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"DISASTER RESPONSE & DECISION MAKING IN UNPREDICTABLE ENVIRONMENT IN SUPPLY CHAIN MANAGEMENT"

UNDER THE GUIDENCE OF

Faculty Guide

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CHAPTER -1

INTRODUCTION

INTRODUCTION

Recent natural and man-made disasters like Hurricane Katrina in 2005, Hurricane Gustav in 2008, flooding in Iowa and North Dakota in 2009, the earthquake in China's Sichuan Province in 2008, the U.S. anthrax attack in 2001, and the potential for an H1N1 influenza pandemic in 2009 have made us aware of the importance of having effective disaster preparedness and response planning. The Oklahoma City bombing in 1995, the crash of United Flight 232 in 1989, the Sarin attack in the Tokyo subway in 1995, and Hurricane Floyd in 1999 and Hurricane Charlie in 2004 are reviewed historically by Larson et al. (2006), who emphasise the importance of using operations research models to enhance readiness for and response to major emergencies. In the case of numerous natural and man-made catastrophes including hurricanes, earthquakes, floods, and terrorism, one of the duties of federal and local governments is to give emergency relief supplies to disaster victims, such as water, meals, blankets, generators, tarps, and medicine. Millions of people may need to be served by emergency relief efforts quickly. To avoid major health risks and death, it is preferred that food and water reach sufferers within three days. In the event of a widespread smallpox outbreak, it is advised to

immunise everyone in potential contact within four days of exposure, and in the event of an anthrax outbreak, it is advised to distribute antibiotics within two days of the incident. Inadequate distribution planning can have negative effects like sickness, mortality, and societal unrest. For instance, Hurricane Katrina in 2005 caused $200 billion in damages and over 1,300 confirmed fatalities. The number of fatalities from these events would have been lower with a better response strategy. Because it will have an impact on the lives of many people, meticulous planning of the distribution of emergency supplies is crucial, taking into account a variety of risk factors and uncertainties. Coordination between the local and federal governments is also necessary for the task of delivering immediate disaster relief andrecovery support.

The supply chain for relief supplies is very different from commercial supply chains in a number of ways, including the following: a sudden and enormous increase in demand, damaged or congested roads, erratic behaviour of demand (victims), collapse of communication networks, short lead times, and many other unknowns and uncertainties. It is challenging to plan for a major disaster like a hurricane since it is impossible to accurately foresee where it will strike. For instance, based on the National Hurricane Centre's (NHC) average forecast inaccuracy, the likelihood that a hurricane would make landfall within 65 nautical miles of a specific place in 48 hours is the highest is only 20–25% of hours (NHC, 2009). A new breed of analytical models is therefore required for HCLP (high-consequence, low-probability) occurrences in order to better understand the disasters and better prepare for and respond to disasters.

Disaster Management

A catastrophe that causes significant human suffering, material loss, and social disruption strains a community's ability to cope to its limit. When the community's ability to cope with the situation is exhausted and the status quo becomes unsustainable, the event turns into a disaster.

We require a strong and reliable supply network to change this circumstance. The following elements must be present for the supply chain to function well in a catastrophe situation:

1. **Agility**

The ability to swiftly adapt to and respond to changes in the distribution process at any stage in the operation in order to harmonise and rationalise urgent needs and priorities is known asagility.

2. **Value**

To deliver the most responsive service for the least amount of money, value implies having the finest possible synergy of efficacy and efficiency.

3. **Velocity**

Velocity is the rate at which the distribution system satisfies demands. The efficacy of the entire system is maximised by synchronising the velocities of the various global distribution components.

4. Visibility

For accurate and timely flow monitoring and management by all parties, visibility is necessary. Apps for supply chain visibility give management the ability to gather data from many platforms and applications and distribute it throughout the supply chain. It enables distribution managers to plan ahead for logistical bottlenecks, disruptions, and changes to the operationaldistribution strategy.

DISASTER PREPAREDNESS AND RESPONSE MODEL

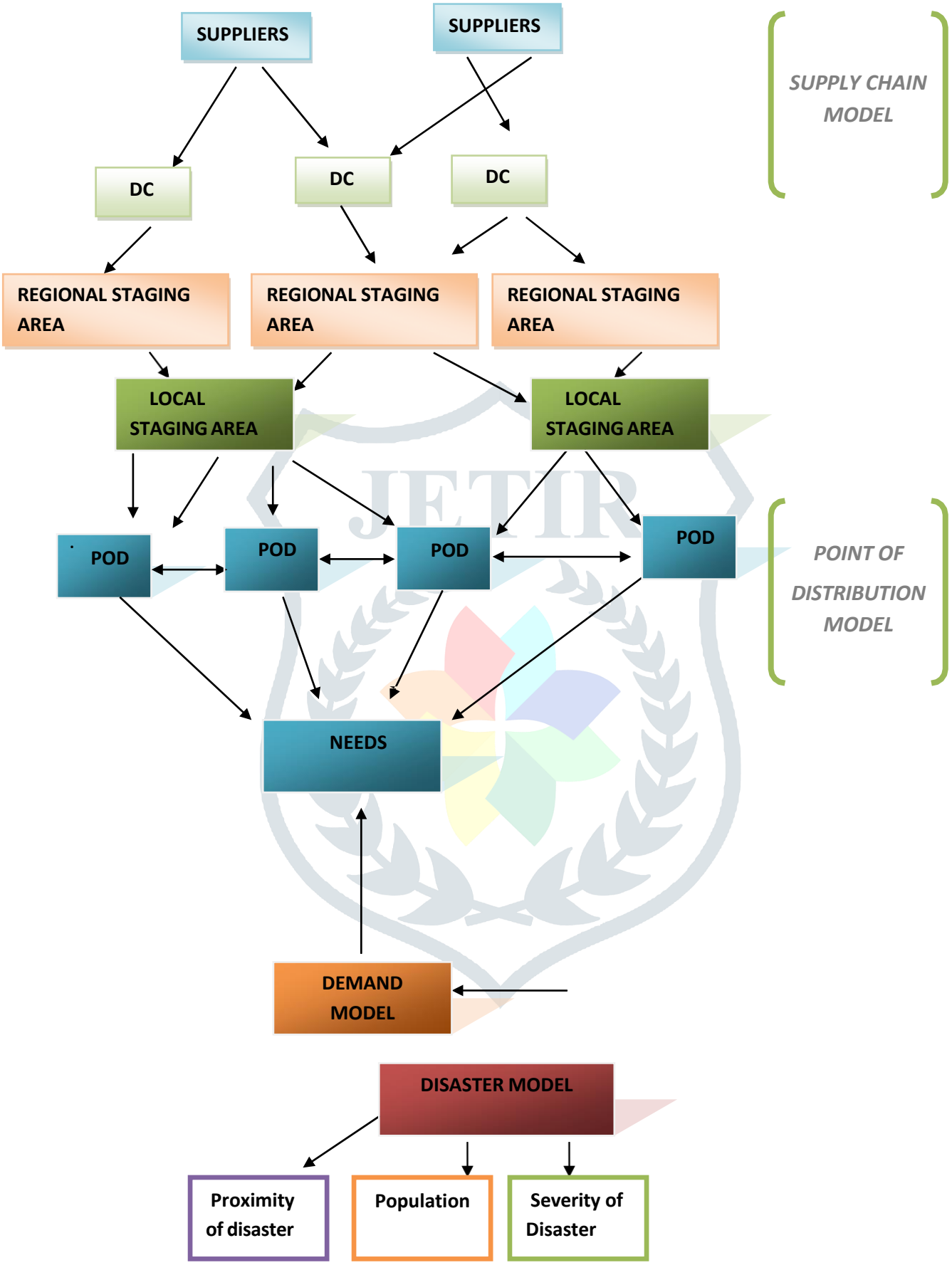
The supply chain model, POD distribution model, demand model, and disaster model are the four components that make up disaster preparedness and response modelling. According to the supply chain model, materials for disaster relief move from federal government suppliers to distribution centres (DC), federal staging locations, local government staging areas, and lastly to the places of distribution (POD). According to the POD distribution methodology, victims who visit a POD to receive supplies are given relief materials. In terms of place and time, the demand model reflects the occurrence of disaster victims needing relief supplies. The arrival and course of catastrophes with respect to time and place are described by the disaster model. The other three models are impacted by the disaster model. It affects the quantity of victims (i.e., the demand model), the transportation and activation of supply chain nodes (i.e., the supply chain model), as well as the effectiveness of POD activities (i.e., POD distribution model). The impact of disasters and overall performance of disaster preparedness and response operations are influenced by all four models taken together. Any potentially relevant analytical models should be assessed and tested in the simulation environment where all four areas are modelled in order to conduct a thorough analysis of catastrophe preparedness and response.

Supply chain model, POD distribution model, demand model, and disaster model are its four subcomponents. Despite the fact that the simulation model discussed here is for hurricane scenarios, the framework can be altered to accommodate various disaster responses. We mimic the flow of disaster relief materials from federal government suppliers through distribution centres (DC), to federal government staging locations, to local government staging areas, and finally to the place of distribution for the supply chain model (POD). Water and MREs are the goods I'm concentrating on here for disaster aid (Meal-Ready-to-Eat).

Selected supply chain nodes, such as a specific number of suppliers, DCs, staging zones, and PODs, are activated to manage the necessary supply chain depending on the nature, location, and severity of the catastrophe. According to the POD distribution concept, supplies are given out to victims who visit PODs to get them. Parking lots of stores or schools can serve as PODs for commodity items; victims often pull up, pick up boxes of materials, and then leave. Buildings like schools, recreation centres, theatres, stadiums, and medical facilities, among others, can serve as PODs for medical supplies. PODs call for a large workforce (usually volunteers), equipment like folk lifts, triage for medical supplies, service queue lines, etc. The overall throughput rate (processing rate for distribution or dispensing) is dependent on all the setups and resources. In terms of place and time, the demand model reflects the occurrence of disaster victims needing relief supplies. The peaks and lengths of victim profiles might vary depending on the type of disaster, its intensity, and the reaction. The demand model may also incorporate an evacuation model that counts the number of victims

who leave the disaster region. Most coastal areas must begin their evacuations 48 hours in advance of a hurricane in order to finish them before tropical storm-force winds reach. Those who remain in the disaster zone and are affected by it are the victims who require immediate assistance supplies. According to time and place, the disaster model outlines how disasters arrive and develop. The other three models are impacted by the disaster model. It affects the quantity of victims (i.e., the demand model), the transportation and activation of supply chain nodes (i.e., the supply chain model), and the effectiveness of POD operation (i.e., POD distribution model). The coverage reflects the equilibrium between the supply of disaster aid and the demand from disaster victims (i.e., percentage of victims receiving emergency supplies over time). The impact of disasters and the overall success of disaster preparedness and response plans and operations are influenced by all four models (supply chain, demand, POD distribution, and disaster model). Any prospective analytical models created should be assessed and tested in the simulation environment where all four areas are modelled for a thorough examination of catastrophe preparedness and response.

Figure 1: DISASTER PREPAREDNESS AND RESPONSE MODEL



In the supply chain, several analytical tools can be helpful. For instance, an optimal resource planning model can determine the ideal number of trucks, storage facilities, and staging areas. Pre-stocking levels of supplies at different DCs and staging sites can be calculated using an optimal pre-stocking model. Each vehicle that leaves the nearby staging area can have its destination POD determined by an efficient dispatching model. When delivering supplies to several PODs, a truck's best path can be determined through an optimal routing model. A model for optimal cross shipping can determine the best times and amounts for cross shipping between PODs.

Along with the flow of emergency supplies, there is also a flow of information among the hierarchy of command centres, which may include a local command centre, regional command centre, and national government command centre (e.g., Joint Field Office, National Response Coordination Center) (e.g., EOC–Emergency Operating Center). Throughout the relief operations, the command centres communicate data on demand (number of patients and lines) and supplies (inventory level, truck dispatch and arrival). Efficient response operations depend on effective communication. Even if the supply chain is set up correctly, the effectiveness of the disaster response operation would be compromised if inaccurate or delayed information is delivered.

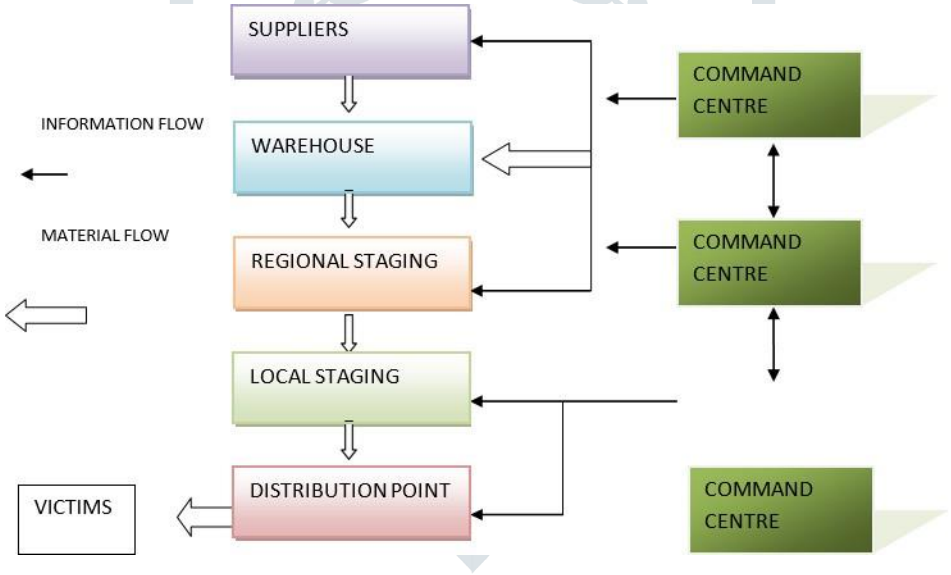


FIGURE 2: Material and Information Flow

RELIEF CHAIN PROCESSES

Planning and Preparation	During pre-disaster, proper planning and preparedness for logistical procedures and activities must be done.
Assessment	Assessment comprises of activities like preparedness planning, survey and data collection, interpretation and forecasting, reporting and monitoring
Resource Mobilization	Human and financial resources need to be mobilized by various humanitarian organisation
Procurement	This is emergency supplies which can be done locally or globally and can be acquired in different ways such as bulks or stored at the vendor until needed
Transportation	It involves shipment, logistics, transportation etc, through which the goods are brought into a country at an entry point and then moved to collection sites run by relief organisation
Tracking & Tracing	It means keeping track of what has been ordered, promised, things on its way and already arrived, etc.
Stock Asset Management	The stock should be inspected and accounted, and if there is any flaw should be sent back.
Extended Point of Delivery & Relief to Beneficiaries	An extended delivery point is an inland destination close to the affected area where goods can be staged before the final distribution of relief to beneficiaries. Finally, distribution should be carried out in proportion to the requirement and all the affected gets there share
Monitoring, Evaluation & Reporting	During implementation, monitoring and evaluation create the information base for decision making. It is also used to formulate conclusions and recommendations for the supply chain.
Communication & Collaboration	In disaster, setting communication is quite a difficult task, but quite helpful. Between different agencies working for relief should have proper cooperation

LOGISTICS

The logistics of humanitarian aid are crucial. The ability of logisticians to find, transport, receive, and distribute goods at the scene of relief efforts determines the pace and effectiveness of relief programmes. A well-organized and managed supply chain for disaster aid can save lives.

The following qualities would be necessary for logistics: -

1) It must convey people and goods via several terminals using different transportation methods (Land, Sea, and Air).
2) Travel distance is frequently great.
3) Transportation must be quick and adaptable.

A variation of "All shipment via Central DC (Distribution Center)" is the network layout that would work well for disaster management. In this approach, suppliers ship goods to the DC, which then sends the right shipments to the retailer. DCs typically acted as a location for storage and transfer. With this model, both incoming and outbound expenses are reduced.

We'll employ a modified version of this model for disaster management. All shipments would be routed through a series of DCs in this scenario. The nodes would be as follows:

1. The source or point of origin

   The actual source of all the information, individuals, etc., is referred to by this node. These nodes are typically numerous.

2. Point of Collection

   This is where all the information from different sources would be gathered. We could use this as our initial DC. This is typically near the actual sources and is situated in a transit hub. The material is now transferred from this location to the expanded delivery point.

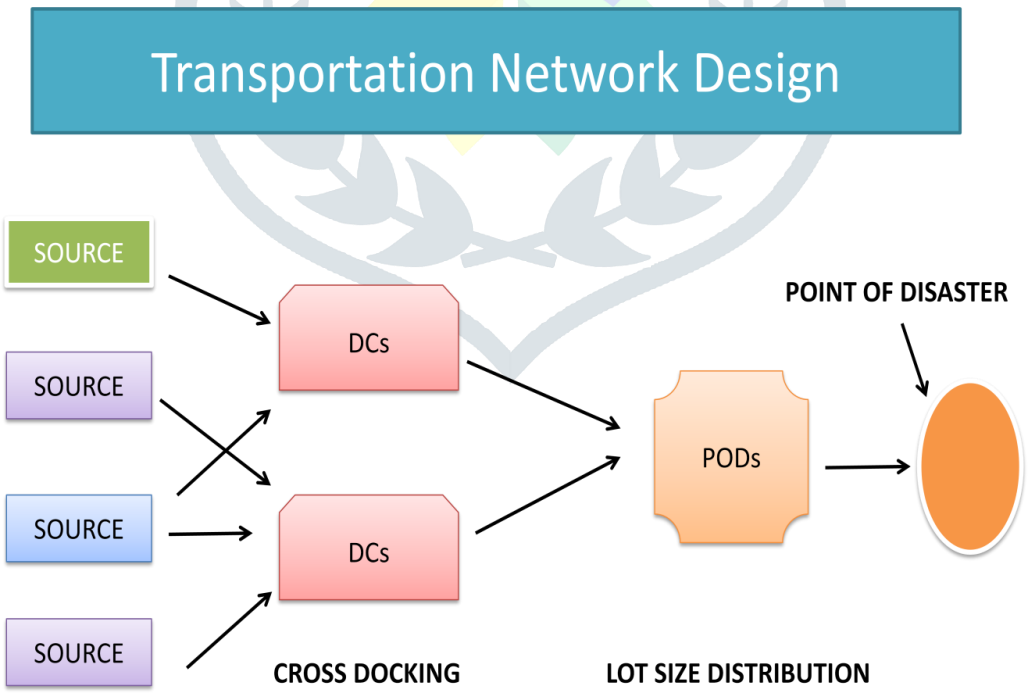
3. Extended Delivery Point

   This location, which is close to the catastrophe region, would serve as the second DC. Normally, the closest airport or other transportation hub would be in this location.

4. Area of Disaster

   Most of the time, disaster areas are blocked off from the outside world. From the extended delivery point, equipment would be brought here. The most popular mode of transportation tothis region is air.

FIGURE 3



In the two DCs model mentioned above, there is only need for one centre to keep inventory; the other location would serve as a transfer location. In this section, we could discuss in-transit merging and cross-docking. Cross-docking involves quickly emptying, deconsolidating/reconsolidating, and reloading inventory rather than storing it. The pipeline is still present when goods are combined while in route, but they are not aggregated at the delivery location.

DCs serve as transfer points; no inventory is kept there; cross docking is used instead. Simple mixing and transfer of materials from inbound transportation into outbound transportation. To do this, the actions must be painstakingly synchronised and coordinated.

Whereas at PoDs, materials are kept, divided into suitable lot sizes, and then sent to the disaster-stricken area as needed.

MANAGE INFORMATION

Natural and man-made disasters can happen anytime, anywhere. Disasters can be overcome in two ways: first, by preventing them from happening, and second, by having an emergency system and plan of action in place before any crisis arises. Communications are crucial to disaster management in both strategies.

Information system design must adhere to certain criteria for disaster management.

1. Prognostic information processing should be used.
2. It needs to be done using a case-based approach.
3. The system should be as automated as possible, but with ongoing human oversight andoverride capabilities.

INFORMATION SYSTEM ARCHITECTURE

Based on above requirements, an information system is proposed. Key characteristics of the proposed model are listed below.

1. Web Based

The greatest way to share information in real-time situations is through a web-based information system. It gives all parties involved quick access to information, thereby lowering response times.

2. Centralized Database

Centralized database refers to the idea that all users would have access to the sameinformational database. It would require the following data to be saved:

1. Inventory information

   This comprises inventory information for every link in the chain, such as the sources, thepoint of extended delivery, and the point of transit.

2. Conditions at the tragedy scene

   The PoED operator would input this data, essentially in the form of an order.

3. Tracking details

   Monitoring the transportation of materials is necessary. Details like the number of cars, thetransportation timetable, and the inventory in transit are all included in this.

4. Information regarding disasters

   The main purposes of this data are demand projection and proactive decision-making. The extent of the damage, the restoration process, etc., would fall under this heading..

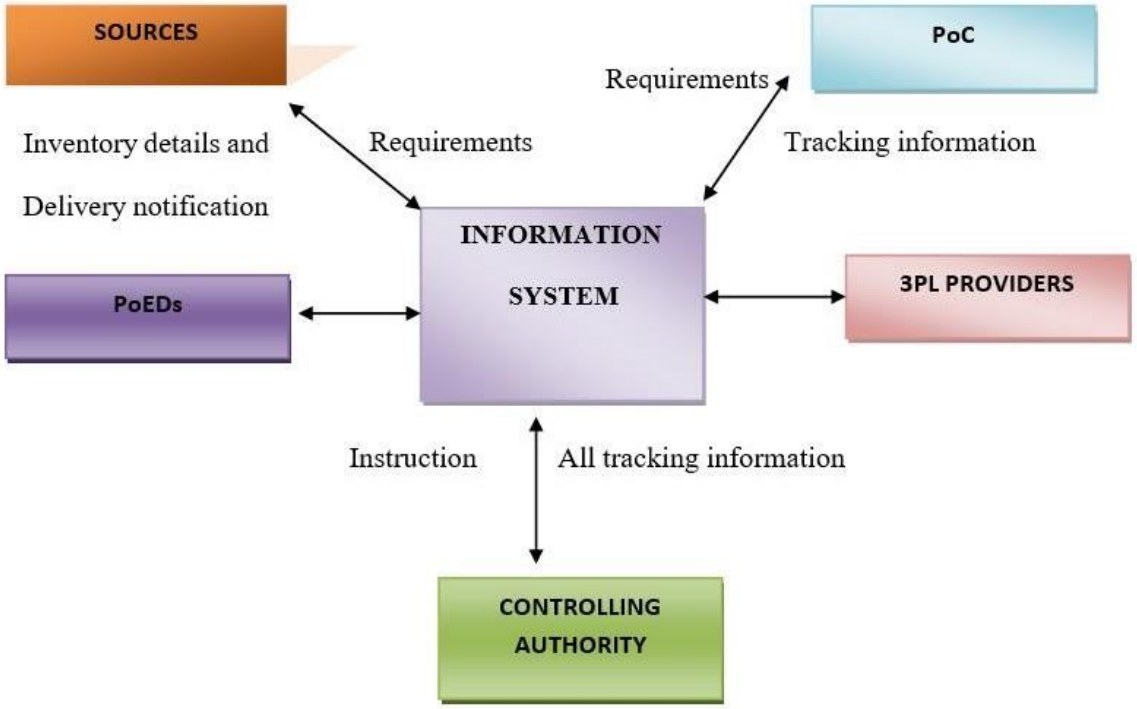


FIGURE 4: Information System Design

INFRASTRUCTURE

Damaged infrastructure, inaccessible infrastructure, and the absence of infrastructure required for large-scale assistance cause bottlenecks, delays, and congestion at entry points to the disaster region when it comes to relief efforts during disasters and complex humanitarian emergencies. Due to a lack of transportation, authorization to access particular areas, or even roads, products might be delayed at ports, border crossings, and airports as they flood into a region. All aid organisations face this issue, and those working during the tsunami were no exception. The entire infrastructure in its path was damaged by the sea as it stormed ashore. This comprised highways, bridges, storage facilities, ports, airports, and transportation and communication systems. Everything was covered in debris as the flood drained, including both damaged and undamaged infrastructure. Up until repair and cleanup efforts could be finished, the pre-Tsunami infrastructure was rendered worthless. The absence of infrastructure before the tsunami made things worse as relief started to get to the area. The demands made on this infrastructure by the relief networks exposed flaws in the intact system, including a shortage of cars, poor fuel storage, inadequate runway capacity for cargo flights, inadequate warehouse space, and insufficient air traffic control. Congestion was one of the major problems due to a lack of infrastructure suitable for a large-scale rescue effort and damage to a section of the infrastructure that was present. For instance, in Sumatra, the main seaports and airports were operating, but the surrounding infrastructure was harmed. Unharmed automobiles were in low supply and had trouble getting through the area. Before the accident, there were three flights a day at the little airport in Banda Aceh. Large trucks that travelled on cleared routes were among the few vehicles that could pass through, but they were unable to reach people who needed help the most. Helicopters consequently became a highly sought-after resource. In Darfur and Ethiopia's high plateau, the same is true. It is simpler to fly supplies in than it is to transport them there by land. The unloading of planes was slowed down by a lack of ground personnel to handle the contents. At one point, a cargo plane at Aceh's sole airport crashed into a cow, causing damage that blocked the runway and put a day's worth of rescue planes on hold (Djuhari, 2005). Due to a lack of storage space, cargo had to be offloaded, which quickly filled the tarmac. Poor information technology infrastructure and communication issues resulted in very little visibility over inbound goods. It was challenging to predict a shipment'scontents, arrival date, and pick-up party.

CHAIN OF FINANCIAL SUPPLIES

The amount of money raised for the Tsunami by both public and private donations was extraordinary. But before assistance can start to flow, the financial supply chain needs to be established. It takes time and is first tough to do this. While this is happening, monetary reserves are swiftly used up. Organizations may suffer before official agreements with nearbybanks and retailers and money transfer procedures are in place.

There are several cash flow issues in the initial days. Organizations have exercised their ingenuity in regions with less developed banking infrastructure. To start the aid work in Southern Sudan, CARE employees brought in suitcases filled with cash (Martha Thompson, personal communication, October 8, 2004). Two NGOs who responded to the survey described challenges they faced in the early stages of their tsunami response. Even if they had access to financial resources, many reported having trouble getting cash. Due to the

Christmas holiday and weekends, banks in Jakarta were closed immediately following the tsunami. This made it challenging to get into contracts with merchants and to transfer money out of Europe. In this area, competition can also be detrimental to advancement. The cost of employing labour on the local market was higher than World Vision could offer, therefore they had trouble finding local employees.

Software for logistics is used in disaster relief

Purchasing and tracking supplies from the point of appeal through delivery is the responsibility of relief logisticians, who must also keep track of financial data and the flow of commodities via the pipeline. Information that is accurate and relevant must be readily available. Despite their importance in helping beneficiaries, logisticians are infrequently involved in the creation and acquisition of information technology solutions for aid operations (Lee & Zbinden, 2003). For decades, numerous groups have been offering assistance. They created ad hoc systems to assist in managing the logistics of disaster assistance when the information technology revolution swept them up. Yet Microsoft Excel is the only tool used to coordinate the majority of relief efforts. Software development has taken a backseat as a result of the staff's lack of technical systems knowledge and increased emphasis on overhead reduction. As a result, these systems lack historical data, are unreliable, lack integration across functions, are prone to errors, are subpar at reporting, and cannot manage both food-related and non-food gifts in one system. This issue was recently looked into by the Fritz Institute with assistance from University of Washington scholars. They started by analysing the logistical methods used byprominent NGOs.

PROCESS FLOW CHARTS

Supply Chain Flow: In-warding to Dispatch

VQA
(Material Inspection)

STORES
(Acknowledgement)

CRDO
(Goods Inwarding)

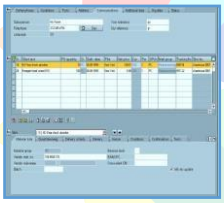
ASSEMBLY
(Production)

VEHICLE
(Inspection)

FINAL DELIVERY
(Sales)

Supply Chain Flow: Procurement to Payment

SRM SCHEDULES
(Supplier Relationship Mgmt)



MRP
(Material Req Planning)

SALES PLAN
(Corp. SHQ)

CRDO
(Goods Inwarding)

VQA
(Material Inspection)

BMS
(Payment by Bank)

COMMUNICATIONS

Communication is just as crucial in a disaster as food and water. Infrastructure for telecommunications can be harmed by a disaster. Thousands of people may attempt to make calls simultaneously during an event in a densely populated location, overloading the network. NGOs are aware of the value of communication. Solutions for internal communication have been created by those with significant resources. For instance, the American Red Cross has developed mobile communication trucks as part of its Disaster Services Technology Integration Project. As soon as they are in place, the telecom trucks offer "48 phone lines, high-speed internet access, e-mail, and satellite-enabled connection with national headquarters" (Larkin, 2001). Both the reaction to the 9/11 attacks and Hurricane Lili in 2002 involved the use of these trucks. The American Red Cross is able to respond in an effective, coordinated manner because of its access to real-time information about casualties, volunteers, logistics, and financial matters (Rudduck, 2002). Organizations with fewer funds or those operating in more remote areas must turn to alternative solutions. Currently available communication methods are shownin Figure 4.

Short Wave or HFRadio VIHFRadio	Voice communication over a medium to long distance is possible with High Frequency (HF) radio. It has the ability to connect to both mobile phones and the global telephone network. Fixed short-wave radio stations are used by peripheral units to connect to the global network. These systems can send and receive faxes between stations, connect to global positioning systems offer data transmission similar to FTP, and use genuine TCP/IP for email Additionally, it is conceivable to set up local radio-to-telephone links that over the long term, will be less expensive to maintain than employing ground stations. Software systems do need antennas, substantial electric current—typically from a local main, generator, or battery power supply—and experienced installation and operation.
VIHF Radio	Voice communication over a medium to long distance is possible with High Frequency (HF) radio. It has the ability to connect to both mobile phones and the global telephone network. Fixed short-wave radio stations are used by peripheral units to connect to the global network. These systems can send and receive faxes between stations, connect to global positioning systems offer data transmission similar to FTP, and use genuine TCP/IP for email Additionally, it is conceivable to set up local radio-to-telephone links that over the long term, will be less expensive to maintain than employing ground stations. Software systems do need antennas, substantial electric current— typically from a local main, generator, or battery power supply—and experienced installation and operation.

Satellite	High-quality direct-dial phone, fax, and telex communications to and from the global public telecommunications networks are provided by the InMarSat constellation of four geostationary satellites. Mobile-to-mobile calls are also possible, but the quality will be lower and the costs will be higher because they require two satellite "hops". RBGAN, also known as Regional Broadband Global Area Network, is a service recently made available by InMarSat. This satellite terminal provides access to the internet Iridium uses a constellation of 66 satellites in a cross-linked, near-polar Low Earth Orbit (LEO). Using small, portable phones and paging devices Iridium services provide global voice, paging, Short Message Service (SMS), and data communications.
Cellular Phones	The use of cellular phones is spreading around the world. Mobile phones may be the most economical form of communication if a disaster strikes an area with cell infrastructure without damaging it. Temporary towers can be built in the case that cellular towers are damaged. They may also be positioned in camps for refugees. This technology was put in place by Norte during the tsunami to provide cellular communications within ten miles of Banda Aceh.

KEY LEARNING FROM THE SUPPLY CHAIN MODEL

0. Based on this supply chain model, the following are the essential characteristics of a supplychain that are required in a disaster situation.

- Strong and robust supply chain
- Dexterity (adjust & respond)
- Value (synergy of effectiveness & efficiency)The velocity (speedy recovery)
- Visibility

1. The lead time for a supply chain model for disaster management should be very short ornegligible.

2. Logistics would need to possess the following qualities: - It must convey people and cargovia several terminals using a variety of transportation methods (Land, Sea, and Air).

- Travel distance is frequently great.
- Transportation must be quick and adaptable.

3. Purchasing: The emergency suppliers should always be prepared to deliver large quantities of emergency supplies in the event of a calamity. Therefore, the idea of an efficient and speedy supplier request is crucial.

4. To save time and expedite the delivery of sufficient food and medical supplies to the injured, the transportation operation should apply the concepts of cross-docking and in-transit merging.

5. The communication supply chain has the most disruption after a disaster. So it is important to adopt an effective communication process. Short Wave or HFRadio, VIHF Radio, satellite communications, etc. are currently available as means of communication. These solutions should be used to give the people in a

panic a way to communicate.

6. Since POD throughput and victim demand might vary greatly, disaster response strategies should be flexible enough to address challenging circumstances like low POD throughput and a high victim count.

7. It is crucial to employ efficient logistics software to monitor the status of the supplies and the rescue operation.

8. Extended Point of Delivery & Relief should be roomy and easy for the casualties to access.

9. Centralized database refers to the idea that all users would have access to a single database of data. It would need to provide the following information: - Inventory details - Requirementsat the catastrophe site - Tracking details - Disaster-related details

10. Various humanitarian organisations must mobilise both people and financial resources. Effective assessment is also absolutely essential. It consists of tasks including preparing for readiness, gathering data through surveys, interpreting that data, forecasting it, and reportingon it.

CONCLUDING REMARKS

Due to the numerous uncertainties and complexities affecting the supply chain, POD operations, the course of disasters, and the behaviour of disaster victims, it is challenging to quantify the efficacy of disaster planning and response. A useful technique for evaluating, testing, and creating efficient emergency response plans is simulation. To have a quick reaction and better coverage, disaster relief goods should be pre-positioned close to the possible catastrophe region. Plans for responding to disasters should be flexible enough to deal with challenging circumstances like low POD throughput and a high victim count since POD throughput variability and victim demand can both be quite high. Additionally, PODs should be able to handle shortage and surplus circumstances by improved RSA dispatching and/or cross-leveling. Effective disaster management also heavily relies on an efficient information and communication system.

Critical Decision-Making Issues in Disaster Relief Supply Management Following a tragedy, a sizable population of victims must rely on emergency supplies including food, water, shelters, and medical care, all of which must be delivered quickly, efficiently, and effectively. The COVID-19 pandemic outbreak has once again highlighted the critical function of supply chains for disaster assistance. Disaster relief operations are significantly made more difficult by the unpredictable nature of disasters, which leaves unclear messages about supply and demand for relief in terms of timing, location, and impact. To provide a quick and successful response to disasters, resources for relief efforts must be prepositioned. Nevertheless, in light of the following problems, organising disaster relief supplies is never aneasy process.

Several relief actors are involved, but there are few funds and resources available.

There will undoubtedly be a large number of relief actors involved in large-scale disaster relief operations, ranging from the public sector, which includes all levels of government, military forces, and official humanitarian organisations (such as the Red Cross), to the private sector, which includes a variety of

nongovernmental organisations (NGOs), religion-based organisations (such as churches), and private businesses (e.g., local retailers and service providers). To obtain supplies for relief efforts, these organisations either run their own warehouses or enter into agreements with their suppliers. After a disaster, there may be operational management issues with material convergence, duplication of effort, and/or potential operational conflicts. These issues result in not only significant resource waste but also inefficiency in the relief efforts. Additionally, one of the challenges facing the emergency room is finding the right mix of medical personnel.

Due to financial limitations, not all relief actors are able to operate warehouses or preposition relief inventories. In actuality, the bulk of NGOs receive inadequate financial support. Their post-disaster donations, including monetary and material contributions, are their only source of funding for humanitarian aid, which is hysterical and represents the majority of uninvited donations. Inventory management for disaster relief faces the challenging task of timely and economically meeting demand from impacted people. The availability and accessibility of resources, however, would be a major issue when purchasing from local, domestic, or international suppliers to acquire relief supplies, such as supply shortages of local, domestic manufacturers/retailers and lengthy lead times due to international transportation and personnel organisation. Successful disaster relief operations need on a plan and set of techniques that maximise limited resources to address as many demands of the victims as possible. This is OR's strength.

Affected Area's Situation is Complicated and Unpredictable

Large-scale natural disasters will devastate the local infrastructures, shut down the transportation system, and hinder the distribution of aid. The destruction of the warehouses or life-supporting roadways makes relief supplies inaccessible or nonexistent. To meet the needs of the victims, aid organisations must shift their activities and relief supplies. Accessibility and equitable issues in the provision of material help are brought on by the complex conditions in the impacted communities. Due to the halted post-disaster transportation, some impacted people may be trapped far from the points of distribution (PODs). It is crucial but challenging to take impacted communities' demographic and socioeconomic traits into account. Additionally, subsequent calamities like aftershocks and disease outbreaks change the situation in the afflicted area on the fly. Changes in demand, supply, and information communication patterns brought on by the uncertain response environment will make handling disaster relief supplies more difficult.

Demand Is Very Uncertain and Changing Constantly

Information on the date, location, kind, and quantity of relief supplies is required as much as feasible to ensure an effective and efficient response to affected demand. However, information on demand is few, imprecise, erroneous, and hysterical following disasters, especially catastrophes. Because the disaster environment is constantly changing, it is exceedingly challenging to assess the disaster's effects precisely. There is never enough time for careful planning to meet the needs of the impacted populations in a way that is both economical and timely. As a result, supply chains for disaster assistance may generate an

excessive amount of waste and pollutants, which could eventually impact the environment and the surrounding communities.

Since disaster relief constitutes around 80% of the logistics that would come after it, it is important to thoroughly comprehend and investigate the crucial decision-making concerns surrounding disaster relief supplies. Prior pertinent research mostly focuses on facility site decisions (e.g., [4, 14–16]), inventory planning and control, and inventory prepositioning (e.g., [8–13]). (e.g., [17–20]). The location, timing, and capacity of disaster relief inventories are examined in Balcik et alanalysis .'s of the literature from [21]. They classify the known research in accordance with the pre- and post-disaster planning phases of a disaster management cycle.

Behl and Dutta evaluate the existing literature in-depth from a thematic perspective in order to represent the change in the trend of humanitarian supply chain management. In contrast to their viewpoints, Ye et al. examine three crucial choice themes of disaster relief inventory management while shifting the emphasis from analysing the literature to identifying the gaps between research and practise. As a supplement, this survey summarises the most recent academic research from the perspective of three decision-making issues, namely coordination decisions, facility location decisions, and inventory decisions. These three decision-making issues are coordination decisions, facility location decisions, and inventory decisions. To discuss their point of view focused on these three crucial decisions of disaster relief supply management, we make an effort to quote the majority of pertinent publications, including journal articles, book chapters, and academic works, most of which were published within the last ten years. Since only experience-based research with generality and validity concerns can support humanitarian operations, we also introduce the humanitarian logistics practise highlighted by the Logistics Operational Guide. We conduct keyword searches for terms like "disaster relief supply," "relief material," "emergency supply," "emergency material," "disaster relief supply chain," and "disaster inventory prepositioning" using databases like Web of Science, ProQuest, JSTOR, ScienceDirect, Springer, and Emerald as well as Google Scholar. Without using the keywords we searched, we additionally cross-reference pertinent and significant studies from the papers that were cited. In the other sections of the paper, Sections 3, Section 4, and Section 5, we review the most pertinent publications with regard to the three important decision-making concerns. In the last section, we synthesise the literature and make suggestions for future research areas.

Coordinating choices

Surprisingly many distinct types of relief actors who perform material supplying responsibilities in response to a disaster may be included in disaster relief supply chains. The local/regional/national social groups, religious organisations (e.g., local churches), government agencies (e.g., Federal Emergency Management Agency, FEMA) and military forces, as well as the commercial sector, are among these humanitarian organisations (e.g. local or national- wide retailers and manufacturers). According to Besiou and Van Wassenhove, the Logistics Cluster Practitioner Conference's most commonly discussed topic has been the changing role and number of stakeholders, particularly addressing partner connections

and sector cooperation. The functions of international and local relief groups must be distinguished because they operate on various scales. Local relief actors are typically the main force in delivering the first wave of emergency supplies because they are much closer and more familiar with the terrain, infrastructure, and demographics of the affected areas. International relief actors, on the other hand, typically stockpile relief supplies in preparation for relatively slow- onset disasters and crises and provide long-term humanitarian aid throughout the world. Supply chain management for disaster assistance is always most effective and efficient when coordination mechanisms between various relief actors are designed. However, the bulk of studies make the assumption that only one person will make decisions about the management of relief supplies, but operationally speaking, the coordination challenges are not well understood.

Coordinating Difficulties

In the rescue and relief efforts following a disaster, especially a catastrophe, hundreds of relief organisations take part. For instance, the victims of the 2004 Asia Tsunami received immediate aid from more than 700 NGOs from more than 40 nations. With variable demand, constrained logistics capabilities, poor information feedback, and many decision-makers, the challenges of managing the relief supplies in response to disasters are greatly increased. As a result, coordination amongst various relief actors encounters difficulties for the following reasons:

Local Resources are Scarce

In addition to inventory prepositioning, there are three main ways to obtain relief supplies: through international, local, and in-kind donations. Local supply chains are more likely to be destroyed or affected by large disasters even though they have shorter lead times and less expensive logistics. Additionally, it is extremely possible that local providers will struggle to meet the soaring demand, which could lead to rivalry between relief actors for the limited resources available, ultimately driving up the cost of local goods. Supporting resources are also insufficient, as evidenced by the rising need for employees and vehicles, as well as the increased financial load on relief organisations or directly on the indigent.

Unexpected gifts and supplies

Following a crisis, many in-kind offerings are made impulsively without considering the actual need. The logistical systems are always congested as a result of these unsolicited donations and supplies from well-wishers. After sudden-onset disasters like the tsunami that hit Indonesia in 2004, Hurricane Katrina in 2005, the Tohoku earthquake in 2010, and even man-made disasters like the 9/11 terrorist attack, it was highly noticeable that uninvited supplies were given to the affected areas at the wrong time, in excessive quantity, and in unsuitable types. The identification, prioritisation, transportation, and storage of these relief goods need time and resources, which seriously interferes with the priority of material supply, takes up valuable warehouse space, congests the transportation systems, and undermines the relief operations. Therefore, coordination methods are essential to arrange the deployment and transportation

across the entire system, disseminate information about the required relief supplies immediately, and reduce waste and congestion.

A lack of information sharing and communication

Decision makers find it challenging to forecast the aggregate demand and supply of resources in the face of extremely uncertain demand information about the number, nature, and location of relief supplies, leading to a severe mismatch between demand and supply. For instance, 60% of the 211 million pounds of ice that FEMA requested in the week following Hurricane Katrina's landfall turned out to be unneeded. Asymmetric information makes it difficult for relief organisations to coordinate their observation of one another's efforts. A disaster-affected area can have received assistance more than once because the post-disaster landscape is always changing. The shortage of resources for aid is made worse by this kind of attempt duplication.

The longevity of coordination-information bubbles presents a significant ongoing difficulty for humanitarian decision-makers. Comes et al. focus on the fragmentation and misalignment of coordination structures and decisions in the emergency, which are caused by volatile information and sensemaking reaction, and undertake two case studies on Typhoon Haiyan and the Syria Crisis. Designing strategies and procedures to assist decision-makers in understanding the function of information in emergent coordination and in reaching adaptive conclusions is essential.

Involvement in military and governmental operations

The majority of those who are impacted worldwide are citizens of underdeveloped nations. Governments at all levels are the most dependable actors in disaster relief operations in underdeveloped nations. They also play a key coordination function in bringing together various social organisations and commercial enterprises to deliver aid materials in a timely and effective manner. Similar to interorganizational collaboration, it became openly understood that bridging the gap between governments was necessary. People would suffer if the government were to collapse. The military, on the other hand, is a unique and important relief force that is outfitted with more sophisticated logistics capabilities and skill than the majority of relief groups in the deployment of a significant amount of relief goods. However, due to varying purposes, mandates, working disciplines, and/or operational procedures, many relief organisations are hesitant to collaborate with the armed force for fear of igniting confrontations.

In conclusion, cooperation protocols and coordination mechanisms should be put in place to define each relief actor's role, share information (such as logistics capabilities, real-time emergency supplies, demand estimation, and operation feedback), identify resource availability and accessibility, prevent resource duplications and waste, manage and distribute relief supplies in a coordinated manner, lower inventory-related costs, and most importantly, improve s In order to comprehend how earlier research has explored coordination problems and accompanying solutions, we evaluate the literature from the perspectives of macro- and micro-coordination.

Coordination Viewpoint

The consensus among academics and practitioners is that efficient coordination between various relief actors throughout the stages of disaster relief lays the groundwork for enhancing logistical performance. In this section, we go over the disaster relief supply chain's macro- andmicro-coordination, respectively.

Macro-Coordination

Macro-coordination is the process of creating a platform for centrally gathering and disseminating vital information, as well as defining operational standards and norms for all participating relief players. Three degrees of collaboration are used to establish coordination:
(1) information sharing (for example, exchanging supply and demand data); (2) operational cooperation (for example, cooperation in transportation or warehousing); and (3) organisation alliance (e.g., Logistics Clusters). To avoid duplication of effort and resource redundancy, the coordination platform for each level is required to make clear the partnerships across various relief groups, combine data on demand and supply, and simplify the utilisation of scarce resources. As the complexity of the disaster environment increases, a coordination platform should be created in a dynamic way. The government at all levels often assumes the leading position in the coordination platform at the national level.

The On-Site Operation Coordination Centre (OSOCC), for instance, which was set up by the UN Disaster Assessment and Coordination Team (UNDAC) and the United Nations Joint Logistics Centre (UNJLC), acts as a focal point for information exchange, facilitates coordination meetings, demand assessments, and communications, reports to recently arrived relief organisations, and coordinates with local authorities. The UNJLC similarly keeps track of the distribution of aid materials. Such platforms create a base for collaboration, tracking the flow of items, and improving the coordination of relief supplies between disaster relief agencies.

It is crucial to build coordination platforms as well as widely agreed norms and directives for efficient relief efforts. In order to provide emergency help where the effectiveness of relief operations may be compromised, disaster relief operations will necessarily involve a number of new and inexperienced relief players. People and organisations who are incapable of adhering to the qualifying standard must be rejected. On the other side, it is important to give operational instructions to encourage the involvement of private companies and additional training for aid groups. Private businesses are crucial components in disaster relief operations, whether they have contracts with relief organisations for humanitarian logistics or have made spontaneous donations of relief materials. They must abide by the material supply guidelines, work together with qualified relief groups, and get familiar with the operational practises used in a disaster relief setting.

The "platform" and "standard" in the relief community are combined in the cluster approach to cooperation. Humanitarian groups, such as UN agencies, NGOs, the Red Cross and Red Crescent Movement, other social groups, or even government officials, make form clusters. They work together to satisfy the demands of a certain industry (e.g., logistics, camp coordination, health, and protection).

Clusters give actors a framework for working together to address shared needs, create strategic plans with related goals, and efficiently coordinate among themselves and with national authorities. Each industry should create a compatible labour division and establish operational rules and guidelines that correspond to it. The Logistics Cluster, which has four pillars—a partnership base, standards and policy, bolstering response capacity, and operational support—is a partner collaboration community with the specific goal of overcoming logistical constraints and improving logistics response in the humanitarian environment. However, further research is still needed to determine how well the vertical coordination between clusters and the horizontal coordination within clusters are balanced.

CHAPTER -2 LITERATURE REVIEW

LITERATURE REVIEW

Global supply chains are a result of international trade, and supply chain management entails hazards (SCM). The susceptibility in SCM has grown, as have the hazards, as a result of globalisation and trade opening. In manufacturing businesses, supply chain costs have the highest financial value (Dey et al. 2011). But in the finance and insurance sectors, SCM risks are considered to be non-financial hazards in the conventional meaning of risk.

The supply chain network is made up of trade-offs connected by material, financial, and informational movements (Fugate et al. 2006). Since 2000, there have been many supply chain disruptions. Fear of WMDs, terrorist attacks, fuel protests, and disease outbreaks are a few of these disturbances (Jüttner 2005). Risk is the likelihood that actual results will differ from those anticipated (Spekman and Davis 2004). Probabilities can be assigned to different outcomes, and risk can be calculated (Khan and Burnes 2007). But uncertainty cannot be measured (Knight 1921). Risk denotes uncertainty regarding a result (Teigen 1996). Consequently, uncertainty describes a risk that might not be mitigated. However, with careful evaluation andpreparation, these uncertainties can be reduced (Slack and Lewis 2002).

In order to achieve supply chain resilience, risk management refers to the execution of strategies and plans to manage supply chain networks through ongoing risk assessment and vulnerability reduction. Although not all supply chains face the same dangers, some do. Additionally, some risks are unique to a particular industry or subject of research (Jemison 1987). The weakest link in a supply network determines how strong the entire chain is. As a result, the chance of a supply chain failing increases with its length. There are many participants in supply chains. There are many players, which poses risks (Braithwaite and Hall 1999). However, creating a strong supply chain is costly (Vahid Nooraie and Parast 2016). Numerous academic studies have emphasised the need for such supply chains due to the severity of risk's negative performance impacts (Chandra and Grabis 2007; Chopra and Sodhi 2014; Christopher and Lee 2004; Ritchie and Brindley 2007).

Supply chain risk management (SCRM) is a methodical, staged methodology for identifying, assessing, rating, minimising, and keeping track of potential supply chain disruptions (Aqlan and Lam 2016). Due to

an incident's ripple effects on logistics networks, SCRM is a crucial field (Cigolini and Rossi 2010). September 11, the Gulf War, the emergence of a pandemic (such as bovine spongiform encephalopathy and coronavirus disease 2019, COVID-19), and the Millennium Bug are a few examples of such occurrences. Practitioners have been forced to investigate supply chain vulnerabilities and assess risks as a result of these disruptive events.

Supply chain vulnerabilities are dependent on the supply chain (Caniato and Rice 2003; Chapman et al. 2002). In addition, regardless of their size or stage of development, the COVID- 19 epidemic has disrupted the workings of most economies.

Risks in SCM include those related to globalisation, shorter product lifecycles, multidimensional networks of trade partners spread across many nations, market demand unpredictability, cost pressures, outsourcing, and offshore (Hachicha and Elmsalmi 2014; Lavastre et al. 2012). More uncertainty exists in the business environment as a result of increasing SCM complexity and network complexity (MeInyk et al. 2005; Sofyalolu and Kartal 2012; Thun et al. 2011; Verbano and Venturini 2011). These are instances of supply chain risk that have an effect on the entire network of supply chains (Cagliano et al. 2012; Fernandes et al. 2011; Xanthopoulos et al. 2012). An indication of a hazard that disrupts a supply chain is a risk event (Fernandes et al. 2011; Huang et al. 2009). Global supply chains face several obstacles and increased dangers (Blackhurst et al. 2005; Chopra and Sodhi 2004; Tang 2007). With the advent of the supply chain, reliance on an organisation for parts has changed (Christopher 1992). Greater information sharing and transparency amongst supply chain participants are necessary for this.

Because of globalisation and nations' economic interactions with partner countries, global industrial patterns have altered. These have made supply chains more complicated and exposed to a wider range of threats. To gain cost savings, access to less expensive raw material sources, or to access specialised skills and capabilities, businesses have built warehouse facilities, production plants, and fulfilment centres across nations (Choi et al. 2012). In the current era of global supply chains, distribution centres are also referred to as fulfilment centres. The place where client needs are met called a fulfilment centre. As a result, these centres must be effectivebecause their effectiveness influences the SCM value as a whole.

The impacts of disasters distressing the supply chain and guaranteeing effects on operational performance must be given significant consideration (Prasad et al. 2016; Wang et al. 2014). Supply chain disruptions and the related operational and financial risks, according to Craighead et al. (2007), "are the most pressing challenge facing enterprises that compete in today's global marketplace." The possibility that an unfavourable or unexpected event may occur and disrupt the supply chain directly or indirectly is known as risk in a supply chain (Garvey et al. 2015). Disruption and danger, however, are two distinct things. In supply chains, disruption is a sign of danger. Risks do occur, though, because of disruption. The tsunami that hit Japan in 2011 had a long-lasting impact on the auto sector. Additionally, Thailand's floods later that year had an impact on the supply chains for semiconductor and auto manufacturing facilities there (Chopra and Sodhi 2014).

Risks lead to disruption, which has an impact on the supply chain network as a whole. SCRM makes ensuring supply chains run smoothly (Christopher and Lee 2004). Vulnerability, uncertainty, disruption, tragedy, peril, or hazard are some synonyms for risk. Lack of knowledge about potential supply chain disruptions and their causes makes a supply chain susceptible and SCM leaders less effective (Vorst et al. 1998). In SCM, risk and uncertainty have been used interchangeably. Since uncertainty includes multiple potential outcomes, it is challenging to calculate (Knight 1921). Uncertainty, which has a few potential outcomes, is the source of risk (Hubbard 2007, 2020). Risks, though, may be measured. A strategic view of an organization's supply chains called SCRM also incorporates supply chain security (Williams et al. 2008).

In order to evaluate how the word "risk" was used in the various fields/sector under examination, this report evaluated papers that were published between 2010 and the end of December 2019. The analysis took into account how frequently risk was used as a keyword in journals that printed articles in different academic fields. The remaining portions of the essay are structured as follows: The second portion reviews pertinent SCRM literature and goes over the study technique. Analyses are presented in the third section, and research implications for SCRM experts are discussed in section 4. The research debate on risk and its effects on the supply chain network is concluded in Section 5.

There are two main groups of SCRM approaches. The first is a strategy for all-encompassing risk management (Azad et al. 2012; Christopher and Peck 2004; Craighead et al. 2007; de Matta 2016; Tang 2007; Xu et al. 2015), and the second is a method that is concentrated on a particular disruption. Security (Véronneau and Roy 2014), lead times (Kouvelis and Li 2008), or terrorism are examples of these specialised interruptions (Sheffi 2001).

Although these methodologies brought enormous value and insights, it was assumed that the disruption-causing events were unintentional. Theoretically, businesses are exposed to environmental dangers that cannot be avoided due to a gap in risk management systems. In 2007, lead-based paint was used on children's toys without Mattel's knowledge. This has an impact on Mattel's supply chains. At the factories of its suppliers, Mattel eventually set up quality assurance centres to ensure that the lead paint problem wouldn't happen again. The supplier used lead-based paint in an effort to cut back on small operational costs. Roloff and Aßländer (2010) claim that Mattel paid a far greater and perhaps lower price for the disruption.

Four subsections make up the remaining portion of the section. In the first section, numerous risk definitions from the past literature are reviewed. The risk disruption in SCM brought on by natural disasters or other uncontrollable events is covered in the second subsection. Weak supply chain strategies may result in risk disruption. Methods and techniques for risk management are covered in the third subsection. For a contingency plan and supplier review to be carried out in order to reduce risk impact and achieve supply chain resilience, the fourth paragraph demonstrates risk detection and risk mitigation in the supply chain network (Figure1).

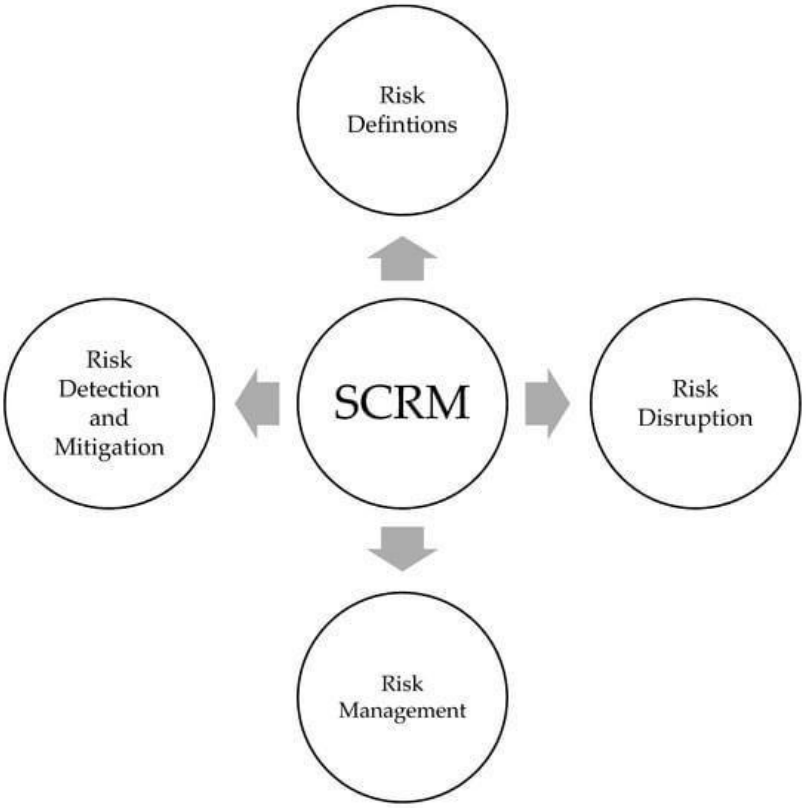


Figure 1. Supply chain risk management (SCRM) categories.

CHAPTER -3 RESEARCH METHODOLOGY

NEED OF THE STUDY

Unpredictable environmental conditions and catastrophic supply chains are now more significant and well-liked study topics. Only a small number of papers have been written addressing the current problems, including the unpredictable climate and the disaster supply chain, particularly in the case of natural disasters. This essay is a draught report on a study on the supply chain for healthcare during disasters. The study aims to assess and evaluate a number of publications on the aforementioned subject that were published in the recent 10 years. Three key themes—healthcare supply chain, disaster supply chain, and healthcare supply chain in natural catastrophe—were identified in published papers on unpredictable environment and disaster supply chain study between 2010 and 2020. Operational management, information technology, inventory and control management, strategic management, and service management are some of the subtopics in each primary subject. Also included in this category of research methods are case studies, modelling and simulation, literature reviews, and conceptual theories. The review's findings will serve as the foundation for the direction of further investigation into these three issues.

OBJECTIVES OF THE STUDY

1. To research supply chain management's disaster reaction and decision-making in unpredictably volatile environments.
2. To be familiar with the organization's structure, supply chain, and product profile.
3. Researching new supply chain and logistics trends
4. to conduct research on the operations and supply chain in disaster management

METHODLOGY

The act of gathering data is known as methodology, and it aids in identifying a solution to the problem the researcher has chosen.

Whereas Research aids in learning and discovering the methods that follow the right procedure.

It is a methodical approach to providing information.

The means to systematically address the research challenge is through research methodology. The following techniques were used to get the data needed for the project.

Designing research

The method of random sampling has been used, and the sample for this inquiry consists of fifty clients. Additionally, this sample includes clients that are both male and female. Finding out how consumers feel about digitization in the logistics sector is the goal of the study.

METHOD OF DATA COLLECTION

The data for the study were compiled using both primary and secondary sources.

Primary Data

Procedures like questionnaires, interviews, and observations—all of which have been employed rather frequently—are used in any research project that gathers primary data. These methods have been applied pretty often. One of these strategies used for data collecting was the questionnaire technique. It was chosen because it can interact with opinions and interventions and is the most flexible of all of these approaches. The main source of information to be gathered is the clients themselves.

Secondary Data

The following secondary data sources were used in this study:

through the gathering of customer data. by way of observation and examination of past research projects. through the use of the internet and the reading of books, journals, andwebsites.

Population

Fifty clients make up the client's sample size, and all of them have provided responses. Tables, a pie chart, and histograms are used to finish the analysis.

LIMITATIONS TO THE STUDY

1. Not all of the customers were included in the study. There may be bias in some of the respondents' responses.
2. A few respondents chose not to answer certain questions. Therefore, there is a chance to some level of not learning the true feelings of the respondent.

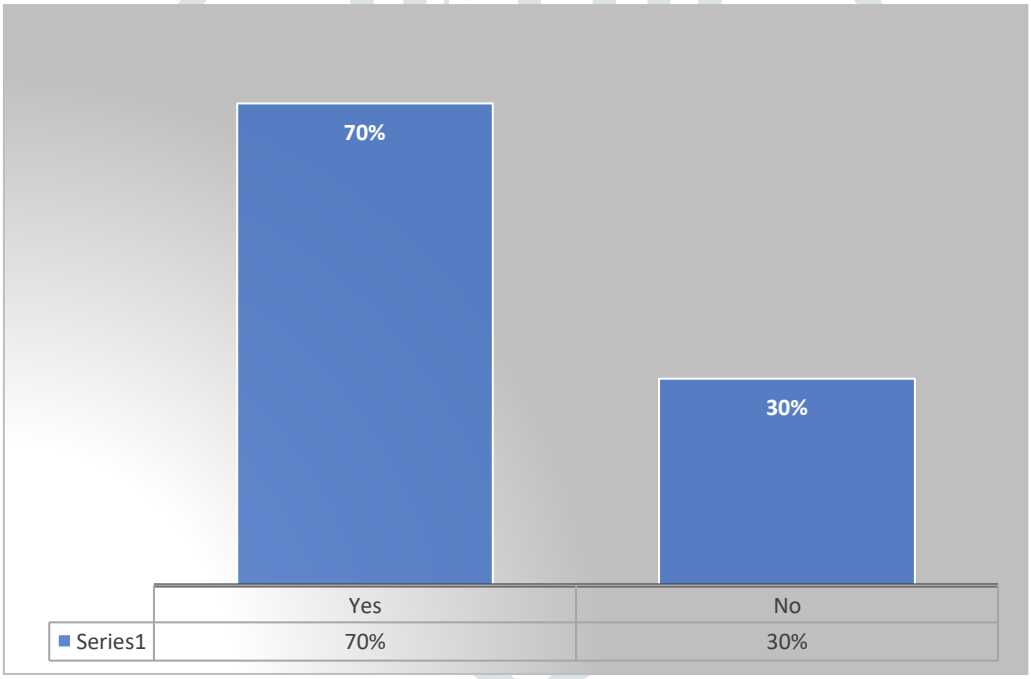
CHAPTER -4

ANALYSIS

ANALYSIS AND INTERPRETATION

Q-1: Are you satisfies with the Supply chain Management level in disaster?

	Respondent	Percentage
Yes	70	70%
No	30	30%
Total	100	100%

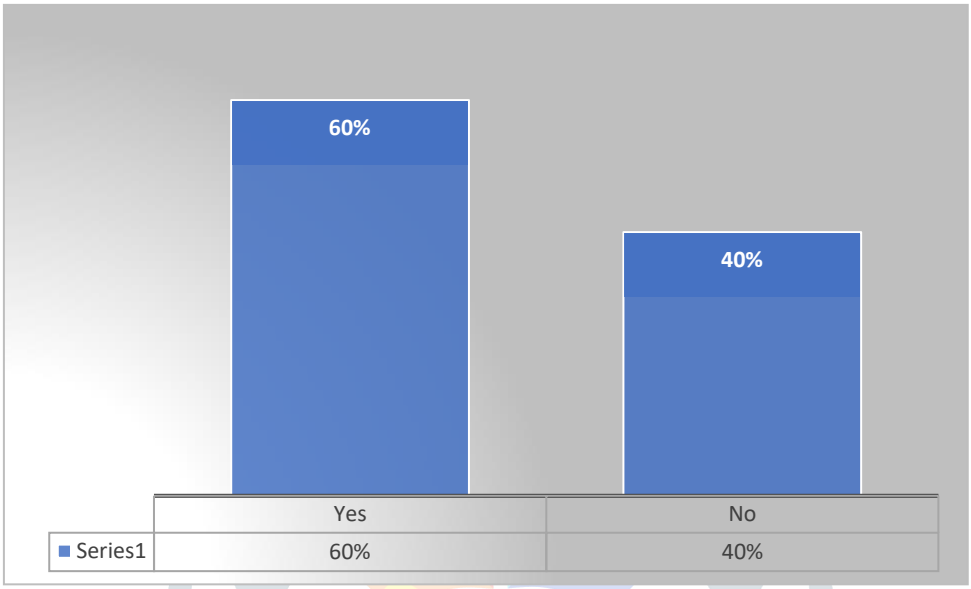


Interpretation

As per above analysis we can find that 70 percent respondents are satisfied withsupply chain management level and 30 percent not satisfied.

Q – 2: Do you think decision making in unpredictable environment for supplychain is challenging?

	Respondent	Percentage
Yes	60	60%
No	40	40%
Total	100	100%

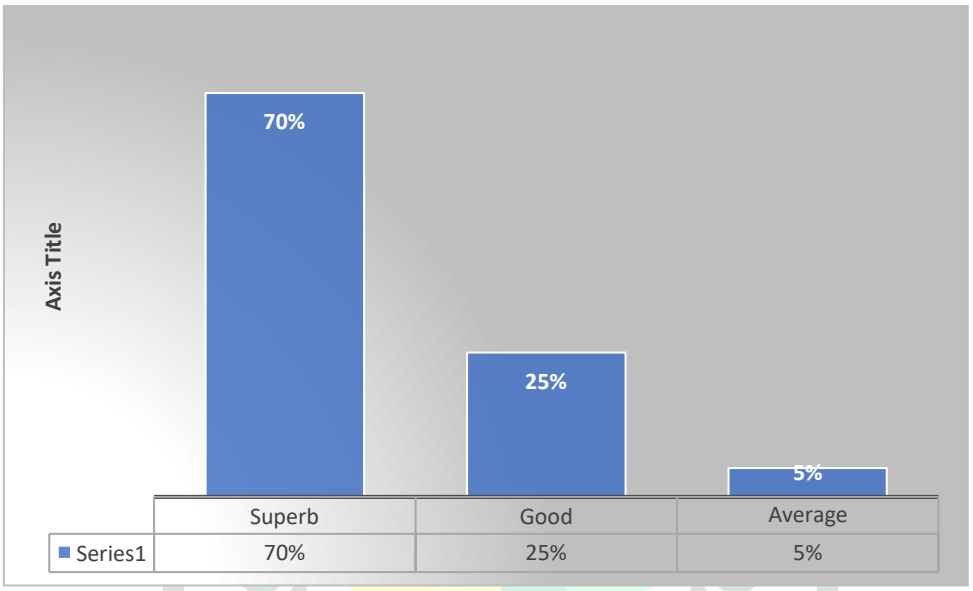


Interpretation

As per above analysis we found that 60 percent agree that supply chain is challenging in unpredictable environment and 40 percent says not challenging.

Q-3: What level of quality do you expect from your supply chain management?

	Respondent	Percentage
Superb	70	70%
Good	25	25%
Average	5	5%
Total	100	100%

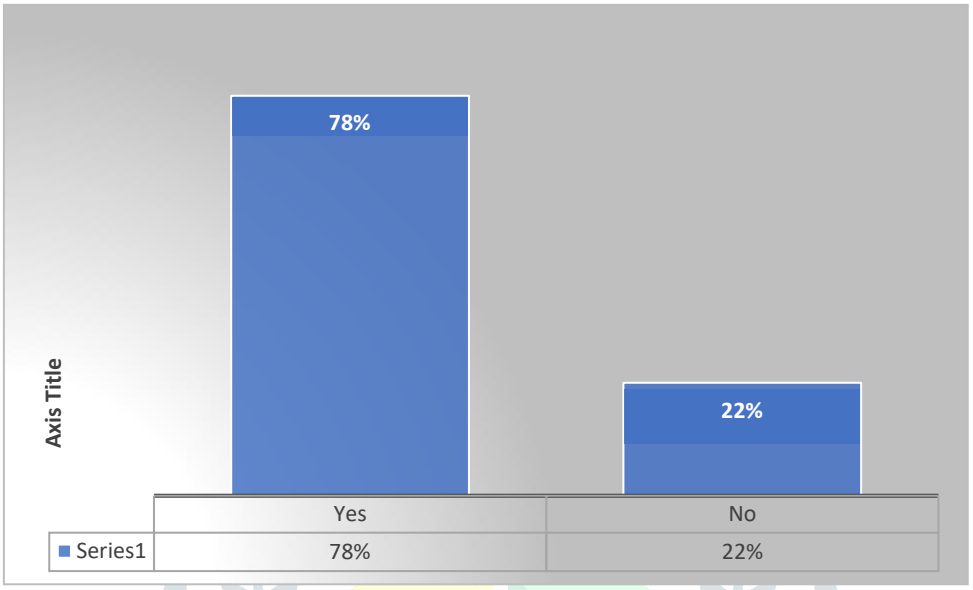


Interpretation

As per above analysis we found that 70 percent want a superb quality expectation from supply chain management and 25 percent want good quality and 5 percent expect average quality of management.

Q-4: Does your current management meet that level of your supply chain?

	Respondent	Percentage
Yes	78	78%
No	22	22%
Total	100	100%

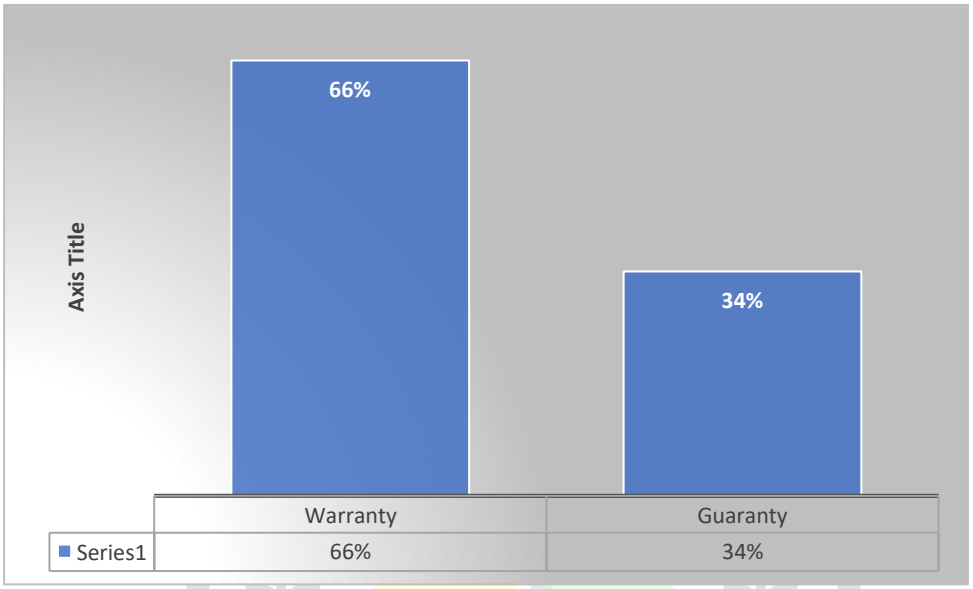


Interpretation

As per above analysis we found 78 percent of the respondents happy with the current management and 22 percent was not happy with the management.

Q-5: What kind of productivity or quality does your manufacturer provide?

	Respondent	Percentage
Warranty	66	66%
Guaranty	34	34%
Total	100	100%

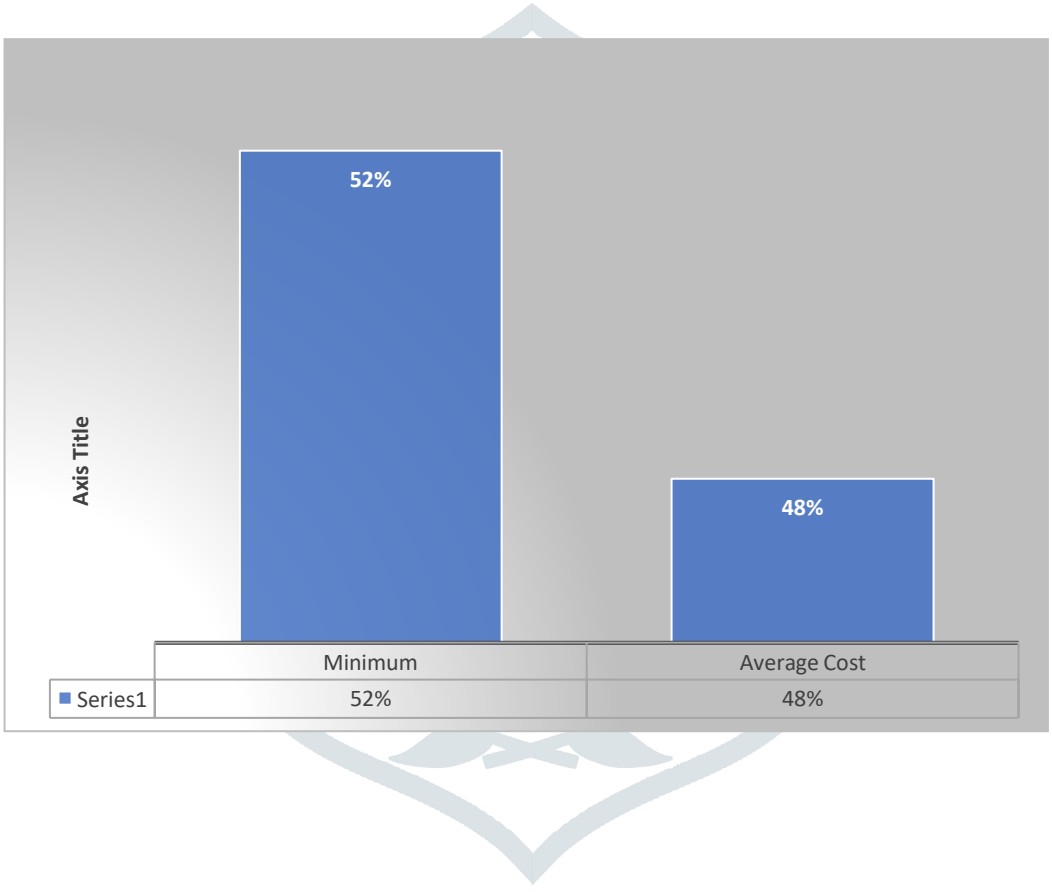


Interpretation

As per above analysis we found 66 percent of respondent says that they get warranty of their goods and 34 respondent says that they get guaranty of their goods.

Q-6: At what cost you think you should get all those facility and quality for yoursupply chain management?

	Respondent	Percentage
Minimum	52	52%
Average Cost	48	48%
Total	100	100%

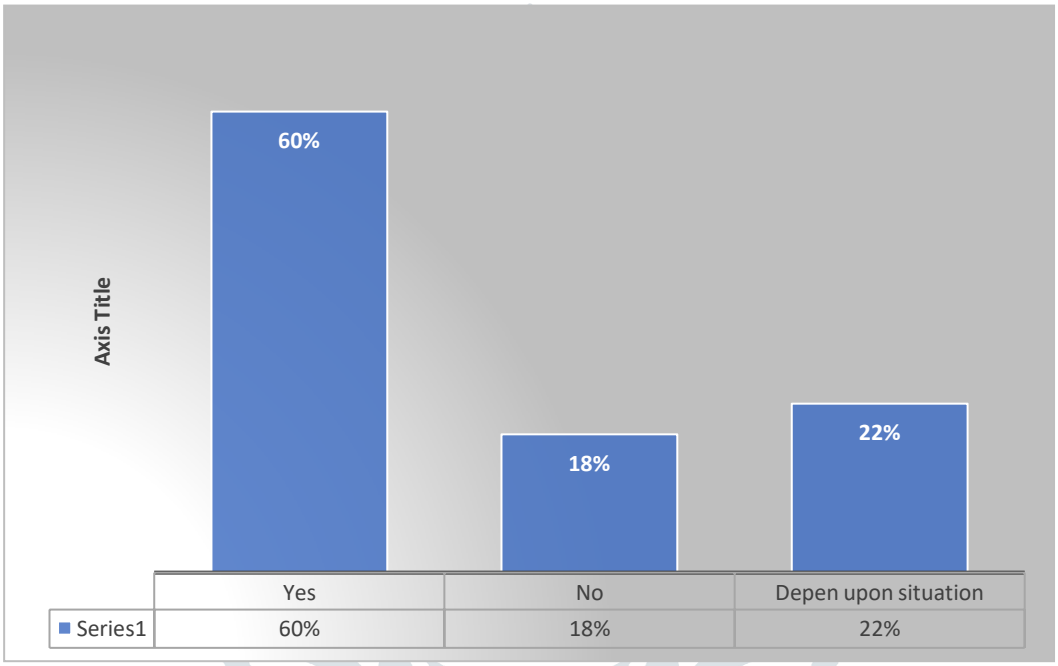


Interpretation

As per above analysis we found 52 percent people think that they get all those facility at minimum cost and 48 percent says that they get at average cost for their supply chain management.

Q-7: Does your supply and demand needs are completely fulfilled by you always?

	Respondent	Percentage
Yes	60	60%
No	18	18%
Depend upon situation	22	22%
Total	100	100%

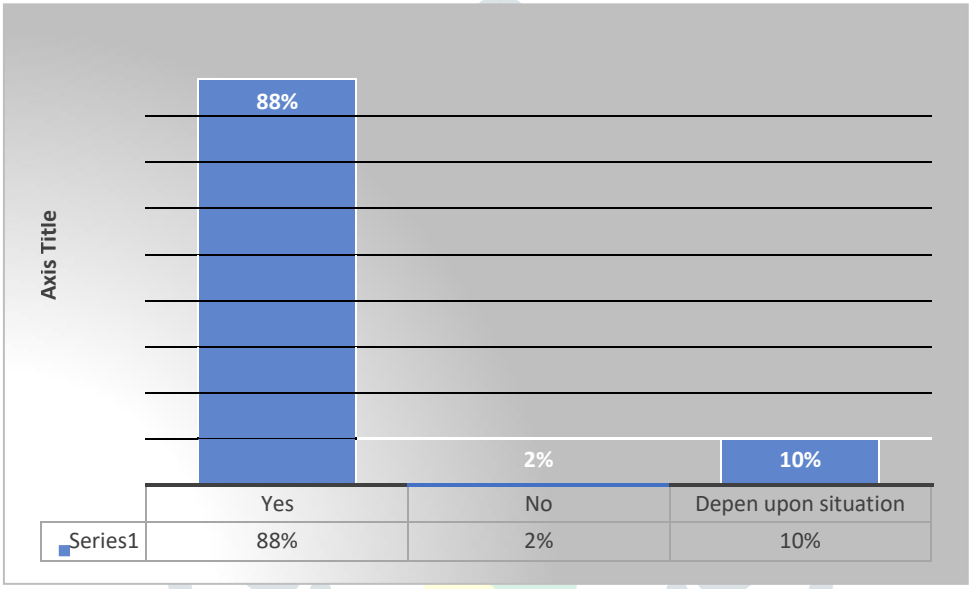


Interpretation

As per above analysis we found that 60 percent the need and requirement being fulfilled on time and 18 percent not on time 22 percent depends on the situation.

Q-8: Does the company consider quality as number one criterion in selecting suppliers?

	Respondent	Percentage
Yes	88	88%
No	2	2%
Depend upon situation	10	10%
Total	100	100%

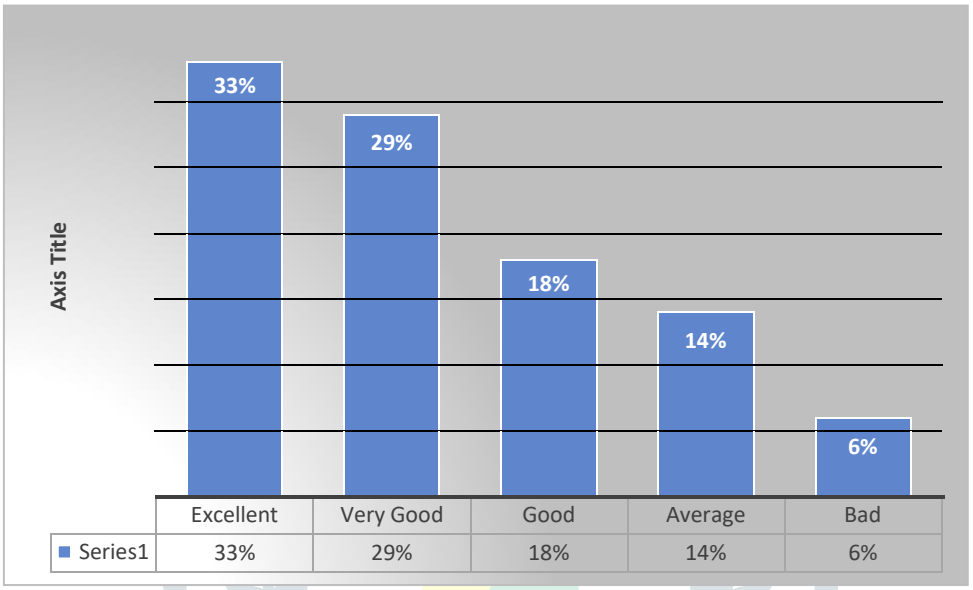


Interpretation

As per above analysis we found that 88 percent respondent consider quality as number one criterion in selecting suppliers and 2 percent not consider and 10 percent respondent consider depending on the situation.

Q9. How do you rate the process of supply chain in the company?

	Respondent	Percentage
Excellent	33	33%
Very Good	29	29%
Good	18	18%
Average	14	14%
Bad	6	6%
Total	100	80%

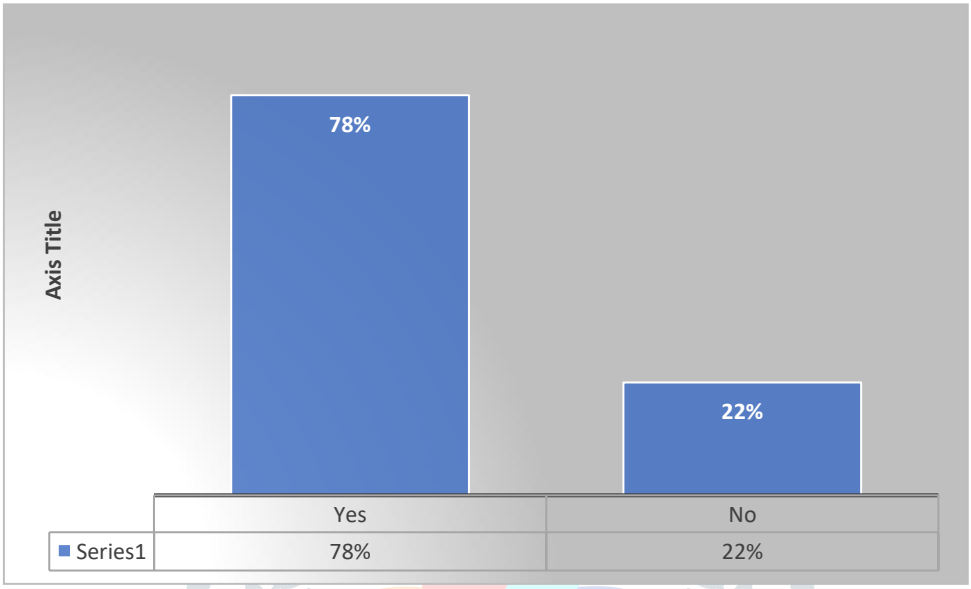


Interpretation

As per above analysis we found that respondents rate 33 percent for excellent supply chain process of the company and 29 percent very good and 18 percent good supply chain process and 14 percent found only average and 6 percent says bad supply chain process of the company.

Q-10: Does the company helps its suppliers to improve their product quality?

	Respondent	Percentage
Yes	78	78%
No	22	22%
Total	100	100%



Interpretation

As per above analysis we found that 78 percent respondent helps their suppliers to improve their product quality, hence 22 percent do not help to improve their product quality.

FINDING

The research's findings are as follows:

- According to the data above, 70% of respondents are satisfied with the degree of supply chain management, while 30% are dissatisfied.
- Based on the aforementioned data, we discovered that 60% of respondents agree that supply chain management is difficult in a volatile environment, whereas 40% disagree.
- Based on the aforementioned data, we discovered that 5 percent of respondents want management of ordinary quality, 25% want outstanding quality, and 70% expect supply chain management of superb quality.
- According to the aforementioned analysis, 78 percent of respondents were pleased with the current management, while 22 percent were not.
- Based on the aforementioned data, we discovered that 66% of respondents claim to receive a warranty for their items, whereas 34% claim to receive a guarantee.

- According to the aforementioned analysis, we discovered that 50% of people believe they receive all of those facilities for their supply chain management at the lowest possible cost, and 48% believe they do so at an average cost.
- According to the study above, we discovered that 60% of the needs and requirements were met on time, whereas 18% were not. The circumstance will determine the 22 percent.
- Based on the aforementioned analysis, we discovered that 88 percent of respondents rank quality as their top criterion for choosing suppliers, whereas 2 percent do not consider it and 10% do, depending on the circumstance.
- Based on the aforementioned data, we discovered that 33% of respondents thought the company's supply chain process was exceptional, 29% thought it was very good, 18% thought it was good, 14% thought it was only average, and 6% said it was awful.
- According to the data above, 78 percent of respondents assist their suppliers in raising the calibre of their goods; the other 22 percent do not do so.

CONCLUSION

Setting up disaster response supply chains is in high demand because of the wide range of disasters this study has revealed and the various implications they have. Additionally, due to the wide variety in its defining criteria, the creation of a generic disaster response supply chain that enables a speedy and effective reaction would not prove viable. This article's primary goal was to identify various supply chain models for disaster response that are essentially applicable along the continuum between strictly civilian and fully military supply networks. There have been four different supply chain models proposed, each with different actors and coordinating styles. The impact of disasters is becoming more and more severe, leading to the conclusion that coordination between many players is becoming more and more essential rather than just necessary.

Therefore, in the future, it is unlikely that solely civilian or military supply chains will be in charge of managing swift and efficient catastrophe response. Although the advantages of hierarchical structures over hierarchical ones have been emphasised, cooperation between civil and military organisations is challenging due to the disparities in organisational cultures, goals, and mandates. Therefore, it is necessary to deal with the establishment of mutual concurrence and other issues that hierarchic coordination might not be able to eliminate. To conclude, the suitability and acceptance of hierarchical coordination within civil-military supply chains must be thoroughly confirmed. As a result, the focus of future research activities should.

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QUESTIONNAIRE

Name:

E-Mail:

Address:

Date:

Q-1: Are you satisfies with the Supply chain Management level in disaster?

a) Yes b) No

Q – 2: Do you think decision making in unpredictable environment for supplychain is challenging?

a) Yes b) No

Q-3: What level of quality do you expect from your supply chain management?

a) Superb b) Good c) Average

Q-4: Does your current management meet that level of your supply chain?

a) Yes b) No

Q-5: What kind of productivity or quality does your manufacturer provide?

a) Warranty b) Guaranty

Q-6: At what cost you think you should get all those facility and quality for yoursupply chain management?

a) Minimum b) Average Cost

Q-7: Does your supply and demand needs are completely fulfilled by you always?

a) Yes b) No c) Depend upon situation

Q-8: Does the company consider quality as number one criterion in selectingsuppliers?

a) Yes b) No c) Depend upon situation

Q9. How do you rate the process of supply chain in the company?

a. Excellent b. Very Good c. Good d. Average e. Bad

Q-10: Does the company helps its suppliers to improve their product quality?

a) Yes b) No

Q-13: Suggestion:

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