

# **A Case Study on Impact of Chennai Floods: Supply Chain Perspective**

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## **Abstract**

Natural disasters and its after effects on business operations is one of the major risk factors that supply chain risk management practitioners still find difficult to manage. Researchers in this area have extensively studied the impact of such unpredictable incidents on supply chain performance, major example being the impact of 2011 Japanese earthquake and tsunami on electronics and automotive industries around the globe. Consequently, Toyota lost their top position as global car producer in 2011, handing the title back to General Motors. Despite this, research papers have also discussed the impacts of Thailand floods and US hurricanes like Sandy, Katrina, etc. Accordingly, this case study is the first attempt to put lights on the impact of the severe flood that happened in 2015 December at Chennai from the supply chain perspective. As Chennai is one of the four metropolitan and major manufacturing hubs of India, any calamity in that location can affect the overall production of the nation. This study investigates the effects of flood on supply chain disruptions in four major industrial sectors with respect to some major firms located in the city. In addition, the study documents the strategies that these companies adopted to manage the disruptions. Furthermore, the paper also suggests strategies that firms can adopt in catastrophic situations like these.

*Keywords:* Chennai floods; supply chain risk management.

## **1. Introduction**

Heavy rain in the beginning of December 2015 caused severe flooding in Tamil Nadu and Andhra Pradesh. A deep tropical depression came through the Bay of Bengal and hit the south-eastern coast of India and Sri Lanka on 10-11 November 2015, causing heavy rain. Heavy rain started during Nov 16-19, with 30-37 cm of rain accumulating over a 9-day period 9 (Fig. 1). After pausing for several days, the rain again resumed in early December and in some locations the rain continued until December 10. Chennai received over 33 cm of rain in a 24-hour period from December 1-2, causing widespread flooding and damage. In Tamil Nadu, Chennai city, Cuddalore, Kanchipuram, and Tiruvallur districts were worst affected. Unfortunately, around 500 people have lost their lives in Tamil Nadu as a result of this devastating flood (Sphere India, 2015). The main reason that led to this situation is the unscientific urbanization and expansion of Chennai city. Many studies had made warning signals against converting marshy land to concrete infrastructure that worsened the condition ([Lavanya, 2015](#)).

The Government of India had declared Chennai a National Disaster zone, and National Disaster Response Force carried out rescue operations in the city. Severe flooding on December

2 and 3 wreaked havoc, with large parts of the city under water. The rains and subsequent overflow of the Adyar River and Cooum River had caused severe flooding and extensive evacuations in Chennai and surrounding areas, as well as significant damage to homes and surrounding farm fields. Many parts of the city got isolated since road and rail access had been cut off, while failure of the power and telecommunication system elevated the risk. The runway at Chennai airport was flooded and got closed for 3 days and 3,500 people got stranded there. For most people stranded in rain hit Chennai, taking a flight to neighbouring cities had been a bleak option over those days. This was not just due to the fact that the Chennai airport has been flooded, but also because tickets were priced as high as Rs. 50,000 one way (Sinha, 2015a; DNA, 2015; TOI, 2015; The Hindu, 2015d)

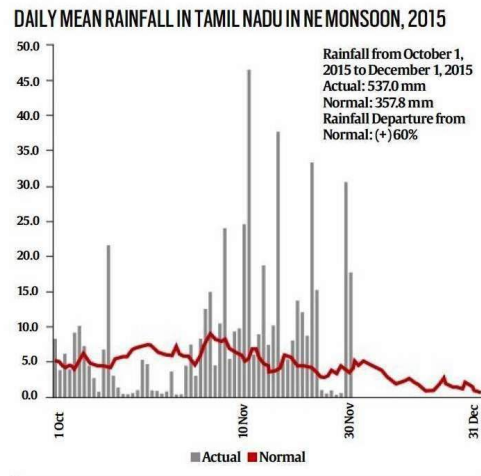


Fig 1 Chennai Rainfall Statistics (Source: Indian Express Daily)

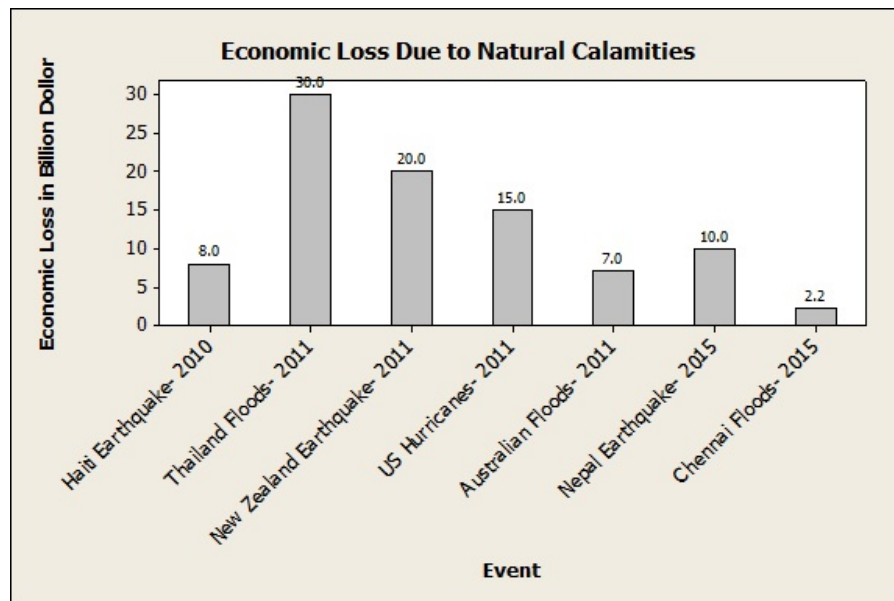


Fig 2 Economic loss due to natural calamities

From the supply chain perspective, the aftermath of the rains and extensive flooding was a huge blow for the industrial activities in Chennai, which is home to outposts for multinational companies ranging from BMW and Ford Motor to Tata Consultancy Services and IBM. Major manufacturing units had to suspend operations with units either flooded or unable to operate due to inadequate workforce. The industry lobby, Associated Chambers of Commerce of India, estimated the overall economic loss from the flooding at over Rs. 15,000 crores. In other words, approximately 10-15% of the country's production was impacted in the month of November because of Chennai rains (Thakkar, 2016). However, recent studies show that damages and losses account for Rs 14,630 crores i.e. \$ 2.2 billion (Fig. 2) according to reinsurance company Swiss Re (TOI, 2016). According to the study, the insured losses due to the Chennai floods were estimated at \$755 million, making these floods the second costliest insurance event in India on sigma records. The public sector United India Insurance is the one to handle most number of claims (Sinha, 2015b; The Indian Express, 2016). This case study briefly consolidates and classifies these impacts within four major manufacturing and service sectors like automobile, IT & telecommunication, food supply chain and Health sector. The rest of the paper is organised as follows. Section 2- 5 deals with the impact on four major manufacturing and service sectors such as automobile & petroleum industry, IT & telecommunication, food industry and health sector respectively. Section 6 provides the inferences drawn from the study and finally, section 7 provides the conclusion.

## **2. Automobile and Petroleum Industry**

The automotive industry is one of the key drivers of India's economy, accounting for around 4 percent of India's GDP and over 200,000 jobs. Gujarat and Chennai-Bangalore corridor are the two major areas where Indian automobile manufacturing is concentrated. Subsequently, Chennai is renowned as the Detroit of India. In fact, Chennai hosts country's largest auto manufacturing hub with Ford, Daimler, Nissan, TVS, Hyundai, Renault-Nissan, Royal Enfield and Ashok Leyland having their factories there. Out of the \$38 billion annual production of auto components in India, almost 25 percent, or \$9.5 billion comes from Chennai and its surrounding automotive belt.

Unfortunately, the unprecedented rainfall in Chennai has impacted logistics and supply chain resulting in disruption of production. Automobile manufacturers in and around Chennai have suffered heavy losses due to the floods. However, most of the original equipment manufacturers restored operations within a month but many of them faced difficulties to restore their supply chains as logistics, due to road conditions, continued to pose a challenge for two months. While no official numbers were given, industry sources claim that production loss could be between Rs 1200-1500 crore as an after effect of this natural disaster (Lakshmana, 2015).

South Korean carmaker Hyundai, has the largest car manufacturing plant around 45 km from Chennai having daily production of 2,200 cars whereas the annual capacity is 6,80,000 units. In view of the heavy rain and floods, the company had to call off the third shift on December 1 and all shifts on December 2, 3 and 4. The company did not share the exact production loss. However, going by its daily production capacity and the number of shifts and days suspended, production loss could be around 7,300 units. The damages to roads because of the floods have caused logistics challenges, despite this, they are also facing issues like supply uncertainty since most of their vendors was located close by. However, later they worked closely with their vendors and supply chain partners to ensure supply of parts is not impacted. The

company then had to work all shifts and its production teams worked towards resolving the shortfall. Even though, the waiting period of some models impacted by a week to 10 days (Williams, 2015).

Renault-Nissan's manufacturing plant is located at Oragadam, 45-50 km from Chennai. Due to extreme weather conditions which made it unsafe for employees to travel, Renault-Nissan Alliance plant suspended operations for four days in the beginning of December and three days in mid-November. However, the company has not incurred any damage to the plants, facilities or warehousing. As a result, operations were resumed on December 6. The company was close to 10,000 cars short of planned production. The company reported that its spare parts warehouse did not incur any damage and, therefore, parts supply has not been a major problem. Like Hyundai, Nissan also faced supply uncertainties since some of the firm's smaller suppliers got adversely affected (Narasimhan, 2015)

The US auto major Ford did not share information regarding production loss. Ford with an annual capacity of 3.4 lakh engines and 2 lakh vehicles had to shut its plant. The estimated cost of production loss of Ford is about Rs 600 crores (Ketan, 2015). Commercial vehicle majors namely Ashok Leyland and Daimler India, which have plants in and around Chennai, did not share details regarding production loss. Meanwhile, Florian Laudan, head of corporate communication at Daimler Trucks Asia, stated that they have production buffer for compensating the lost work hours (Williams, 2015).

Royal Enfield's production facilities at Thiruvottiyur and Oragadam were shut on December 1 and the company resumed production of motorcycles on December 7. However, owing to low turnout of employees and some issues with its local suppliers, the facilities had to run at their 50 per cent capacity in December second week. The firm has reported production loss of 11,200 vehicles owing to the closure of both the facilities (The Hindu, 2016). Finally, Indian two-wheeler manufacturer TVS Motor claimed that the company suffered sales loss of approximately 15,000 units due to the inclement weather.

Apollo Tyres has informed the exchange that its factory at Oragadam, near Chennai, was flooded and production disrupted till December 2 due to heavy rains in Chennai. The production loss due to this natural calamity was 450 tonnes but it was adequately covered under the insurance policy of the company. The shutdowns and production losses have affected shares of some Chennai-based companies on domestic stock exchanges. Shares of Ashok Leyland—whose Ennore plant in Chennai accounts for 40% of its production—closed down over 1% on the Bombay Stock Exchange (BSE) on Dec. 3. Shares of Chennai Petroleum Corporation (CPCL) ended down over 5% while TVS Motors closed over 2% lower on the BSE.

In general, major supply chain risks faced by manufacturing sectors were production halts, outbound delays, inventory shortage and logistics failure. Most of the parts for these organisations were being supplied on a just-in-time (JIT) basis that elevated the risk of inventory shortage, while production halts had made deliveries to be delayed by 7-10 days. However, firms like Daimler India Commercial Vehicles (DICV) made up the shortfall in production in due course, since they were not running at full utilisation and thus they just used their full capacity to meet the promise times (Williams, 2015).

When coming to the petroleum industry, Supreme Petrochem Limited informed the BSE that the operations of the company's EPS plant at Chennai had disrupted due to heavy rains and floods. Even though they did not produced exact loss statements, they claimed, that the plant was adequately insured. In addition, they served their customers from the company's EPS plant at Maharashtra. Reuters reported that the state-run Chennai Petroleum Corp (CPCL) had to shut its 210,000 barrels per day refinery in the city's industrial zone of Manali. Finally, the flood has made The Indian Oil Corporation's large Manali refinery in Chennai to close down, disrupting the fuel supply chains in and around the city (Press Trust of India, 2015). This also affected the transportation facilities in the state.

### **3. IT and Telecommunication Industry**

Chennai is also a hub for several Indian and multinational IT companies, such as Infosys, Cognizant, and Mphasis, along with Tata and IBM. Around 400,000 people in the city work in the IT sector. Most of the IT companies are located in Porur, an area west of Chennai that was widely inundated. However, given the nature of their business, IT companies say they have successfully managed to get the work executed from other locations.

It is important to note the strategies executed by IT firms against flood caused disruption. Cognizant has activated its "business continuity plan," under which some employees were made to travel to offices in other cities to provide uninterrupted client support. Some of the facilities at Cognizant's delivery centre in Chennai were still operational and several employees working on critical projects were put to stay back at the office. The company also worked with network providers to ensure continued connectivity at its offices. IT giant Infosys also implemented similar strategies by moving some of the work that is done at Chennai to other locations. Even though, it remained shut on December 2nd.

Telecom operators have suffered Rs 300 crore of losses amid the unprecedented rainfall in Chennai and its surrounding areas. The calamity has also compelled Finnish network gear maker Nokia to stop production of 3G and 4G gear at its nearby factory. China's biggest telecoms gearmaker Huawei also got hit by the flood situation that affected its Chennai factory, which purely caters to export markets such as China, Asia Pacific and the Middle East. Even under the circumstances, most of the telecom operators offered their customers free calls and internet data to facilitate communication that was crucial even in the relief work. Companies like Airtel, Vodafone, BSNL, MTS etc. offered free 10 minutes talk and 50-100 Mb of data for prepaid customers in Chennai.

Out of the Rs 300 crore losses estimated by Cellular Operators Association of India (COAI), Rs 100 crore is on account of network restoration and Rs 200 crore on account of revenue losses in the first week of December 2015. Global network vendor such as Nokia having a large manufacturing plant near Chennai have been hit hard by the floods which forced them to temporarily stop production at its factory over two days. This was done to prioritise the safety of its 1300 employees and equipment. Nokia's Chennai works, which is amongst its key factories globally, meets the 3G and 4G network gear requirements of India and as many as 26 export markets across continents. A senior industry executive aware of the devastation stated that Nokia was closely working with its global factories in China and Finland to balance production volumes and bridge the Chennai production shortfall for meeting global customer requirements. Since Nokia follows a global supply chain, processes were in place to ensure customers can be served from its other global factories. Nokia India was also changing inbound and outbound

shipping points to Bangalore instead of Chennai and had taken steps to organise alternate shipments of raw material to ensure minimal disruption to production in times of crisis like that. In the case of television networks, popular television networks, namely Puthiya Thalaimurai, Jaya TV and Mega TV halted services following flood-related technical difficulties.

#### **4. Food supply Chains**

The floods severely impacted the food availability for initial days but the community was supported by government and other agencies. Across the three districts Cuddalore, Kanchipuram and Chennai, the food and security issue was much common since many household had lost their food items in the flood and was unable to restart cooking as there was muck, wet floor and no dry ration available. People depended on the food been supplied by the philanthropists. Cuddalore district was the most affected.

Most of the people expressed that the special nutritional needs of children, women and the elderly could not be met. As per the report of UNICEF, more than 30 percent of children in Tamil Nadu aged fewer than 5 years were underweight, raising serious concerns about their healthy growth and development. Furthermore, more than 30 percent of adolescent girls (15–19 years) and half of pregnant women (15-19 years) were anaemic. Only 52 percent of children were exclusively breastfed for six months. This percentage would have increased after the disaster as food availability and access is an acute problem in different areas. In both urban and rural areas, prices touched all-time high making it difficult for poor and vulnerable households to buy adequate food. This aggregated malnutrition among children.

Essential household items like milk and vegetables were sold at more than double the normal price in some places in Chennai. As the state electricity board had suspended power as a precautionary measure, most of the residents of the city and its neighbourhoods, who had stocked milk and vegetables, were unable to preserve them for long. Large queues were seen in places where milk was being sold. Despite this, famous Koyambedu vegetable market was cut off from the city, leading to the spiralling vegetable prices. In addition, the price of mineral water also hit the roof with a 20-litre bottle normally available for Rs 30 being sold for Rs 150 per bottle. Most of the supermarkets and hotels across the city were either shut or had run out of stocks (The Hindu, 2015a). Adding to this vulnerability, over 1.5 lakh (150,000) street vendors sustained losses of over 300 crores (The Hindu, 2015b).

#### **5. Health Sector**

When rains ravaged the city, a well-known MIOT International hospital on the banks of the Adyar river in Manapakkam was hit by flood in parts of its premises and according to the government 18 people were declared dead within the initial two to three days of the floods (The Hindu, 2015c). As there was no electricity, the hospital was put to run on the generator. Unfortunately, flooding of generator room and resultant snap of ventilator and oxygen support resulted in loss of human life. Speaking to reporters, some relatives of those dead alleged that those on life support like ventilator and oxygen could not be continuously given such backup as the generator room was flooded. Out of 75 ICU patients in that hospital, 57 ventilator patients were moved out. To avoid similar situations seven emergency ambulances were deployed to transport patients from MIOT hospital to private and a government hospital. Also, out of the 18 dead, 14 were taken to the Government Royapettah Hospital as there was no power in the mortuary of MIOT Hospital.

## 6. Inferences

Supply chain disruptions are unplanned and unanticipated events that prevent the normal materials flow through the supply network (Kim *et al.*, 2015). This case study reveals the after effects of Chennai floods, especially from the supply chain perspective. Accordingly, major supply chain risk factors that rose as a result of Chennai floods are as follows:

- Production halts
- Power failure
- Communication system failure
- Logistics failure
- Inventory management failure
- Supplier delays
- Outbound delays
- Human resource unavailability
- Environmental regulations
- Credit risk
- Asset impairment
- Plant safety issues
- Insurance security risk
- Share market depression
- Inertia: lack of firm's response to market changes

This scenario reflects the unpreparedness of organizations in handling disruptions. In addition, the above description of supply chain performance in various sectors reveals how a single natural calamity raises issues of various supply chain risks. Therefore, future studies in this area should also consider how one supply chain risk factor is related to others. This study of interrelationships between various risks will help the managers to cluster and classify risks based on various aspects like impact strength, frequency of occurrence and cost of containing/mitigating risk. This can again lead to the ranking of various risks and can be utilized to prioritize the execution of mitigation strategies and to frame the business continuity plans.

After close evaluation, it can be noted that IT sector turned out to be the one to manage the effects of the flood. Fortunately, most of the firms did not find any threat to their communication network that is vital for doing business. Moreover, most of the major IT firms had backup plans already made to react to these kinds of situations. As an example, Cognizant activated its “business continuity plan,” during the flood times. According to this plan, some employees travelled to offices in other cities to provide uninterrupted client support. Similar strategies were adopted by other major IT giants like Infosys, TCS, IBM etc. However, when coming to manufacturing supply chains, the after effect was devastating, leading to the total halt in operations. This is due to the fact that unlike IT sector creating a physical backup is not appropriate in the manufacturing sector. Furthermore, the geographical closeness of the major vendors also aggregated the situation since the failures of facilities of the vendors resulted in supply uncertainties for most of the manufacturing industries. Despite this, almost all manufacturing firms were financially secured as they were insured. This mitigated the risk of financial setback that the industries might face due to impairment of physical assets and

infrastructure facilities that got damaged due to water logging. Fortunately, industries in the city were able to roll back to normal operations as the rain receded within a week.

In the food supply chain area, the impact was similar to manufacturing supply chains. However, unlike manufacturing supply chains, any disruption in food supply chain can turn out to be critical that can even lead to death penalties. Flood caused logistics failure was the major risk factor that led to the failure of food supply chains. Alternate transportation facilities using helicopters was utilized by the government officials to distribute food packets to the isolated needy people. This act was able to tackle the issue at least to some extent.

Finally, when analyzing the overall risk mitigation efforts delivered by various sectors, it is evident that some of the strategies worked well for some firms. However, these were traditional strategies that could have been substituted with more effective modern strategies with the help of supply chain risk management philosophies. Some of the promising strategies that are applicable to these situations include the following (1) multi-location sourcing, (2) agile supply chain management, (3) collaboration, (4) flexible transportation (multimodal) etc. Furthermore, supply chain risk due to such disasters can be minimized by (1) enhancing visibility of supply chain by identifying n-tier suppliers and determining interdependencies, (2) mapping key risk areas associated with n-tier supply chain, (3) engaging and sharing global best practices with suppliers, (4) preparing emergency preparedness plans for business continuity etc. (Kohli, 2016).

## 7. Conclusion

The unprecedented rains in the first week of December 2015, the worst in 100 years, battered Tamil Nadu's northern districts such as Chennai, Tiruvallur, Kanchipuram and Cuddalore. This was a huge blow to all enterprises situated in and around Chennai city. Supply chain disruption issues from the four major sectors of the economy are discussed in this case study. From this, it can be noted how a single natural calamity raises issues of various supply chain risks. Considering these kinds of situations, World Economic Forum (WEF) has highlighted supply chain disruptions and vulnerability as one of the four emerging risk issues that will affect the world's economy and society during this decade. The WEF considers supply chain vulnerability to have an impact potential as high as systematic financial risks, food security or energy supply. This signifies the need to design and execute agile supply chain strategies instead of traditional supply chain strategies. In order to execute these strategies, firms should reconfigure their supply chain design and operations that can handle high levels of demand, supply uncertainty and supply chain disruptions effectively by improving their reliability and flexibility.

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