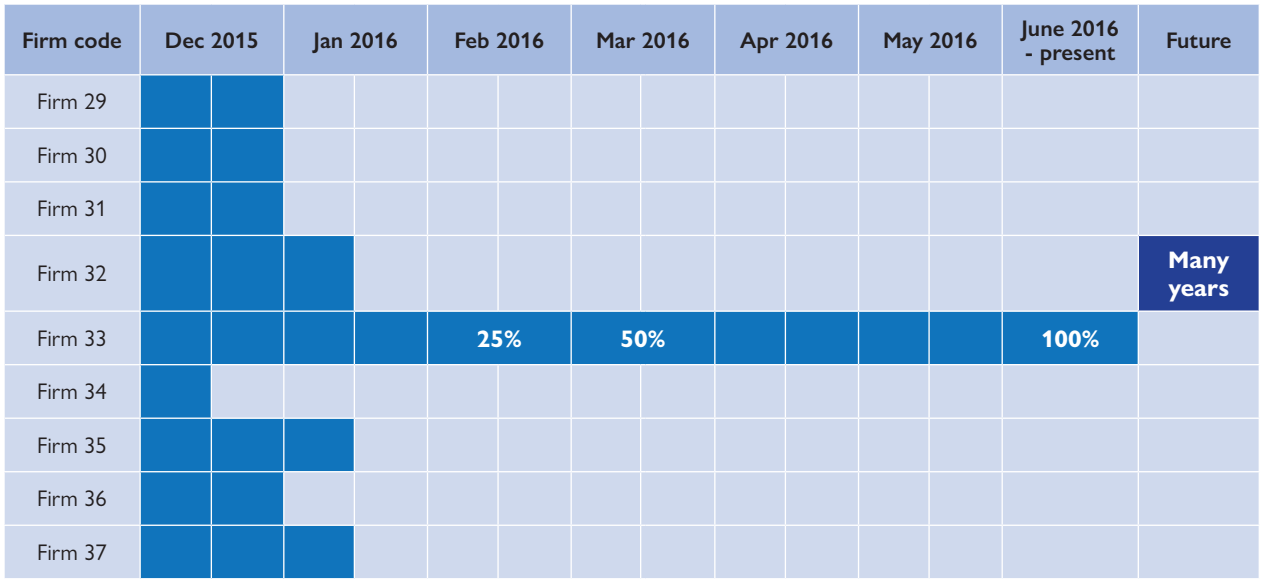



Figure 20 continued from page 79

Firms that achieved 100% production and those that are yet to achieve that level have adopted a staggered approach to repairing their machines. They repair machines one at a time, as finances are constrained. A related problem is replacement of affected machine parts. Some components have been rendered completely useless, while some others are still functioning. However, when the entire machine is run, the components that have been affected, and are no longer useful, deter the rest of the machine. Since some of the wires and components are not modular, it is insufficient to fix only a part of it; the entire wiring has to be changed, adding additional costs to the enterprise.

## a. Damage to Buildings, Documents, Equipment, and Inventory

The interviews captured information on losses incurred due to damage to buildings, documents, equipment, and inventory. Damage to one or more of these components often affected the functioning of the business. For instance, equipment damage reduced the number of production shifts, and damage to inventory (including raw materials) affected enterprises' ability to meet customer demands. While most enterprises provided binary responses with details on the type of losses incurred, they did not provide information on the financial losses arising from these damages. This makes it challenging to assess the extent of damage, which in some cases remains unknown even to insurance companies.

Almost two-thirds of the firms were most affected by damage to equipment in comparison to other forms of damage (buildings, documents, inventory).

Damage to buildings mostly occurred on the floors or the ceilings (through water seepage). Most firms had to repaint the walls of their factory premises and a few also had to re-do the woodwork in their facility. Of those who had insured their facility premises, only two enterprises had insurance to help them recover losses from building damages. Two enterprises stated that they are yet to recover from damage to their buildings, and that they will take another two months to recover fully. Most firms had neither appraised nor begun post-flood renovation work and did not provide the renovation costs. Since restoration is expensive, some of the enterprises are either waiting for the owners of

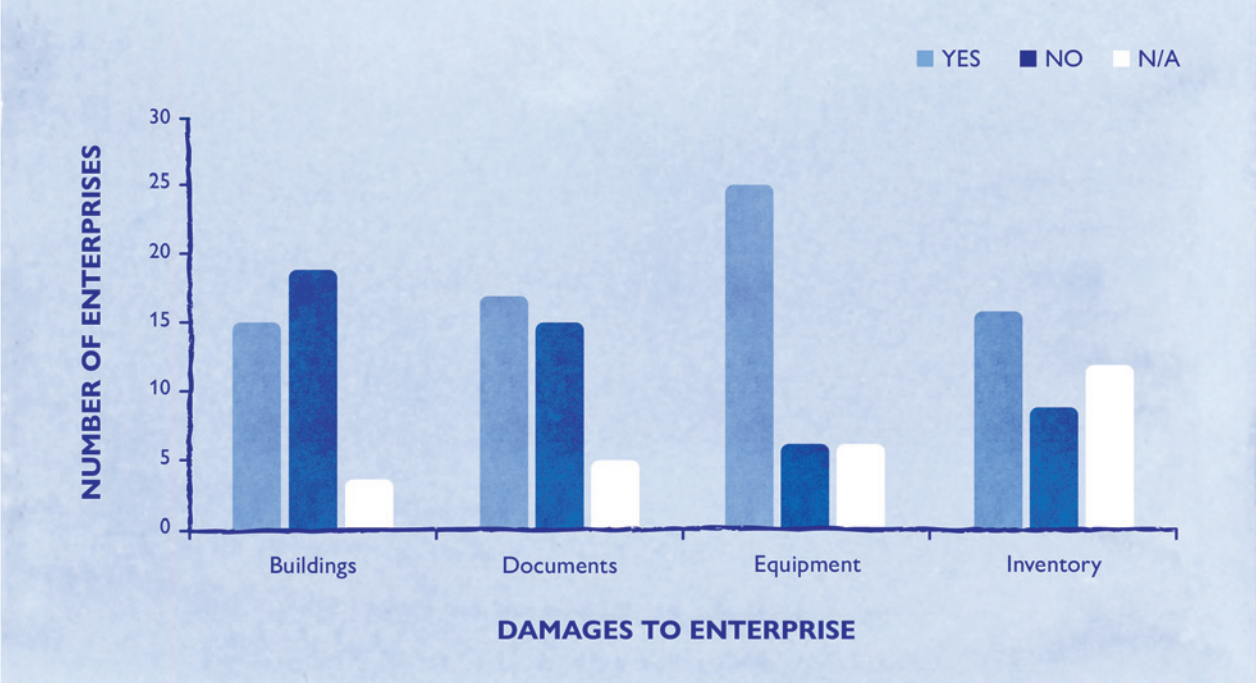



**FIGURE 21:** DIFFERENT TYPES OF DAMAGE TO ENTERPRISES

N/A – Not available since firms did not provide a response.

their facility to do the renovation or are renovating as required, fixing the most important parts to keep production moving and leaving the rest for later, when finances are more readily available. There are a few exceptions. One enterprise spent INR 80,000 to INR 90,000 to cover expenses for reconstruction of broken parts of their building.

Apart from damage to buildings, some enterprises also lost important work-related documents. Documents that were lost due to waterlogging include job cards, sales invoices, account books, chequebooks, bank statements, and statutory documents. Soft copies of documents saved on computers and laptops were lost as these electronic items were also washed out. Recovering statutory documents from the Commercial Tax Department has been challenging for one enterprise. Some of these legal and regulatory documents and certificates require the enterprises to pay a huge sum (up to INR 8 lakhs). Hence they are yet to buy these certificates. Those that did not report any damage to documents had kept their documents in drawers on the first floor or in their homes, which were unaffected during the floods.

Damage to equipment was the most prevalent, and expensive damage incurred, especially when compared to damage to buildings, documents, or inventory. The cost of recovery for damaged equipment ranges between INR 25,000 to INR 2.5 crores, with the average cost being INR 20,00,000. Although INR 2.5 crores seems like a large sum, the turnover for that company is INR 425 crores. Components and industrial parts were fully or partially rusted. Only one enterprise started operations within 15 days of the rains stopping, the others adopted a more staggered start to their production. Some firms are yet to repair and recover their equipment, as they do not have sufficient finances to carry out the repairs.

In terms of damage to inventory, some of the enterprises provided information on raw material loss as well as stock of produced goods. Many firms do not have steady orders and the inventory at a given time is variable. Moreover, raw materials are rarely covered under insurance, particularly when they are customer supplied, making it hard from many entrepreneurs to provide accurate estimates for the value of raw

materials that they stored during the flood.

For this section, inventory includes both raw materials as well as stock of finished goods. On an average, enterprises lost around INR 11,00,000 worth of inventory. Some of the enterprises also shared the production losses incurred on account of loss of inventory, which amounted to around the same figure, INR 11,00,000. Most of the enterprises had placed their raw materials on the bottom racks of shelves, as they were heavy. So, when the water receded from their premises, these raw materials had gathered rust and had to be given away.

Lastly, most enterprises incurred losses due to damaged equipment that is less than or equal to half of their annual turnover (Figure 22).[20]

However, only one enterprise that has not been included in Figure 23, Firm 21 (also detailed in Figure 18) incurred costs to equipment that is significantly higher than their annual turnover (333% of the total annual turnover). Firm 21's unit is on the riverbank.[21] During the December 2015 rains, water was as high as 12 feet within the company premises. The land behind Firm 21's facility also slid down, because of the impact of the floods and the waterlogging. While their machinery has been insured, and they have claimed INR 70,00,000, they believe that they are likely to get less than one-tenth of the claim amount. Even if some of their machines are only partially affected, it still affects their overall production as the partially affected components make it difficult for the unaffected parts to run smoothly. At the moment, their turnover alone is insufficient to provide them with the kind of finances required to recover their losses.

Apart from this, Firm 13 and Firm 20 also have a high ratio of losses incurred on damage to equipment to annual turnover at 33% and 42% respectively. Firm 13 lost all its machines. Raw materials supplied by their clients were also damaged during the floods. This has caused excessive damage to their production, with the enterprise still producing at only 50% of their pre-flood production levels. Similarly, Firm 20 also incurred severe losses on account of damage to equipment. In fact, they lost their clients and orders as they had to return their raw materials to their supplier immediately after the floods, when they were not in a position to resume production. They are currently operating at 75% capacity.

Some of the enterprises could not clean their equipment immediately as they had to wait for the insurance companies to evaluate and assess the extent of loss before the claim was finalised. Another enterprise had a relative who repaired the damaged components free of charge, which then reduced the amount of claim the enterprises needed to raise from the insurance company. Often, relief in one sector was insufficient to make up for losses in other sectors of a business. For instance, in the case of insurance, even if the enterprises had labourers and technicians who could clean the machinery and get it running, institutional barriers in the form of delayed insurance responses could make the recovery process longer. It is likely that they may be operating in an environment of loss, where each factor compounds the effect of loss triggered by another factor.

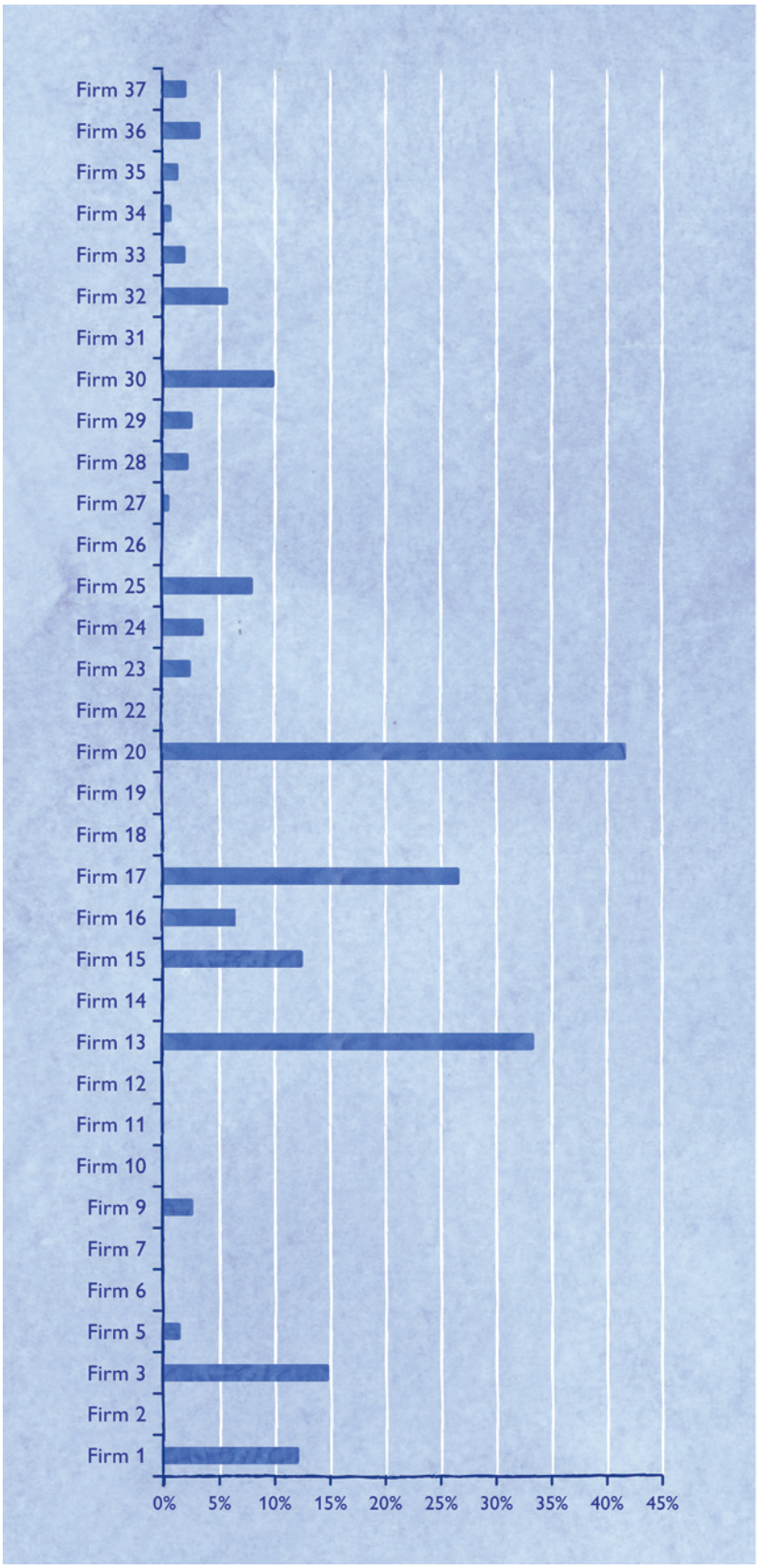



**FIGURE 22:** PERCENTAGE OF LOSS INCURRED ON EQUIPMENT TO TOTAL ANNUAL TURNOVER

Note: Firm 4 and Firm 8 did not provide details on the loss incurred on inventory. Firm 21's loss on equipment as a percentage of total annual turnover is 333%. This has not been included, as it distorts the axis on the graph.

### b. Access to Inputs[22]

To resume production, access to inputs, particularly raw materials, is an important starting point. Supply chains can be severely affected if the enterprises do not have access to sufficient quantities of high quality raw materials.

While firm facilities were waterlogged, only over a quarter of the sample enterprises had access to raw materials for production. In some cases, since the stock of raw materials in their factories was damaged, firms were able to purchase new raw materials quite easily. One of the enterprises, Firm 34, managed to source raw material from their inventory because the raw materials had not been damaged during the floods. Their suppliers could not provide the raw materials for two weeks, so Firm 34 restarted production with raw materials from their own inventory. A few other enterprises sourced raw materials from areas like Triplicane that were unaffected by the floods or from suppliers in other states.

On the other hand, there were a few enterprises that did not have access to inputs during the floods. In one case, the enterprise's supplier was also affected and hence could not provide the required inputs. In another case, the supplier was unwilling to sell the raw materials to the enterprise as the supplier was doubtful of the enterprise's ability to repay, given the large existing outstanding amount. Three enterprises who attempted to clean their existing raw materials found that they were unfit for any further use; they had to be set aside as scrap material.

### c. Employees and Clients—Loss and Recovery

Employees proved to be a strong dampener by participating in the post-flood repairs and maintenance work, playing a significantly positive role in firm recovery. Most enterprises view their employees in a favourable light, since they stood by their employers and factories during this particular instance of distress. Employees not only helped enterprises resume the production process, but also helped clean, removing water, solid waste, and sewage from factory premises, and making the factory suitable for production processes.

Less than half the surveyed enterprises lost a few employees. These enterprises lost an average of three employees. Firm 34 lost the maximum number of employees: between 10 and 15. It took them two weeks to hire replacements. They have now hired temporary labourers in the place of the staff and engineers who left the company after the floods. Replacing lost employees has taken enterprises more time than they can spare as most of the employees are technically trained to perform specific tasks. Finding new employees with the same skills, or training them from scratch requires time and capital, both of which are likely to add to the enterprises' recovery costs. In some cases, like Firm 34, firms could not find replacement workers on time. Hence, they outsourced their manufacturing process, in order to ensure that they did not lose existing client(s).

Of the total number of enterprises that have lost employees, only half of them have managed to replace these employees. A few enterprises that did not lose employees during the floods have also hired additional labourers to help them with the cleaning and renovation of their buildings and facilities.

Most enterprises stated that their employees stood by them and

returned to work immediately after the water receded. Employees were paid even during periods of no production. Local workers, employees from within the state, continued working, while some of the workers from other states returned to their home states.

Enterprises' supply chains also consist of clients who were affected by December 2015 floods and those who were not. Clients of some of the enterprises who were affected by the floods were also in a position similar to the enterprises, themselves taking a long time for recovery. For example, Firm 15 did not lose any clients during or after the floods. Their clients were facing the same problems as the enterprise and believed that any other service provider would be in a similar position. Hence they chose to stick with Firm 15 and waited until they recovered from the waterlogging. In another instance, a client of Firm 9 was affected by the floods, and was therefore lenient with Firm 9. Delays in production were fairly acceptable to these clients. However, clients that were unaffected by the floods, either because they were located in other parts of the city or state, continued with the business-as-usual, and required components from the affected enterprises who themselves could often not deliver.

Similar to employee loss, less than half the enterprises lost their clients during and after the floods. On an average, enterprises lost around two clients. Firms that could neither retain clients nor reacquire them were most affected after the floods as they were unable to bounce back and resume production. For instance, Firm 21 lost the maximum number of clients, around 10 of them. Firm 21 has not repaired their machinery fully as they don't have the finance to restore some of their automatic controls. They have restored only 50% of their production and will take another year to get to 100% production. Hence, most of their clients have redirected their job orders to enterprises in Ambattur, Hosur, and Salem.

**BOX 3:** EMPLOYEE AND CLIENT LOSS AND RECOVERY

### Employee Loss and Recovery

- **Number of enterprises that lost employees : 14**
  - ◊ Of these, number of enterprises that recovered their employees : 7
  - ◊ Of these, number of enterprises that have not recovered their employees : 7

- **Number of enterprises that did not lose employees : 20**
  - ◊ Of these, number of enterprises that hired additional employees : 5
  - ◊ Of these, number of enteprises that have not made any additional hires : 15

### Customer Loss and Recovery

- **Number of enterprises that lost clients : 15**
  - ◊ Of these, number of enterprises that recovered their clients : 6
  - ◊ Of these, number of enteprrises that have not recovered their clients : 9

- **Number of enterprises that did not lose any clients : 18**
  - ◊ Of these, number of enterprises who have gained new clients : 2
  - ◊ Of these, number of enterprises that have no new clients : 16

Note: Information on employee loss & recovery is unavailable for the remaining enterprises.

Firm 21 has been unable to acquire new clients as clients are worried about the quality of the product from their facility, given that it is not a fully automated process anymore.

Of those who lost their clients, two-fifths of the firms managed to recover their clients partially. The duration of recovery—that is, the time period between losing clients and recovering them—has not been provided by the enterprises.

Overlapping recovery time with client loss and overall production recovery time revealed an interesting relationship. Enterprises that are yet to recover and have not achieved 100% production as of June 2016, Firm 3, Firm 10, Firm 13, Firm 21, Firm 28, and Firm 32, are the ones that have not managed to recover their lost clients. Only Firm 32 has reacquired two-thirds of lost clients. The other firms have lost one or more clients since December 2015, without recovering even a single one of them, which means that they are most likely not receiving a sufficient number of orders to produce at a 100% level.

## d. Utilities

To ensure safety during the floods, utility services (like electricity and water supply) were temporarily cut. In most cases, though, there was no access to electricity and water supply even after the rainwater had receeded from the enterprises' facility, further deterring post-flood production.

Most of the enterprises did not have access to basic utilities such as electricity, water supply, solid waste, or sewage management in the days following the floods—that is, from the second week of December 2015 onward (refer Annexure 3).

### Access to Electricity

During times of heavy rainfall, the Electricity Board often switches off the power to prevent deaths occurring from electrocution. As a result, enterprises did not have access to electricity, on average for around 15 days. Some, such as Firm 20, Firm 21, Firm 27, and Firm 33, did not have access to electricity for almost a month. Only Firm 23 did not have any problem regarding access to utilities. This is surprising, since they were also waterlogged for three days. For most other companies the power supply was restored only after water drained out of their facilities and the waterlogging reduced.

Lack of electricity created additional challenges for some companies. For instance, some of the companies could not pump water to their overhead tanks without electricity supply. In two cases, the enterprises received power supply in phases: one phase was restored by the end of December, and the remaining phases were restored by the end of January.

### Access to Water Supply

In comparison, water supply, used for drinking, sanitation, and industrial purposes, was less of a problem. Only half the surveyed enterprises did not have access to water for an average of 12 days.

Firm 18 has been facing water problems from December 2015 onwards and has been unable to find a solution. Water is a particularly important input for Firm 18's production process as its technology requires the use of water for the production of its chemical products. With the contamination of ground water during the floods, they have been unable to use it. Instead, they have been relying on water tankers since the time of the floods.

## Access to Solid Waste Management and Sewage Disposal

Apart from electricity and water supply, some of the other services that were affected during this period include solid waste and sewage disposal. The distinction between solid waste and sewage is unclear in some of the interviews, with interviewees treating the two as one. More than half the enterprises were affected by either poorly managed solid waste or sewage or both in their facilities. Firm 5 remained largely unaffected and did not have solid waste or sewage in their premises. They were the only enterprise in the sample that appreciated the efforts and quick action[23] taken by the Tamil Nadu State Government. Two enterprises, Firm 4 and Firm 8 have sewage treatment plants (STPs). Firm 8 could not run the STP as there was no provision for them to let out STP wastewater during the floods. Firm 4 also has a solid waste-processing unit of its own. However, they did not have any garbage on the premises and as a result there was no need for their waste-processing unit during the floods. While not all enterprises have shared the amount spent on cleaning their facilities, those that could provide details have spent anywhere between INR 500 and INR 20,000. Often, segregating the waste before disposal added to the cost, like it did for Firm 27, who had to segregate wet and dry waste from their facility. What would have normally cost them INR 200 to INR 300, cost them INR 20,000; they engaged outsiders[24] to clear the solid waste from their facility.

In most cases, the employees themselves were involved in the cleaning process. Only one enterprise, Firm 18 unofficially employed municiple workers to remove the accumulated solid waste from their premises. Firm 19 was also assisted by the municipal workers, but only after a full week had lapsed, adding to their recovery time and losses.

## Bottlenecks and Cascading Failures

Most firms lacked access to at least one of the utilties listed above and in some cases this proved to be a bigger problem than waterlogging. Firms that were worst affected by utility failure were those that lacked access to at least three of the four utilities that were covered in the firm survey. Five firms did not have access to electricity, solid waste management, or sewage removal for a minimum of 15 days. In some cases, such as Firm 21 and Firm 27, the cleaning process was still being carried out in June 2016. While most enterprises experienced waterlogging for an average of five days, it took longer for them to clear the solid water and sewage from their facilities. Thirteen firms were affected by the solid waste or sewage in their premises, even after the water had drained from their facilities. Until their facilities were free of all the waste and contaminated water, it was difficult for them to begin production processes.

Access to utilities was not a concern for the first few days following the December 2015 floods since waterlogging prevented employees from even entering the premises. This was also the time when nothing worked across most surveyed enterprises. It was only after the waterlogging from the roads had drained out and receded that employees could make their way to production facilities.

Obstructed access to each of the utilities served as a deterrant to resuming production. Enterprises approached access to utilties in a step-by-step manner in order to ensure that their employees were not exposed to electrical risks. Even after power was restored by the Electricity Board, enterprises had to ensure that the water in their premises had drained out fully before running equipment and machinery. All the machines that were affected by the floods but under operation now are being closely monitored to ensure that there are no electrical hazards to the employees. However, enterprises like Firm 5 were under an obligation to meet their deliverables. When the electricity did not resume and their own generator failed, they rented generators to package finished goods. Back-up power options like generators also failed as water had entered them, rendering them useless.

Sometimes, even when all the utilities were in place, enterprises could not restart production as they had to wait for insurance companies to inspect their premises, their equipment, and/or their machinery, as a part of insurance claims processing. However, in some cases, the amount received was insufficient to repair machines and resume production. If enterprises had lost workers or clients, inputs for production or inventory of finished goods, and if their buildings and equipment were damaged beyond repair, it added to the failure and often exacerbated it.

Some, such as Firm 21, have been facing nothing but obstacles—including damaged inventory and buildings, loss of documents, and loss of 10 clients. In that firm's case, even complete access to utilities today would not allow for pre-flood production levels; failure on other fronts would prevent this. In their case, loss in one aspect of business further amplifies losses in other aspects. These are all interconnected components of the enterprises' production pass. Deficiency in any one of these components has a cascading effect, adding to overall enterprise failure. In fact, the chain of events experienced by Firm 21, which have been described above here and in previous sections, is a perfect example of this cascading failure that the enterprise endured, and continues to endure. This is important to note, especially when planning firm-specific relief measures. Enterprises like Firm 21 would require a holistic solution that tackles all aspects of their business.

## 7. Post-Flood Resilience Structure

### What Preventive Measures are Firms Taking?

The previous section provides details on the extent and magnitude of damage endured by enterprises during the December 2015 floods and the waterlogging that followed. While the monetary value of the losses were not provided across all categories of loss (buildings, inventory, raw materials, loss of labour and customers, cleaning and general operations, and production), it is safe to say that most enterprises spent a certain amount

(and some continue to incur expenses even as this report is written—almost a year after the floods) that is a significant proportion of their total annual turnover.

The assumption then is that these enterprises would take preventive measures to ensure against the possibility of future floods. However, this study has shown that this hypothesis is not necessarily true for a majority of surveyed enterprises.

A quarter of these enterprises have not provided any information on preventive measures taken, so they may or may not have taken any. Another quarter of the sample enterprises are still thinking about it or believe that the government should provide such preventive measures. A few believe that they are financially weak and therefore depend on the government for relief measures. The others believe that it is the government's responsibility to help enterprises cope with the heavy losses during times of disaster. A handful of enterprises have adopted what can only be called a 'fatalistic' attitude towards the floods, believing they cannot do anything to help themselves and all help must come from outside. Those enterprises that are still thinking about taking preventive measures, but haven't taken any so far, view the December 2015 floods as a one-time occurrence and believe that such events are unlikely to recur in the future. As a result, they do not see the need to take any drastic preventive measures.

However, a little less than half of the sampled enterprises have taken charge of their facilities and have either begun to or will begin to make changes based on specific damages or weaknesses in their production infrastructure. The following are some of the changes being considered:

- **Facility infrastructure:** Apart from repairing affected portions of buildings (which is really a curative step) some of the enterprises are increasing the height of their facilities to prevent water from entering facilities in the future. One of them also placed water pumps in their facility so they can pump water out, especially if there is excessive waterlogging. Waiting for the water to drain out naturally is often a long and time-consuming process, preventing enterprises from recovering quickly. Another enterprise stated that they could not make changes to their building since they do not own it. In terms of safeguarding items within their facility, one of the enterprises has raised the height of the slabs on which they place inventory (finished goods and raw materials) to protect against future waterlogging. Another enterprise has created evacuation plans to help protect employees, enabling them to find safe spaces that do not pose a threat to their lives.

- **Location—desire to relocate to an industrial estate:** Apart from rebuilding the walls of their building, Firm 11 wants a place inside the SIDCO estate. This firm believes that location within that estate will help them add more employees and machines to their production so they can gain additional clients in the process.

- **Modifications to insurance coverage:** While one enterprise, Firm 11 is considering taking insurance, another enterprise, Firm 7,

**BOX 4:** HOW ONE LARGE IT FIRM WAS ABLE TO MINIMISE LOSSES

Firm 4 is a large IT services company in Shollinganallur which reported no financial losses during the floods. Firm 4 has world- and nation-wide locations and over 200,000 employees. In Chennai alone Firm 4 has 10 physical locations. Several dampeners were established long before the floods took place. Any new possession of a plot is preceded by an initial assessment of potential disasters and locational vulnerabilities. Two Chennai premises were severely waterlogged during the floods, and also experience seasonal waterlogging, a likelihood that was known prior to establishing facilities there. The locations were selected anyway with business continuity (a department in its own right) plans and scenario planning being designed from the very beginning. Some measures include:

- **An elaborate employee evacuation plan**
- **Transport and catering facilities for employees during disasters**
- **Alternate communication channels**
- **Re-distribution of work to other locations**
- **Options for employees to work from home**
- **Access to large in-house financial resources**
- **Detailed and multiple insurance plans**

With these measures in place, Firm 4 was able create and maximise dampeners for each of the factors detailed in the section on firm findings. They are in large part attributed to resources which are vast, clearly earmarked, and swift. Moreover, insurance was responsive, and able to act quickly on software and IT–based assets: a noted area of unawareness among insurance agents surveying firms in the MSME sample.

The respondent from Firm 4 commented that recovery plans might have been even more effective and transferable if similar large enterprises in the area had pooled disaster management resources and plans. This is an undertaking for which Firm 6, a medium enterprise in Sriperumbudur, was willing to contribute time and money, and is also a potential course of action towards collective dampeners and shared resilience for small and micro firms as well.

has modified its insurance coverage. Firm 7's earlier insurance covered only their plant machinery; it now covers the total value of the company.

- **Strengthening supply chains:** One of the enterprises, Firm 8, is attempting to insulate its production against future losses arising on account of broken supply chains by identifying alternative suppliers. They are in the process of identifying alternative suppliers outside Tamil Nadu, spread across the country, so that suppliers can compensate for each other's deficiencies.

- **Changes in hydrology:** While it is unclear if enterprises are going to or can change the hydrology of the areas they work in without prior authorization or permission from the concerned government agency, one of the enterprises wants to channelize the route of the water flow differently, so that water doesn't flow into their facility. It is unclear if they are planning to execute this on their own or if this is an 'ask' from a government agency.

[15] Team Social. (2015). This Chennai map will show you exactly which waterlogged area, road you need to avoid. The Times of India blog
Retrieved from: http://blogs.timesofindia.indiatimes.com/everything-socialthis-chennai-map-will-show-you-exactly-which-waterlogged-area-road-you-need-to-avoid/

[16] For a breakdown of the number of enterprises in each location, please see annexure 3.
[17] Development Commissioner MSME, Ministry of MSME, Government of India. [Online] Retrieved from: http://www.dcmsme.gov.in/ssiindia/defination_msme.html. Amendments to the Act are under consideration. The proposed update can be found here: Press Information Bureau, Ministry of MSME, Government of India. (2015). MSME Amendment Bill 2015. Retrieved from: http://pib.nic.in/newsite/PrintRelease.aspx?relid=133655
[18] Initial investment is how the International Finance Group interprets the Act in its 2012 report on the MSME sector in India: Micro, Small and Medium Enterprise Finance in India. 2012. International Finance Corporation. World Bank Group. Retrieved from: <http://intellegrow.com/images/download/publication/Publication%20-%20IFC%20MSME%20Report.pdf>
[19] In an analysis of credit and lending in the MSME sector, Duflo and Banerjee intepret the Act and the official claissification to mean total investment, and use this as the basis of their analysis. Banerjee, A. and E. Duflo. 2014. Do Firms Want to Borrow More? Testing Credit Constraints Using a Directed Lending Program. Review of Economic Studies. 81 (2). Pp 572-607
[20] Figure 22 does not include damage to documents, inventory and buildings, as most of the enterprises have not provided the monetary value of loss incurred.
[21] Respondent from Firm 21 did not mention the name of the river.
[22] Please note that over half the enterprises surveyed did not provide any response regarding access to inputs for production during the waterlogging period.
[23] Respondent from Firm 5 did not provide any additional information on what 'quick action' means.
[24] It is unclear what outsider means – it could be municipal worker(s) or any other cleaner who is not directly employed by Firm 27.

# 6. Recommendations

This section begins with a description of "asks," or specific MSME requests that emerged from our firm interviews. "Asks" are categorized in terms of: general, from the government, from banks, from insurance companies, and from others.

Following the MSME "asks" are our recommendations based on analysis of the firm experiences and the larger context in which they operate. We present these recommendations generally first. We then list specific recommendations according to who can do what, and when. These are action items categorized into short, medium, and long term, and in terms of who should take the action: MSME, bank, insurance company, government, or industry association.

Finally, we present a brief comparison of the two lists: similarities and differences between what firms want and what we observe as needed.

## 'Asks' From Support Institutions

Enterprises rely on the supporting ecosystem during floods recovery times. This ecosystem includes state government agencies, insurance companies, banks, and associations (typically industrial estate associations). After the December 2015 floods, most enterprises received limited assistance from these institutions. Overall, most enterprises were disappointed with the lack of comprehensive relief measures they received. This section is a summary of asks from those enterprises: specific activities that enterprises believe the relevant support institutions should offer to serve as relief measures from last year's floods, as well as a precaution against the possibility of recurring floods. Along the same lines, enterprises asked for specific zones allotted for industries.

### a. General Asks

- **Location issues:** A few enterprises asked for separate land area for industries: area that is less is likely to be neglected or waterlogged. Some even asked more specifically for land area within an Industrial Estate, with one of the enterprises showing a special preference for SIDCO. One of the enterprises asked to move to another location, Oragadam, where the government has officially promised to sell land at INR 6,000 per square feet. However, the enterprise found the land to be too expensive and the asking price above the prevailing market rate for the same piece of land at INR 4000 per square feet. The enterprise also objected to the government's request that the Oragadam land be paid for upfront. Another consideration was that enterprises were unsure that their employees would actually move to new locations.

- **Physical infrastructure improvements:** Enterprises also asked generally for physical infrastructure improvements in the areas where they are located. For example, they asked for better sewerage facilities, replacement of electricity boards that were affected during the floods, widening of the canals to help facilitate easier water movement water, and clearing lakebeds, river beds, and other encroached spaces where excessive waterlogging occurred in December 2015.

### b. Asks From the Government

- **Better flood management:** Almost all enterprises hold the government[25] responsible for city flood management. As mentioned above, enterprises ask that the government clear areas, including former water bodies, that have been encroached upon and where water flow through the city is impeded. These enterprises ask that government make city level plans available; these plans and information should be accessible to all and should be updated frequently.

- **Ease of doing business:** In terms of easing business operations, enterprises ask for a more business-friendly environment. To help enterprises revive their businesses post-December 2015, they ask the government to create a single window system connecting all government departments that enterprises can reach out to and access assistance in recovering from calamity-related losses.

- **Relief measures:** Enterprises also hold government responsible for relief measures. Most enterprises ask for monetary support—in many forms—either through the government's own efforts or in collaboration with banks and insurance companies. One of the enterprises stated that the government should make up for at least 50% of the losses incurred due to the floods. As of now, the government has not discounted corporation license fee, which enterprises could greatly benefit from.

- **Insurance schemes and regulations:** In terms of insurance, enterprises believe that the government should introduce a low-premium scheme, and also create awareness about the scheme. Enterprises also ask that the government make purchase of insurance mandatory at the time of MSME registration.

- **Banking regulations:** With respect to interactions with banks, enterprises ask that the government work with banks to provide interest-free loans and refrain from demanding principal or interest for a six-month period (following natural disasters such as the December 2015 floods).

- **Positive feedback:** While most of the enterprises blamed the government for inadequate public infrastructure which they think made it difficult for them to operate during and after the floods, Firm 5 is one enterprise that disagreed and showed a positive attitude towards the government. This firm stated that the govern-

ment provides them with all the amenities they require to conduct their business. They also stated that the government should not be blamed for problems that enterprises face; that middlemen are more likely to be the cause of such problems. This view is in stark contrast with the opinions shared by the other enterprises, all of whom believe that the entire responsibility lies with the government.

### c. Asks From Banks

- **Flood relief measures:** To recover from floods-related losses, enterprises asked that banks extend loan repayment periods or modify existing repayment schedules so they are more flexible to enterprise needs. Since most enterprises face cash flow problems, they also ask that banks provide them with credit during post-floods periods, or increase overdrafts. They asked for reduced rates of interest, rebates, and a waiver of the equated monthly installments (EMIs) for a minimum six-month period. They believe that banks would be in a better position to understand the challenges faced by enterprises if bank managers cultivated a personal relationship with their customers (in this case the entrepreneurs who run the affected MSMEs).

### d. Asks From Insurance Companies

- **Flood relief measures:** Most insured enterprises did not gain significantly from being insured. Enterprises asked that insurance companies reduce delays in processing and paying of claims in post-disaster situation.

- **Early settlement of claims:** Enterprises ask that insurance companies provide them with anywhere between 50% to the full claim amount so they can recuperate from losses incurred.

- **Awareness programmes:** They also ask that insurance companies conduct awareness programmes about the different types of insurance available to MSMEs.

### e. Asks From Others

- **Industry association support:** One enterprise also received support from an association. However, that enterprise did not provide information on the nature of support or the name of the supporting association.

## Recommendations

Below are our preliminary recommendations. They are spearheaded by our observation that 'ease of doing business' indices urgently need to be framed differently in order to draw continued and sustained attention to the challenges of business continuity during post-disaster situations. Finally, we itemize specific actionable recommendations in terms of time frame: short, medium, and long term, and in terms of target organization: MSME, bank, insurance company, government, and industry association.

### General Recommendations

**Frame the 'ease of doing business' index differently.** It is important that this index look beyond the ability to start a company to include resilience thinking. This would mean embedding resilience thinking into business continuity planning by focusing, for example, on quality of access to insurance as much as access to credit; flexibility of financing as much as the fact of financing; quality and resilience of infrastructure as well as access.

**Institute monitoring and evaluation programmes** at the local level, based on successful, local clean-up and micro drainage maintenance efforts. "Rainfall readiness" could be assessed and highlighted in local media, along with case studies and inter-ward networking to allow for transfer of knowledge about best practices, implementation approaches, and other learning from experimentation.

**Develop a city-level vulnerability index,** identifying and ranking wards based on their susceptibility to natural disasters. This can be an annual or a bi-annual exercise that can reveal ward-level challenges so that public, private, and community actors can have a clear undersanding of steps that can be taken to make them more resilient. Some of the factors that could be included are population density, elevation of the ward, socio-economic profile of the ward, proximity to a water body (river, sea, wetland or any others), and location (on flood plain or otherwise). Residents could also be included in "citizen science" exercises to ensure greater accuracy and resolution as well as salience of the findings.

### Recommendations: Who Can Do What, and By When?

Following is a list of specific recommendations, arranged by time-frame: short, medium, and long-term, and according to organization at which the recommendation is aimed: MSMEs, banks, insurance companies, government, and industry association (long-term recommendation only).

### Short-Term

- **MSMEs** should explore strategies to leverage collective financial MSME resources to improve community level drainage and sanitation efforts. They should also work to create contingency plans for inputs, invoices, and other processes to enhance cash flows and reduce credit crunch during disasters.

- **Banks** should provide short-term soft loans to help enterprises tide over the damages incurred on account of the disaster. They can also work to provide more flexible savings schemes.

- **Insurance companies** can reschedule installments during times of disasters. They should also simplify the claims process by putting in place a process to deal with insurance claims more quickly during times of disaster.

- **Government** should make a series of changes:
  - ◊ SIDCO and the State Government should provide more incentives and subsidies for MSMEs who are stuck in flood prone areas to move to safer locations.
  - ◊ In upcoming reviews, land-use analysis and planning—carried out by the CMDA and partly implemented by the Corporation—should more comprehensively account for flood prone areas whereby economic damage is also considered a risk.
  - ◊ Efforts should be taken by the CMDA, SIDCO, and Chennai City Corporation to publish and distribute these findings widely to improve transparency.
  - ◊ Redevelop infrastructure in disaster-affected areas, like replacing electricity cables, construction of sewerage systems.
  - ◊ Create a single-window disaster help desk during times of natural shocks to decrease paper work and transaction time/cost.

### Medium-Term

- **MSMEs** should engage more in clustering/aggregating to help minimise insurance sales costs and promote trust and relationship building between formal sector credit lenders and borrowers.

- **Banks** should work towards promoting an internal system that encourages relationship building between officers and MSMEs, possibly by implementing a public service-like requirement where officers learn a local language and focus on specific regions rather than transfer in and out of regions across the country as many currently do. They can also leverage developments in small business credit scoring and to lower costs and ease access to loans as well as design more flexible products.

- **Insurance companies** should make a series of changes:
  - ◊ Implement intensive awareness/education campaigns, possibly including an MSME dedicated TV channel, focusing on availability of schemes, importance of insurance, importance of registering, importance of maintaining proper accounts, etc.
  - ◊ Enhance direct approvals, appraisals, and settlements with MSMEs without banking intermediaries.
  - ◊ Create products for labour-intensive MSMEs who are more vulnerable to labour loss than to capital loss.

- **Banks** should make the following changes:
  - ◊ Local officials should build awareness amongst MSMEs and partner with them to improve awareness about financial products and schemes.
  - ◊ Create more comprehensive funding allowances for Government Orders (GOs) that require loan relief and subsidies.
  - ◊ Create relief mechanisms for labour loss, and not just financial loss.

### Long-Term

- **MSMEs** should improve their involvement in decision making processes around environmental and water management conver sations. They should also help create knowledge systems for better disaggregation of product, industry, and size-class specific needs.

- **Banks** should amend transaction requirements and times to allow for faster, more flexible capital flow. They should also work towards long-term customer relationship management that extends beyond the term of a single officer.

- **Insurance companies** should create a cumulative credit system so MSMEs can avail greater funds in times of natural disasters.

- **Government** should implement the following changes:
  - ◊ For water intensive industries, work with the PWD (and Metro-Water) to improve conservation efforts.
  - ◊ Amend provision of the National Disaster Response Fund (NDRF) to provide immediate relief to MSMEs.
  - ◊ Reduce MSME burden of training labour, in order to decrease recruitment-related expenses (time & training).

- **Industry Associations** should work to enhance collective action in the long term, enabling firms to pool common resources (transport, catering, water and shelter), to increase overall resilience and de-crease recovery time.

### Comparison: What MSMEs Want vs. What We Observe As Needed

There is significant overlap between MSME "asks" and our recommendations. While MSMEs do not specifically recommend a new framing of 'ease of doing business' indices, they do echo this in their requests for a better business environment that ensures improved continuity in post-flood situations. Similarly, MSMEs ask for many of the relief measures that we recommend in terms of better access to credit and insurance, particularly as they relate to floods. MSMEs also ask that government improve transparency and information sharing in terms of planning and policy decisions; we recommend the same. Both the MSME ask list and our recommendations call for improved public infrastructure as well as for

relationship-building between firms and banking and insurance sectors.

On the other hand several of our recommendations were not mentioned in the firm surveys. For example, MSMEs do not ask for improved MSME clustering/aggregating while we see this as important to improving MSME access to credit and insurance while also minimizing related costs. MSMEs did, however request new land areas as well as membership in particular industrial estates—requests that could be seen as a variant of our recommendation to rethink clustering and aggregation. MSMEs also do not mention their own involvement in decision making while we see this as important. MSMEs do not request city-level vulnerability indices as we recommend. These indices, however, could help them obtain access to more and better business locations.

[25] By government, it is unclear if the enterprises mean state government or central government or both.

# 7. Looking Ahead

This report looks at how factors in the business environment amplify or dampen the effects of floods on MSMEs. We believe our findings provide an important foundation for building solutions towards strengthening MSME resilience to floods and other disruptions. In addition to the recommendations provided here, we are committed to identifying actionable solutions through further research, strategizing, and convening for collective action. In this section we provide an agenda for taking those next steps towards building solutions, highlighting important themes and issues that stand out as needing more focused study and attention.

Broadly, we suggest an agenda of action-grounded research to address institutional voids, or gaps in rules, culture, norms, policy, and law that prevent desirable interactions and incentives from emerging. Such voids have been identified in a positive sense as opportunities for entrepreneurship (Khanna and Palepu, 2010). Uber, for example, stepped into the institutional void that prevented those willing to drive from connecting with those seeking a ride. But voids also represent obstacles to achieving the kinds of social, supportive, and collaborative behavior that is important for resilience. The mismatch between bankers (who would like to access new, growing, clients), firms (who report credit constraints), and insurance companies (who seek to sell and profit from risk reduction products), for example, is an important cluster of institutional voids identified in our work. All would benefit from a functional market for risk mitigation and lending. We also identified a range of institutional voids in the form of "gaps between rules and their purpose and the effectiveness of their implementation" (Rodriguez, 2013, pp.8). These institutional voids at once represent shortcomings in the business context as well as opportunities for institutional design to have a significant and catalytic impact.

## Breaking Down the Amalgam of the MSME Sector

Most public and private entities approach MSMEs as a homogenous, undifferentiated group of firms. As demonstrated, the heterogeneity within the MSME sector is often ignored not only in the official definition but also in terms of services for this sector. MSMEs are viewed as uniform in size, ownership structure, area of operation, type of industry, and stage of development. This lack of differentiation—at odds with the realities of their varying business strategies, risks, cash flows, and opportunities—obstructs firms' access to credit and insurance, contributes to higher fees and premiums, weakens their ability to seek redress, and translates into poorly-designed schemes where "one size fits none."

An important step going forward will be to break down this amalgam by considering different ways of categorizing MSMEs based on vulnerabilities and their dependencies and embeddedness in the business environment. This would mean building on the research in this report to uncover better and more inclusive ways of risk sharing and co-resilience building, on a scale that is larger than micro insurance/finance and significant enough to address credit and insurance gaps.

Action-oriented research, however, always requires refining the question to ensure that it meets actual needs. We propose to initiate the next phase in our work with a convening exercise to help further understand risks and opportunities beyond flood-related disruptions, highlight best practices and willingness to share risk and resilience strategies, and brainstorm about potential avenues for risk-pooling. We will be seeking further funding and partnerships to initiate this follow-on work in the coming months.

## Anticipating and Planning for Business Disruption

One of this report's key recommendations is to reframe 'ease of doing business' indices to include disaster resilience factors. Institutions need to respond to increasing urbanisation and industrialisation by improving their readiness to meet disruptions that are linked to the business environment and exacer-

bated during shocks. Capital, insurance, and supply chains need to evolve and change, and public and private institutions need to accommodate a better understanding of this to provide relevant, consistent solutions. This has already been attempted to some degree through efforts discussed above such as priority sector lending regulations.

An important step going forward is to study how to make this work better. Doing so would involve an in-depth examination of how to close the loop on disruption and identify, review, and compare mechanisms that build business-as-usual resilience while also heightening disaster resilience. Consider, for example, business disruption insurance: how feasible would it be to implement for small, less-well-documented firms? How can this and other mechanisms be designed with capital, insurance, and other industry interests in mind in addition to those of the MSME sector? What sorts of mechanisms can be lucrative and sustainable for all parties involved?

### Developing New Methods for Calculating Costs

This report highlights that "costs" are seen differently at different levels. MSME definitions of costs vary wildly from the way they are defined at the public or private programme levels, be it in terms of finance and insurance or utilities and infrastructure.

Going forward it will be important to bridge misconceptions and bring differing definitions together. This could involve convening exercises in which bank, insurance, public sector, and enterprise expectations are brought together to discuss how the cost calculus can be more realistic and favourable. At the end of the day, there are large negative externalities. Real costs are being disguised through informal channels, networks, poor environmental choices—to name a few. The underestimation of real costs makes many financial, infrastructure, and insurance arrangements seem unfeasible not just for MSMEs but for the agencies that are currently involved in delivering services during disasters. Creating realistic expectations that are not only deeply rooted in the context of Indian MSMEs but also draw from cases in which expectations have been better addressed will serve to provide more mutually beneficial and lasting solutions, particularly in a context that is subject to increasing water-related environmental variability.

A shared cost-risk-resilience calculus will thus help to unearth hidden costs, identify priorities for policy and market-base support services, and promote sustainable futures, not just for MSMEs but the many agencies that are keys to developing an enabling and resilient business environment for MSMEs to thrive.

# Bibliography & Annexures

# Bibliography

## A

**Achuthan, 2008:** Achuthan, K. (2008, December 2). Encroachment on waterways a factor behind floods. *The Hindu*. Retrieved from: http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/encroachments-on-waterways-a-factor-behind-floods/article1387089.ece

**Achuthan, 2007:** Achuthan, K. (2007, August 8). Corporation identifies 36 flood-prone areas. *The Hindu*. Retrieved from: http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/corporation-identifies-36-floodprone-areas/article1887995.ece

**ADPC, 2016:** Asian Disaster Preparedness Center. (2016). Risk reduction and resilience building. Asian Business Forum 2016. Retrieved from: http://www.adpc.net/igo/contents/blogs/ABF2016/download/12Apr/ABRF2016-Technical%20Note%20and%20Agenda%2011%20Apr.pdf

**ADPC, 2014:** Asian Disaster Preparedness Center. (2014). Towards A Resilient Business Community In THAILAND. [Presentation]. Retrieved from: http://www.adpc.net/igo/category/ID782/doc/2015-vAqd7G-ADPC-SME_Report_Final13_Jan.pdf

**Adlakha, 2015a:** Adlakha, N. (2015, October 30). Industrial hub to residential hotspot. *The Hindu*. Retrieved from: http://www.thehindu.com/features/homes-and-gardens/industrial-hub-to-residential-hotspot/article7822403.ece

**Adlakha, 2015b:** Adlakha, N. (2015, May 29). The fight for more FSI. *The Hindu*. Retrieved from: http://www.thehindu.com/features/homes-and-gardens/home-finance/the-fight-for-more-fsi/article7259772.ece

**Anagol, Cole and Sarkar, 2016:** Anagol, S., Cole, S. A. and Sarkar, S. (2016). Understanding the Advice of Commissions-Motivated Agents: Evidence from the Indian Life Insurance Market. Harvard Business School Finance Working Paper No. 12-055. Available at SSRN: https://ssrn.com/abstract=1978876 or http://dx.doi.org/10.2139/ssrn.1978876

**Ali and Husain, 2014:** Ali, A., and Husain, F. (2014). MSMEs in India: Problems, solutions and prospectus in present scenario. *International Journal of Engineering and Management Sciences* Vol.5(2):pp109-115. Retrieved from: http://scienceandnature.org/IJEMS-Vol5(2)-Apr2014/IJEMS%20Vol5(2)-8.pdf

**APEC, 2014:** APEC. (2014). Preparing SMEs for disaster. Asia Pacific Economic Cooperation (APEC). Retrieved from: http://www.apec.org/Press/Features/2014/0324_smes.aspx

**APEC, 2013:** Asia-Pacific Economic Cooperation. (2013). Guidebook On SME Business Continuity Planning. First Edition.

## B

**Bal et al., 2016:** Bal, P.K., Ramachandran, A., Palanivelu, K., Thirumurugan, P., Geetha, R., and Bhaskaran, B. (2016). Climate change projections over India by a downscaling approach using PRECIS. *Asia-Pacific Journal of Atmospheric Sciences*. Vol.(52): 353. doi:10.1007/s13143-016-0004-1

**Balaji, 2016a:** R. Balaji. (2016, December 31). Chennai floods: MSME sector fears loss of customers, business if recovery is delayed. *The Hindu Businessline*. Retrieved from: http://www.thehindubusinessline.com/news/national/chennai-floods-msme-sector-fears-loss-of-customers-business-if-recovery-is-delayed/article8050915.ece

**Balaji, 2016b:** R.Balaji. (2016, March 29). Ahead, but peers snapping at TN's heels. *The Hindu Businessline*. Retrieved from: http://www.thehindubusinessline.com/specials/ahead-but-peers-snapping-at-tns-heels/article8410054.ece

**Baud and Jameson, 2016:** Baud, I., & Jameson, S. (2016). Varieties of knowledge for assembling an urban flood management governance configuration in Chennai, India. *Habitat International*, 1-12

**BBC News, 2012:** BBC News. (2012, March 11). Japan Quake: Loss And Recovery In Numbers. *BBC News*. Retrieved from: http://www.bbc.com/news/world-asia-17219008

**Bhaskaran and Halan, 2013:** Bhaskaran, D., and Halan, M. (2013, February 6). Investors lost INR 1.5 trillion due to insurance mis-selling. Livemint. Retrived from: http://www.livemint.com/Money/Bn8wj4mBbZP3hAI0la0sXL/Investors-lost-15-trillion-due-to-insurance-misselling.html

**Business Standard, 2015:** Business Standard. (2015, December 19). 14,000 MSMEs affected in rains and flood in Tamil Nadu, says Kalraj Mishra. *Business Standard*. [Online] Retrieved from: http://www.business-standard.com/article/economy-policy/14-000-msmes-affected-in-rains-and-flood-in-tamil-nadu-says-kalraj-mishra-115121900638_1.html;

**Business Standard, 2013:** Business Standard. (2013, June 12). Chennai housing demand to be 35,000 units this year. *Business Standard*. Retrieved from: http://www.business-standard.com/article/economy-policy/chennai-housing-demand-to-be-35-000-units-this-year-113061200987_1.html

## C

**Chaturvedi, 2016:** Chaturvedi, S. (2016, July 25). Cowering Chennai fears flood fury. *Governance Now*. Retrieved from: http://www.governancenow.com/news/regular-story/cowering-chennai-fears-flood-fury

**Chaitanya, 2015:** Chaitanya, K.S.V. (2015, July 24). 50 percent of 19 lakes encroached. *Deccan Chronicle*. Retrieved from: http://www.deccanchronicle.com/150724/nation-current-affairs/article/50-cent-19-lakes-encroached

**Chennai Development Plan, 2006:** Chennai Development Plan 2006, Retrieved from: http://jnnurmmis.nic.in/toolkit/CDP_CHENNAI.PDF

**Chennai City Corporation, 2015:** Chennai City Corporation. (2015). *Budget*.; Chennai Metropolitan Development Authority. (2006). *Development Plan for Chennai Metropolitan Area*

**Chennai Corporation, 2014:** Chennai Corporation. (2014). *Proceedings of the Collector of Chennai* (Land – Chennai District – Eviction of Encroachment in Government Land – Formation of Various Committees to dispose the grievances relating to the eviction of encroachment in Government Land – orders issued – reg.) Retrieved from: http://www.chennai.tn.nic.in/Land%20disposals.pdf

**Chakravarthy *et al*, 2016:** Chakravarthy, A., Pandey, K., Sengupta, S., & Ventakesh, S. (2016, January 15). Chennai Apart. *Down to Earth*. Retrieved from: http://www.downtoearth.org.in/news/chennai-apart-52265

**CMDA, n.d.(a):** Chennai Metropolitan Development Authority. (n.d.) Second Master Plan for Chennai Metropolitan Area, 2026. Volume II. Development Regulations. Retrieved from: http://www.cmdachennai.gov.in/Volume2_English_PDF/DR-English.pdf

**CMDA, n.d.(b):** Chennai. Chapter X: Master drainage system in CMA. Retrieved from: http://www.cmdachennai.gov.in/Volume3_English_PDF/Vol3_Chapter10_MacroDrainage.pdf

**CMDA, 2008a:** Chennai Metropolitan Development Authority. (2008). *Master Plan* (Volume 1)

**CMDA, 2008b:** Chennai Metropolitan Development Authority. (2008). *Master Plan* (Volume 3)

**Coelho, 2016:** Coelho, K. (2016, January 4). Placing the poor in the flood path: Post-disaster slum resettlement in Chennai. Caravan Magazine. Retrieved from: http://www.caravanmagazine.in/vantage/placing-the-poor-in-the-flood-pathpost-disaster-slum-resettlement-in-chennai

## D

**Davoudi, 2012:** Davoudi, S. (2012). Resilience: A bridging concept or a dead end. *Planning Theory & Practice*. Vol. 13, No.2 (299 – 333). Retrieved from: http://www.tandfonline.com/doi/full/10.1080/14649357.2012.677124

**Daily Thanthi, 2016:** Daily Thanthi. (2016, January 18). CMDA launches anti-encroachment drive in North Chennai. *Daily Thanthi*. Retrieved from: http://www.dtnext.in/News/City/2016/01/18194307/CMDA-launches-an-tiencroachment-drive-in-North-Chennai.vpf

**Deccan Chronicle, 2014:** Deccan Chronicle. (2014, October 21). Rs. 5,000 crore storm water drain projects languish. *Deccan Chronicle*. Retrieved from: http://www.deccanchronicle.com/141021/nation-current-affairs/article/rs-5000-crore-stormwater-drain-projects-languish

**Delion *et al*., n.d.:** Delion, M.L., Hambardzumyan, A., Ibrahim, J., Santillana Farakos, A.M., and Scanlan, M. (n.d.). Zoning and urban planning. Understanding the benefits. Retrieved from: http://www.doingbusiness.org/~/media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB15-Chapters/DB15-CaseStudy-Zoning-Urban-Planning.pdf

**Department of Environment, Government of Tamil Nadu, n.d.:** Department of Environment, Government of Tamil Nadu. (Not dated). Chapter 7: Urbanisation. [Pdf] Retrieved from: http://www.environment.tn.nic.in/SoE/images/Urbanisation.pdf

**Department of Financial Services, Ministry of Finance, Government of India, 2015:** Report of the Committee set up to examine the financial architecture of the MSME sector. (2015). Department of Financial Services, Ministry of Finance, Government of India.

**Development Commissioner, MSME, n.d.:** Development Commissioner, MSME. (n.d.) Entrepreneurs memorandum (Part II) Data on MSME sector. Ministry of Micro, Small and Medium Enterprises. (2007-08 to 2014-15) Retrieved from: http://www.dcmsme.gov.in/publications/EMII-2014-15.pdf

**Djankov *et al*, 2002:** Djankov, S., La Porta, R., Lopez-De-Silanes, F., and Shleifer, A. (2002). The Regulation Of Entry. The quarterly journal of Economics. CXVII.1. Retrieved from: https://scholar.harvard.edu/files/shleifer/files/reg_entry.pdf

**DNA India, 2015a:** DNA India. (2015, December 27). Chennai floods: Rs.1,700 crore of MSME business washed out. *DNA India*. [Online] Retrieved from: http://www.dnaindia.com/money/report-chennai-floods-rs-1700-crore-of-msme-business-washed-out-2159894

**DNA India, 2015b:** DNA India. (2015, December 11). Chennai Floods: PIL alleges faulty release of reservoir water, demands action against Tamil Nadu officials. *DNA India*. Retrieved from: http://www.dnaindia.com/india/report-chennai-floods-pil-alleges-faulty-release-of-reservoir-water-demands-action-against-tamil-nadu-officials-2154456

**Down to Earth, 2016:** Down to Earth. (2016, August 18). Chennai floods panel report highlights encroachments, faulty drainage system. *Down to Earth*. Retrieved from: http://www.downtoearth.org.in/news/chennai-floods-panel-report-highlights-encroachments-faulty-drainage-system-55329

**Dun and Bradstreet, 2014:** SME Cluster Series 2014: Dun & Bradstreet

## E

**Environment and Forests Department, 2016:** Environment and Forests Department. (2016). Forests – Wetlands – Integrated Management of Wetlands in Tamil Nadu – Constitution of Tamil Nadu State Wetland Authority – Orders – Issued. Retrieved from: http://forests.tn.nic.in/graphics/TNSWA.pdf

## F

**Fuller, 2011:** Fuller, T. (2011). Thailand Flooding Cripples Hard-Drive Suppliers. *The New York Times*. Retrieved from: http://www.nytimes.com/2011/11/07/business/global/07iht-floods07.html?_r=0

## G

**GHK Consultants, 2009:** GHK Consultants Indian Pvt Ltd. (2009) Chennai City Development Plan 2009. Volume 1: Main Report. Cities Development Initiative for Asia – CDIA and Corporation of Chennai.

**Godchalk, 2003:** Godschalk, D.R. (2003). Urban hazard mitigation: Creating resilient cities. *Natural Hazards Review*. DOI: 10.1061/(ASCE)1527-6988(2003)4:3(136)

**Gopalakrishna, 2012:** Gopalkrishna, S. (2012, October 12). Can storm water drains help in recharging groundwater? – The case of Chennai, Tamil Nadu. *The Hindu*. Retrieved from: http://www.indiawaterportal.org/articles/can-storm-water-drains-help-recharging-groundwater-case-chennai-tamil-nadu

**Greater Kashmir, 2015:** Greater Kashmir. (2015) Floods inundate Chennai; road, rail, air links disrupted. *Greater Kashmir*. Retrieved from: http://www.greaterkashmir.com/news/national/story/203186.html

## H

**Halan and Sane, 2016:** Halan, M., and Sane, R. (2016). Misled and mis-sold: Financial behaviour in retail banks. NSE-IFMR Finance Foundation. Retrived from: http://ifrogs.org/PDF/Misled-and-Mis-sold-Financial-misbehaviour-in-retail-banks.pdf

**Halan, Sane and Thomas, 2014:** Halan, M., Sane, R., and Thomas, S. (2014). The case of the missing billions: Estimating losses to customers due to mis-sold life insurance policies. Retrived from: http://ifrogs.org/PDF/insurance-misselling_jepr.pdf

## I

**India.com, 2015:** India.com. (2015). Chennai rains: Failure of drainage system, urbanisation behind floods? India.com. Retrieved from: http://www.india.com/news/india/chennai-rains-failure-of-drainage-system-urbanisation-behind-floods-755854/

**Industries Department, 2014:** Industries Department. (2014). *Tamil Nadu Industrial Policy*. Tamil Nadu: Government of Tamil Nadu. Retrieved from: http://ficci.in/SEDocument/20304/TN_Industrial_Policy_2014.pdf

**IFC, 2012:** Initial investment is the International Finance Group interprets the Act in it 2012 report on the MSME sector in India:

International Finance Corporation. (2012). Micro, Small and Medium Enterprise Finance in India: A Research Study on Needs, Gaps and Way Forward *International Finance Corporation. World Bank Group*. Retrieved from: http://intellegrow.com/images/download/publication/Publication%20-%20IFC%20MSME%20Report.pdf

**IRDAI, 2016:** Insurance Regulatory and Development Authority of India. (2016). Complaints of misselling/unfair business practices by banks/NBFCs. *Insurance Regulatory and Development Authority of India. Government of India.* Retrieved from: https://www.irdai.gov.in/ADMINCMS/cms/whatsNew_Layout.aspx?page=PageNo2912&flag=1

**India Today, 2016:** India Today. (2016, January 23). India to remain fastest growing economy in 2016: World Bank. *India Today.* Retrieved from: http://indiatoday.intoday.in/education/story/fastest-growing-economy/1/577798.html

**India Today, 2015:** India Today. (2015, December 2).Man-made disaster: Look how Chennai built its way to floods. *India Today.* Retrieved from: http://indiatoday.intoday.in/story/chennai-floods-man-made-disaster-building-construction/1/537094.html

## J

**Jameson, 2014:** Jameson, S. (2014). Flood Management Does Not Exist: Assembling Flood Governance through Knowledge Management in Chennai. *Amsterdam: University of Amsterdam*

**Janardhanan, 2015a:** Janardhanan, A. (2015, December 14). Chennai floods: The Day city went under, who did what – and who did not. *The Indian Express*. Retrieved from: http://indianexpress.com/article/india/india-news-india/chennai-floods-the-day-city-went-under-who-did-what-and-who-did-not/

**Janardhanan, 2015b:** Janardhanan, A. (2015, December 4). Explained: Why is Chennai under water. *The Indian Express*. Retrieved from: http://indianexpress.com/article/explained/why-is-chennai-under-water/

**Jayaraman, 2015:** Jayaraman, N. (2015, November 18). Chennai floods are not a natural disaster – they've been created by unrestrained construction. *Scroll.in* Retrieved from: http://scroll.in/article/769928/chennai-floods-are-not-a-natural-disaster-theyve-been-created-by-unrestrained-construction

**Jayakumar, 2016:** Jayakumar, N. (2016) Realty post the floods. *The Hindu.* Retrieved from: http://www.thehindu.com/features/homes-and-gardens/realty-post-the-floods/article8197817.ece

## K

**Kanthimathi, 2016:** Kanthimathi, L. (2016, February 13). The Height Of Poor Planning. *The Hindu.* Retrived from: http://www.thehindu.com/features/downtown/the-height-of-poor-planning/article8233383.ece

**Kennedy, *et al.*, 2014:** Kennedy, L., Varrel, A., Denis, E., Dupont, V., Dhanalakshmi, R., Roumeau, S., Baud, S., Pfeffer, K., Sridharan,N., Vijayabaskar,M., Babu, M.S., Seifelislam, A., Rouanet, H., and Saharan, T. (2014). Engaging with Sustainability Issues in Metropolitan Chennai. Chance2Sustain. Retrieved from: http://chance2sustain.eu/fileadmin/Website/Dokumente/Dokumente/Publications/publications_2014/C2S_CR_No05_Chennai_City_Report__V2.pdf

**Khan, 2013:** Khan, M.F.R. (2013). *Growth, Genesis and Profile of Industrial Estates of Chennai.* Chennai: MTRI

**Khanna, and Palepu, 2010:** Khanna, T., and Palepu, K. (2010). Winning In Emerging Markets: A Road Map for Strategy and Execution. Harvard Business School Press

**Kolappan, 2015:** Kolappan, B. (2015) What drives urbanization in Tamil Nadu. *The Hindu.* Retrieved from: http://www.thehindu.com/news/national/tamil-nadu/what-drives-urbanisation-in-tamil-nadu/article7386961.ece

**KPMG, 2014:** KPMG, (2014). Small Industries Development Bank of India Mapping of Financial Gaps in Select MSME Clusters: Mysore Furniture Cluster.

**KPMG, 2016:** KPMG (2016). Preparing MSMEs for effective disaster management. KPMG and Confederation of Indian Industry (CII).

**Kumar, 2006:** Kumar, N.R. (2006). Ambattur Guindy industrial estates to get a makeover. *The Hindu.* Retrieved from: http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/ambattur-guindy-industrial-estates-set-to-get-a-makeover/article3165652.ece

## L

**Lakshmi, 2015a:** Lakshmi, K. (2015, December 7). Understanding Chembarambakkam. *The Hindu.* Retrieved from: http://www.thehindu.com/news/cities/chennai/understanding-chembarambakkam/article7956383.ece

**Lakshmi, 2015b:** Lakshmi, K. (2015, July 3). A golden sage of grit and enterprise. *The Hindu.* Retrieved from: http://www.thehindu.com/news/cities/chennai/ambattur-industrial-estate-a-golden-saga-of-grit-and-enterprise/article7380923.ece

**Lavanya, 2012:** Lavanya, Ar.K. (2012). Urban Flood Management – A Case Study of Chennai City Architecture Research. Vol. 2(6): 115-121. doi: 10.5923/j.arch.20120206.01

**Leichenko, 2011:** Leichenko, R. (2011). Climate change and urban resilience. Current opinion in environmental sustainability. P.164-168. DOI 10.1016/j.cosust.2010.12.014

**Levina and Tirpak, 2006:** Levina, E., and Tirpak, D. (2006). Adaptation to climate change: key terms. OECD. Retrieved from: http://www.oecd.org/env/cc/36736773.pdf

**Lopez, 2013:** Lopez, A.X. (2013, October). Many areas in Chennai have poorly designed open drains. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/many-areas-in-chennai-have-poorly-designed-open-drains/article5222404.ece

## M

**Madhavan, 2015a:** Madhavan, T. (2015, December 25). Anti-encroachment exercise intensified. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/antiencroachment-exercise-intensified/article8027495.ece

**Madhavan, 2015b:** Madhavan, T. (2015, August 16). Ambitious stormwater drain project may resolve stagnation in Chennai. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/ambitious-storm-water-drain-project-may-resolve-stagnation/article7545431.ece

**Mariaselvam and Gopichandran, 2016:** Mariaselvam, S., & Gopichandran, V. (2016). The Chennai floods of 2015: urgent need for ethical disaster management guidelines. *Indian Journal Of Medical Ethics*. 1(2 (NS)), 91. Retrieved from http://www.issuesinmedicalethics.org/index.php/ijme/article/view/2381/4940

**Mariappan, 2013:** Mariappan, J. (2013, October 21). Tamil Nadu govt reviews monsoon preparedness of service agencies. *Times of India*. Retrieved from: http://timesofindia.indiatimes.com/city/chennai/Tamil-Nadu-govt-reviews-monsoon-preparedness-of-service-agencies/articleshow/24494878.cms

**Mariappan, 2009:** Mariappan, J. (2009, June 23). Residents unhappy with road relaying without milling. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/city/chennai/Residents-unhappy-with-road-relaying-without-milling/articleshow/4689898.cms

**Mariappan, 2008:** Mariapan, J. (2008, December 2). Consultant blames flooding in city on Metrowater, Corporation. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/city/chennai/Consultant-blames-flooding-in-city-on-Metrowater-Corpn/articleshow/3782192.cms

**Martin-Breen and Anderies, 2011:** Martin-Breen, P., and Anderies, J.M. (2011). Resilience: A literature review. Retrieved from: https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/3692/Bellagio-Rockefeller%20bp.pdf?sequence=1

**Menon, 2004:** Menon, A. (2004). Colonial constructions of 'agrarian fields' and 'forests' in the Kolli Hills. *The Indian Economic and Social History Review*. 41,3. Retrieved from: http://environmentportal.in/files/Koli%20Hill.pdf

**MSME-DI, n.d.(a):** MSME-DI, Ministry of MSME, Government of India. (n.d.) Brief Industrial profile of Chennai District 2012-13. Retrieved from: http://dcmsme.gov.in/dips/IPS%20Chennai_Revised.pdf

**MSME-DI, n.a.(b):** MSME-DI, Ministry of MSME, Government of India. (n.d.). State Industrial Profile 2014-15 Tamil Nadu. Retrieved from: http://dcmsme.gov.in/dips/state_wise_dips/State%20Industrial%20Profile%20-%20Tamil%20Nadu_4316.pdf

**Ministry of MSME, 2016a:** Ministry of MSME, Government of India. (January 2016) MSME at a glance 2016. [Pdf] Retrieved from: http://msme.gov.in/WriteReadData/ebook/MSME_at_a_GLANCE_2016_Final.pdf

**Ministry of Environment, Forest and Climate Change, Government of India, 2010:** Indian Network for Climate Change Assessment. (2010). Retrieved from: http://www.envfor.nic.in/division/indian-network-climate-change-assessment

**Ministry of MSME, n.d.:** Ministry of MSME, Government of India. Annual Report 2014-15. (n.d). Retrieved from: http://msme.gov.in/WriteReadData/DocumentFile/MSME%20ANNUAL%20REPORT%202014-15_English.pdf

**MAWS, 2015:** Municipal Administration and Water Supply Department. (2015). *Policy Note*

## N

**Nandy, 2016:** Nandy, M. (2016). What developers are planning in affordable housing this year. *LiveMint*. Retrieved from: http://www.livemint.com/Companies/NFXasiAQea2YMQnPmmZKtJ/What-developers-are-planning-in-affordable-housing-this-year.html

**Narain, 2014:** Narain, S. (2014). If only cities can see wetlands. *Down to Earth*. Retrieved from: http://www.downtoearth.org.in/blog/if-only-cities-can-see-wetlands-45270

**Narasimhan, 2016:** Narasimhan, B. (2016). Storm water drainage of Chennai – Lacunae, assets, and way forward. Retrieved from: http://www.icwar.iisc.ernet.in/wp-content/uploads/2016/06/BN_IITM_Chennai100RC.pdf

**Narasimhan *et al*, 2016:** Narasimhan, B., Bhallamundi, S.M., Mondal, A., Ghosh, S., and Mujumdar, P. (2016). Chennai floods 2015. A rapid assessment. *ICWR, IISc Bangalore*. Retrieved from: http://itra.medialabasia.in/img/Chennai%20Floods-Rapid%20Assessment%20Report-May%2023,%202016.pdf

**NIDM, 2015:** National Institute of Disaster Management. (2015). *Tamil Nadu Disaster Risk Reduction Profile*. New Delhi: Ministry of Home Affairs

**Nelson, Adger and Brown, 2007:** Nelson, D.R., Adger, W.N., and Brown, K. (2007). Adaptation to environmental change: Contributions of a resilience framework. *Annual Review of Environment and Resources*. Vol.32:

(395 – 419). Retrieved from: http://www.annualreviews.org/eprint/UFeVsdAUFMw4RsPPE78k/full/10.1146/annurev.energy.32.051807.090348

**Nirmal, 2015:** Nirmal, R. (2015). Lessons from Chennai floods: Why home buyers should know geography. *The Hindu Businessline*. Retrieved from: http://www.thehindubusinessline.com/portfolio/people/lessons-from-chennai-floods-why-home-buyers-should-know-geography/article7983497.ece

## O

**Oppilil, 2016:** Oppilil, P. (2016). In a conservation bid, state sets up wetland authority. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/city/chennai/In-a-conservation-bid-state-sets-up-wetland-authority/articleshow/52646831.cms

**Our common future, as quoted in Gunn, 1998:** Gunn, A. (1998). Rethinking communities: Environmental Ethics in an Urbanized World. Retrieved from: http://hettingern.people.cofc.edu/Environmental_Studies_695_Environmental_Philosophy/Gunn_Rethinking_Communities.pdf

## P

**Potarazu, 2015:** Potarazu, S. (2015). Chennai floods a climate change wake-up call for world. *CNN*. Retrieved from: http://edition.cnn.com/2015/12/19/opinions/potarazu-chennai-flooding/

**Prashant and Sane, 2016:** Prashant, S., and Sane, R. (2016, January 28). Complaints about compliance with IRDAI regulations by insurance companies. *Ajay Shah's blog*. Retrieved from: https://ajayshahblog.blogspot.in/2016/01/concerns-about-compliance-of-irda.html

## R

**Raghavan, 2015:** Raghavan, TCAS. (2015, January 28). Linking urban India to drive growth. *Live Mint*. Retrieved from: http://www.livemint.com/Opinion/VZ2ZW6DSRqTj7PIxbVLcIK/Linking-urban-India-to-drive-growth.html

**Rajendran and Ramanathan, 2015:** Rajendran, and Ramanathan. (2015, December 9). Chennai floods: What happened at Chembarambakkam, negligence or nature's fury. *The News Minute*. Retrieved from: http://www.thenewsminute.com/article/chennai-floods-what-happened-chembarambakkam-negligence-or-nature%E2%80%99s-fury-36675

**Ramalingam, 2015:** Ramalingam, J. (2015, December 25). When Chennai went under. *Frontline*. Retrieved from: http://www.frontline.in/cover-story/when-chennai-went-under/article7965575.ece

**Ramani and Srinivasan, 2015:** Ramani, S., & Srinivasan, V. (2015, December 10). A wrong call that sank Chennai. *The Hindu*.

Retrieved from: http://www.thehindu.com/news/cities/chennai/chennai-floods-a-wrong-call-that-sank-the-city/article7967371.ece?ref=sliderNews

**Rana, 2015:** Rana, P. (2015, December 11). How Chennai floods stack up against other natural disasters in 2015. *The Wall Street Journal*. Retrieved from: http://blogs.wsj.com/indiarealtime/2015/12/11/how-chennai-floods-stack-up-against-other-natural-disasters-in-2015/

**Rao, 2016:** Rao, GV. (2016, July 6) Don't build capital on floodplains. *The Hindu*. Retrieved from: http://www.thehindu.com/todays-paper/dont-build-capital-on-floodplains-experts/article8813176.ece

**Ravindran, 2015:** Ravindran, KT. (2015, December 25) Chennai floods present a lesson in urban planning. *Hindustan Times*. Retrieved from: http://www.hindustantimes.com/analysis/chennai-floods-present-a-lesson-in-urban-planning/story-QOQlkG76xthZcNSqmQ5icL.html

**Ravishankar, 2016:** Ravishankar, S. (2016, January 29). Tamil Nadu's flood-hit MSMEs are crying out for a helping hand. The Economic Times. Retrieved from: http://articles.economictimes.indiatimes.com/2016-01-24/news/70036445_1_msme-sector-entrepreneurs-chennai

**RBI, 2015:** Reserve Bank of India. (2015) Report of the Committee on Medium-term Path on Financial Inclusion. Reserve Bank of India

**Rodriguez, 2013:** Rodrigues, Suzana. (2013). Institutional voids in emerging markets and the dilemmas of growth. Paper presented at IIAS Workshop on Institutional Voids During State Rescaling, 13 May 2013.

**Roumeau, *et al.*, 2015:** Roumeau, S., Seifelislam, A., Jameson, S., and Kennedy, L. (2015). Water Governance and Climate Change Issues in Chennai. Working Paper 8, Institut Francais de Pondichery and Centre for Sciences Humain, New Delhi

## S

**Sakai, Holdsworth, and Curry, 2016:** Sakai, P., Holdsworth, A., and Curry, S. (2016). Economic Impact Assessment Of The Boxing Day Floods (2015) On Smes In The Borough Of Calderdale. Retrieved from: http://www.cccep.ac.uk/wp-content/uploads/2016/04/Economic-Impact-Assessment-of-Boxing-Day-floods.pdf

**Singh and Wasdani, 2016:** Singh, C and Wasdani, K.P. (2016). Finance for Micro, Small, and Medium-Sized Enterprises in India: Sources and Challenges. ADBI Working Paper.

**Sivan, 2011:** Sivan, J. (2011, February 4). TN tightens rules on conversion of wetlands. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/city/chennai/TN-tightens-rules-on-conversion-of-wetlands/articleshow/7421612.cms?from=mdr

**Sivan, 2009:** Sivan, J. (2009, January 28). Nod for premium floor space index in city & suburbs. *The Times of India*. Re-

trieved from: http://epaper.timesofindia.com/Repository/getFiles.asp?Style=OliveXLib:LowLevelEntityToPrint_TOI&Type=text/html&Locale=english-skin-custom&Path=TOICH/2009/01/28&ID=Ar00103

**Swamidurai, 2014:** Swamidurai, S. (2014). Factors affecting urban land value in Indian cities: Chennai city as a case study. International Journal of Research and Scientific Innovation. Vol. 1 (3). Retrieved from: http://www.rsisinternational.org/Issue3/31-34.pdf

**SIDBI, GIZ and M2i Consulting, 2010:** State of Financial Inclusion of Microenterprises: Missing Middle. MSME Knowledge Series, Volume 1. 2010. SIDBI, GIZ, and M2i Consulting. Retrieved from https://www.giz.de/en/downloads/giz2013-en-msme-knowledge-series.pdf

**Sphere India, 2015:** Sphere India. (2015). Joint Needs Assessment Report of Tamilnadu Floods, 2015. Relief web. Retrieved from: http://reliefweb.int/report/india/joint-needs-assessment-report-tamilnadu-floods-2015

**Sreekantha and Kulkarni, 2013:** Sreekantha, K., and Kulkarni, R.V. (2013). Survey of MSME insurance risk assessment techniques. *International Journal of Advanced Research in Management and Social Sciences*.

**Storm Water Drains Department, Corporation of Chenna, 2014:** Storm Water Drains Department., Corporation of Chennai. (2014). Integrated Storm Water Drainage Project for the Expanded Areas of Chennai Corporation. First Draft Social Impact Assessment and Resettlement Action Plan

## T

**The Economic Times, 2015:** The Economic Times. (2015, December 3). Discharge from Chembarambakkam lake inundates new areas in Chennai. *The Economic Times*. Retrieved from: http://articles.economictimes.indiatimes.com/2015-12-03/news/68741968_1_chennai-corporation-flood-hit-areas-kodambakkam

**The Financial Express, 2015:** The Financial Express. (2015, December 3). Chennai airport closed due to rains, floods till Dec 6; 3,500 people affected; Spicejet, Indigo, Jet Airways, other flights, ops stoppage in effect. The Financial Express. Retrieved from: http://www.financialexpress.com/india-news/chennai-airport-closed-till-december-6-2015-air-india-spicejet-indigo-jet-airways-flights-suspended-spicejet-com/173674/

**TN PWD, 2015:** Public Works Department, Irrigation. (2015). *Policy Note*. Tamil Nadu: Public Works Department

**TN WRD, 2015:** Water Resources Department. (2015). *Performance Budget, 2014-2015*. Tamil Nadu: Public Works Department

**TN WRD, 2005:** Water Resources Department. (2005). *Manual Under Right to Information Act, 2005*. Tamil Nadu: Public Works Department. P.5

**TNSPC, n.d:** 12th Plan, Tamil Nadu State Planning Commission. Chapter 7: Urbanisation. Retrieved from: http://www.spc.tn.gov.in//12plan_english/7%20Urbanisation.pdf

**TN SIDCO, 2015:** Tamil Nadu Small Industries Development Corporation Limited. (2015). *Policy Note 2015-2016*. Chennai: SIDCO

**TN SIDCO, 2013:** Tamil Nadu Small Industries Development Corporation Limited. (2013). *Policy Note 2013-2014*. Chennai: SIDCO

**The Quint, 2015:** The Quint. (2015, December 9). Warnings Ignored: Reasons Why Chennai Airport Sank. *The Quint*. Retrieved from: https://www.thequint.com/jnu-sedition-row/2015/12/09/warnings-ignored-reason-why-chennai-airport-sunk

**The Gazette of India, Ministry of Law and Justice, Legislative Department, 2013:** The Gazette of India, Ministry of Law and Justice, Legislative Department. (2013). The prohibition of employment as manual scavengers and their rehabilitation act 2013. Retrieved from: http://indiacode.nic.in/acts-in-pdf/252013.pdf

**The Times of India, 2015a:** The Times of India. (2015, December 9). Delay in opening sluice gates caused flooding. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/india/Delay-in-opening-sluice-gates-caused-flooding/articleshow/50099873.cms

**The Times of India, 2015b:** The Times of India. (2015, November 16). Chennai sinking? Here's why. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/city/chennai/Chennai-sinking-Heres-why/articleshow/49796299.cms

**The Times of India, 2011:** The Times of India. (2011, June 14). TN is second highest in housing shortage. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/city/chennai/TN-is-second-highest-in-housing-shortage/articleshow/8842651.cms

**The Times of India, 2013a:** The Times of India. (2013, May 21). North Chennai home rates grow fastest. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/city/chennai/North-Chennai-home-rates-grow-fastest/articleshow/20160799.cms

**The Times of India, 2013b:** The Times of India. (2013, July 20). Natural calamity prone states have no disaster management mechanism: PIL. *The Times of India*. Retrieved from: http://timesofindia.indiatimes.com/india/Natural-calamity-prone-states-have-no-disaster-management-mechanism-PIL/articleshow/21177283.cms

**Tjaardstra, 2014:** Tjaardstra, A. (2014). EAIC 2014: Thai floods had dramatic impact on SME loss ratio. *POST*. Retrieved from: http://www.eaic2014.org/images/release/www-postonline-co-uk-8_部分1.pdf

**The New Indian Express, 2015:** *The New Indian Express*. (2015, September 29). Make in India targets can be met if MSMEs grow: Experts. *The New Indian Express*. [Online] Retrieved from: http://www.newindianexpress.com/cities/chennai/Make-in-India-Targets-can-be-Met-if-MSMEs-Grow-Experts/2015/09/29/article3052212.ece

**The Hindu, 2016:** The Hindu. (2016, January 26). Encroachment on

water bodies cannot be tolerated: court. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/encroachment-on-water-bodies-cannot-be-tolerated-court/article8153603.ece

**The Hindu, 2015a:** The Hindu. (2015, December 14). Chief Secretary justifies water release from Chembarambakkam. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/chembarambakkam-lake-chief-secretary-justifies-water-release/article7985934.ece

**The Hindu, 2015b:** The Hindu. (2015, December 9). We destroyed unique flood carriage systems: Expert. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/we-destroyed-unique-flood-carriage-systems-expert/article7964071.ece

**The Hindu, 2014:** The Hindu. (2014, June 2). Delay in works will prove a stumbling block. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/chen-infra/delay-in-works-will-prove-a-stumbling-block/article6072630.ece

**The Hindu, 2013:** The Hindu. (2013, April 26). Civic body to terminate stormwater drain contracts. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/civic-body-to-terminate-stormwater-drain-contracts/article4654657.ece

**The Hindu, 2010:** The Hindu. (2010, October 29). Houses encroaching on channel demolished. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/houses-encroaching-on-channel-demolished/article855442.ece

## U

**UNISDR, 2015:** The Human Cost of Weather-Related Disasters. 1995 – 2015. Centre for Research on the Epidemiology of Disasters and United Nations Office for Disaster Risk Reduction. Retrieved from: https://www.unisdr.org/2015/docs/climatechange/COP21_WeatherDisastersReport_2015_FINAL.pdf

**UNDP, 2013:** UNDP. (2013). Small Businesses: Impact Of Disasters And Building Resilience Analysing The Vulnerability Of Micro, Small, And Medium Enterprises To Natural Hazards And Their Capacity To Act As Drivers Of Community Recovery. United Nations Development Program.

## V

**Vasudeva, 2015:** Vasudeva, V. (2015, December 4). Unregulated urbanisation to blame for Chennai flooding: CSE experts. *The Hindu*. Retrieved from: http://www.thehindu.com/news/cities/chennai/unregulated-urbanisation-to-blame-for-chennai-flooding-cse-experts/article7945813.ece

**Vencatesan, 2006:** Vencatesan, J. (2006). Wastelands: is it time to rethink? *Current Science* Retrieved from: http://www.iisc.ernet.in/currsci/dec102006/1454.pdf

## W

**WMO, 2009:** World Meteorological Organization. (2009). Integrated Flood Management Concept Paper (Associated Programme on Flood Management). Geneva: WMO

**WEF, n.d.:** World Economic Forum. (n.d.) The Global Competitiveness Report 2014-2015. World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf

# Annexure 1

Table with enterprises' intitial investment, size class, annual turnover, number of employees.

| Firm code | Initial Investment (in INR) | Size class | Annual turnover 2015-16 (in INR) | Number of Employees |
|---|---|---|---|---|
| Firm 1 | 7 lakhs | Micro | 25.6 lakhs | 3 |
| Firm 2 | 6 lakhs | Micro | 4 lakhs | 4 |
| Firm 3 | 1 crore | Small | 3 crores | 25 |
| Firm 4 | < $10 million | Large | Not available | >240,000 |
| Firm 5 | 50,000 | Micro | 3 crores | 30 |
| Firm 6 | We are asking follow up questions for range of investment | Medium | 52 crores | 350 |
| Firm 7 | 50,000 | Micro | 60 lakhs | 10 |
| Firm 8 | Not available | Large. Subsidiary with FDI from abroad | Not availalbe | 200 |
| Firm 9 | 2 lakhs | Micro | 12 lakhs | 6 |
| Firm 10 | 8 lakhs | Micro | 1.4 crores | 10 |
| Firm 11 | 1 lakh | Micro | 12 lakhs | 2 |
| Firm 12 | Not available | Small or medium | 1.04 crores | 9 |
| Firm 13 | 5 lakhs | Micro | 15 lakhs | 2 |
| Firm 14 | 5,000 | Micro | 12-18 lakhs | 5 |
| Firm 15 | 80,000 | Micro | 4 lakhs | 3 |
| Firm 16 | 10 lakhs | Micro | 12-18 lakhs | 4 |
| Firm 17 | 7 lakhs | Micro | 15 lakhs | 8 |
| Firm 18 | Not available. FDI from parent company | Small or medium | 5.1 crores | 20 |
| Firm 19 | 1.5 lakhs | Micro | 12-18 lakhs | 5 |
| Firm 20 | 25 lakhs | Micro | 24 lakhs | 6 |
| Firm 21 | 1 lakh | Micro | 15 lakhs | 7 |
| Firm 22 | 1,35,000 | Micro | 40 lakhs | 10 |
| Firm 23 | 1 lakh | Micro | 1.5 crores | 7 |
| Firm 24 | 30 lakhs | Small | 75-90 lakhs | 15 |
| Firm 25 | 2 lakhs | Micro | 75 lakhs | 22 |
| Firm 26 | 10,000 | Micro | 74 crores | 200 |
| Firm 27 | Not available | Started as micro before moving to IE. Now small | 4 crores | 40 |
| Firm 28 | 7 lakhs | Micro | 1.5 crores | 15 |

| Firm code | Initial Investment (in INR) | Size class | Annual turnover 2015-16 (in INR) | Number of Employees |
|---|---|---|---|---|
| Firm 29 | 7 lakhs | Micro | 7 lakhs | 5 |
| Firm 30 | 50 lakhs | Small | 2.75 crores | 8 |
| Firm 31 | 4 lakhs | Micro | 20 lakhs | 9 |
| Firm 32 | 10 lakhs | Micro | 1 lakh | 2 |
| Firm 33 | 24 lakhs | Micro | 1 crore | 15 |
| Firm 34 | Not Available (not aware of this as they are several years old) | Medium (most likely started as micro) | 425 crores | 500 |
| Firm 35 | 1,00,000 | Micro (now medium) | 27 crores | 220 |
| Firm 36 | 3 lakhs | Micro | 8 lakhs | 4 |
| Firm 37 | 3 lakhs | Micro | 20 lakhs | 5 |

# **Annexure 2:** Number of Enterprises by Location

- Kandhanchavadi (7)
- Ekkaduthangal (5) – forms 1/5th of the Nurture Trust sample
- Perungudi (2)
- Ambattur (7) – larger location with difference impacts at each site
- Thiru.Vi.Ka. IE (3)
- Guindy (2)
- Gerukambakkam (3)
- Kollapakkam (1)
- Villivakkam (2)
- Sriperumbudur (1)
- Sholinganallur (1)
- Thirumudivakkam (2)
- Thorapakkam (1)

The Industrial estates that were represented were in

- Thiru Vi Ka Industrial Estate, Ekkatuthangal - 2
- Ramanugjan IT SEZ, Tharamani
- SIDCO Industrial Estate Villivakkam - 2
- SIPCOT Industrial Park, Sriperumbudhur
- Ambattur Industrial Estate - 2
- SIDCO Industrial Estate, Ambattur - 2
- SIDCO Industrial Estate, Ekkatuthangal -2
- Guindy Industrial Estate
- Thiru Vi Ka Industrial Estate, Guindy
- SIDCO Industrial Estate, Thirumudivakkam - 2
- TASS Industrial Estate, Ambattur
- SIDCO North Phase Industrial Estate, Ambattur

Those outside of the estate are represented in the following areas

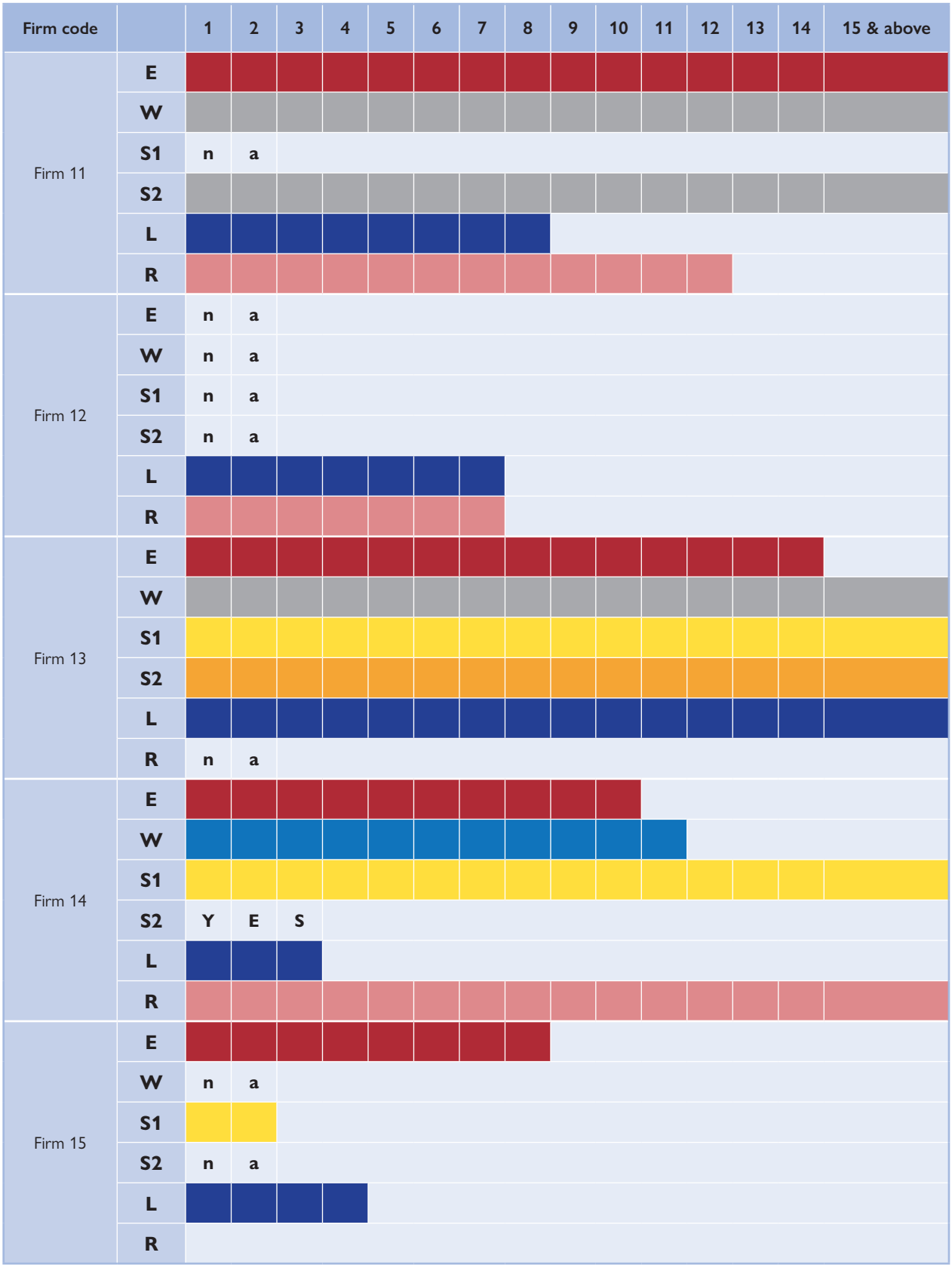
- Kandhanchavadi - 7
- Ekkatuthangal - 4
- Thoraipakkam - 2
- Perungudi
- Gerukambakkam - 3
- Ambattur
- Kolapakkam

# Annexure 4

Number of days enterprises were affected by lack of access to utilities including recovery time, and overlapped with waterlogging and recovery from waterlogging.

| Firm code | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 & above |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Firm 1 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | 1 month |
| | S2 | | | | | | | | | | | | | | | 1 month |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 2 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | n | a | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 3 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | n | a | | | | | | | | | | | | | |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 4* | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | No waterlogging | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 5 | E | | | | | | | | | | | | | | | |
| | W | n | a | | | | | | | | | | | | | |
| | S1 | n | a | | | | | | | | | | | | | |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |


| Firm code | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 & above |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Firm 6 | E | | | | | | | | | | | | | | | |
| | W | n | a | | | | | | | | | | | | | |
| | S1 | n | a | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | n | a | | | | | | | | | | | | | |
| | R | n | a | | | | | | | | | | | | | |
| Firm 7 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 8* | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 9 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 10 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | 1 month |
| | S2 | Y | E | S | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |


Firm code
1
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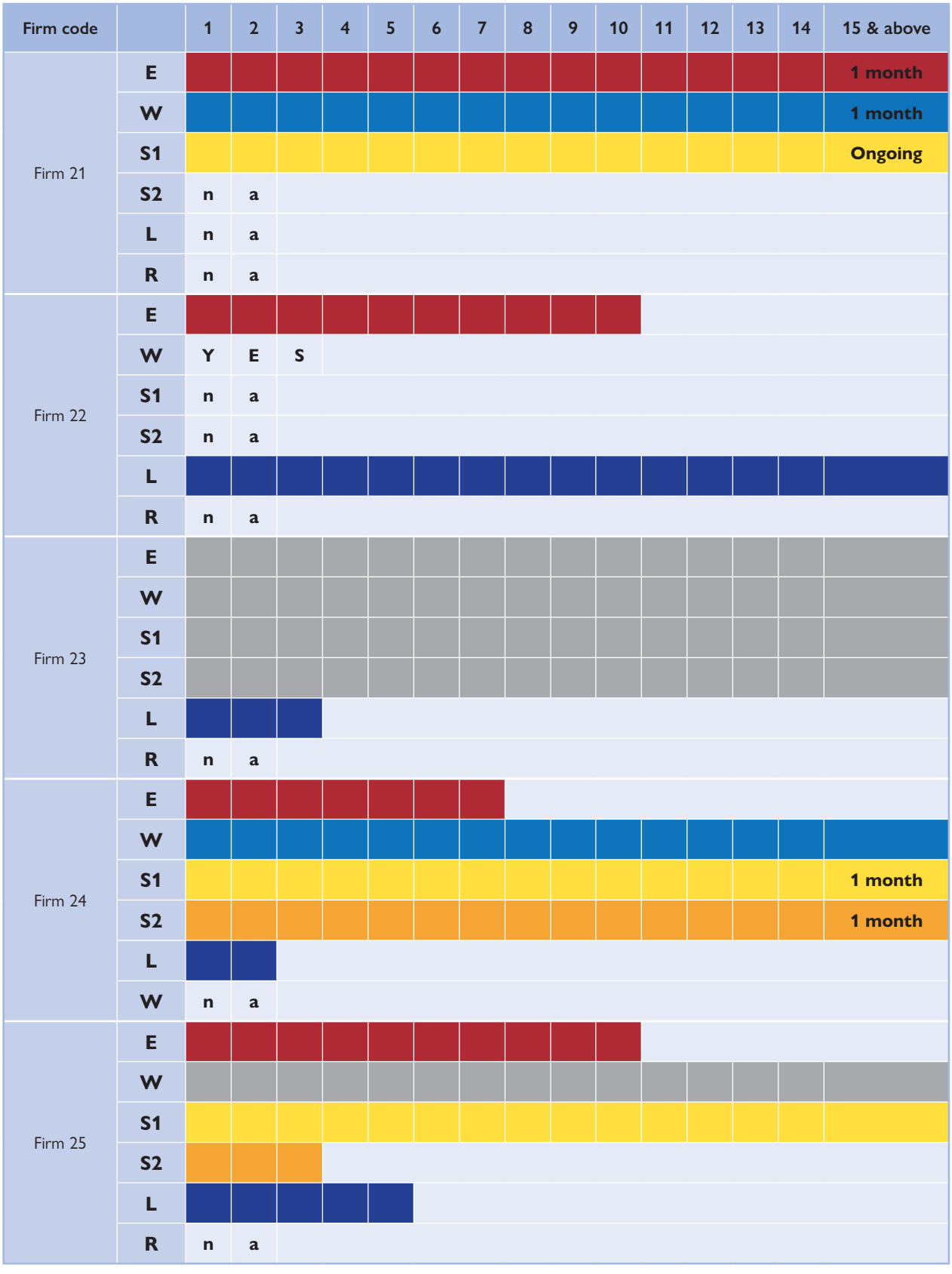
9
10
11
12
13
14
15 & above
Firm 11
E
W
S1
S2
L
R
n
a
Firm 12
E
W
S1
S2
L
R
n
a
Firm 13
E
W
S1
S2
L
R
n
a
Firm 14
E
W
S1
S2
L
R
Y
E
S
Firm 15
E
W
S1
S2
L
R
n
a


| Firm code | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 & above |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Firm 16 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 17 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | n | a | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 18 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | Till date |
| | S1 | n | a | | | | | | | | | | | | | |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 19 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 20 | E | | | | | | | | | | | | | | | 1 month |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | 2 months |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |


Firm code
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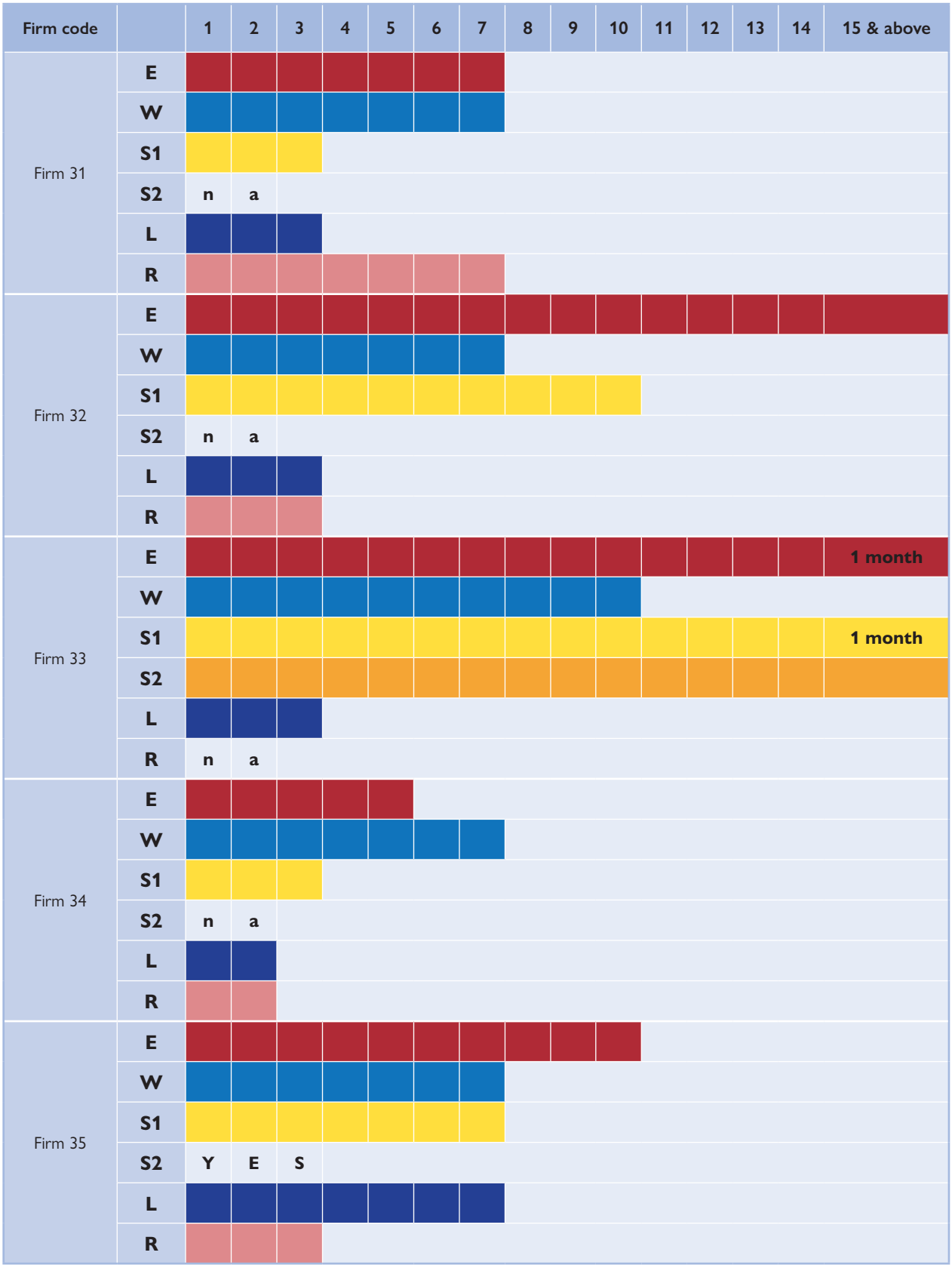
11
12
13
14
15 & above
Firm 21
E
1 month
W
1 month
S1
Ongoing
S2
n a
L
n a
R
n a
Firm 22
E
W
Y E S
S1
n a
S2
n a
L
R
n a
Firm 23
E
W
S1
S2
L
R
n a
Firm 24
E
W
S1
1 month
S2
1 month
L
W
n a
Firm 25
E
W
S1
S2
L
R
n a


| Firm code | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 & above |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Firm 26 | E | | | | | | | | | | | | | | | |
| | W | n | a | | | | | | | | | | | | | |
| | S1 | n | a | | | | | | | | | | | | | |
| | S2 | Y | E | S | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | n | a | | | | | | | | | | | | | |
| Firm 27 | E | | | | | | | | | | | | | | | 1 month |
| | W | | | | | | | | | | | | | | | 1 month |
| | S1 | | | | | | | | | | | | | | | Ongoing |
| | S2 | | | | | | | | | | | | | | | 1 month |
| | L | | | | | | | | | | | | | | | |
| | R | n | a | | | | | | | | | | | | | |
| Firm 28 | E | n | a | | | | | | | | | | | | | |
| | W | n | a | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | 2 months |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | n | a | | | | | | | | | | | | | |
| Firm 29 | E | | | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | n | a | | | | | | | | | | | | | |
| Firm 30 | E | n | a | | | | | | | | | | | | | |
| | W | | | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | n | a | | | | | | | | | | | | | |


Firm code
1
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15 & above
Firm 31
E
W
S1
S2
n
a
L
R
Firm 32
E
W
S1
S2
n
a
L
R
Firm 33
E
1 month
W
S1
1 month
S2
L
R
n
a
Firm 34
E
W
S1
S2
n
a
L
R
Firm 35
E
W
S1
S2
Y
E
S
L
R


| Firm code | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 & above |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Firm 36 | E | | | | | | | | | | | | | | | |
| | W | n | a | | | | | | | | | | | | | |
| | S1 | | | | | | | | | | | | | | | |
| | S2 | | | | | | | | | | | | | | | |
| | L | | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |
| Firm 37 | E | n | a | | | | | | | | | | | | | |
| | W | n | a | | | | | | | | | | | | | |
| | S1 | n | a | | | | | | | | | | | | | |
| | S2 | n | a | | | | | | | | | | | | | |
| | L | No waterlogging | | | | | | | | | | | | | | |
| | R | | | | | | | | | | | | | | | |

* Refers to the large enterprises in the sample survey.

# **Annexure 4:** Experts Consulted

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**Mr. K. Gopalakrishnan**
Chairman, Tamil Nadu Small and Tiny Industries
Association-Friedrich Naumann Foundation Service Centre (TFSC)

**Mrs. K. Saraswathi**
Secretary General, Madras Chamber for Commerce and Industry

**Dr. Jayshree Vencatesan**
Managing Trustee, Care Earth Trust, Chennai

**Ms. Kavitha Selvaraj**
Director, CR Narayana Rao

**Mr. N. Muthuraman**
Director, RiverBridge Investment Advisors Pvt. Ltd.
Member, Nurture Trust

**Mr. Om Prakash Singh**
Executive Director, Citizen Consumer and
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**Mr. Pradeep Sarin**
Senior Vice President, Strategy and Business Development,
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**Mr. V. Raju**
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**Mr. Srinivasan**
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Please note that in addition to these expert consultations, we also held a Chatham House rules workshop with scientists, academics, experts, and state officials at the project inception stage. In accordance with these rules, participants and their specific inputs cannot be referenced, but we thank all who participated for their insights in an early stage of framing this study.