



UNIVERSITY OF BORÅS  
SCHOOL OF ENGINEERING

# Management of Relief Supply Chain & Humanitarian Aids Logistics through Supply Chain Resilience

Case Study: South West Asia Tsunami (2004)

Ehsan Moeiny

Javad Mokhlesi (Mehran)

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Ehsan Moeiny, ehsan.moeiny@gmail.com

Javad Mokhlesi (Mehran), mehranmokhlesi@gmail.com

Master thesis

Subject Category: Technology Management

University College of Borås  
School of Engineering  
SE-501 90 BORÅS  
Telephone +46 033 435 4640

Examiner: <Name>

Supervisor,Name: Daniel Ekwall

Supervisor,Address: University of Borås, School of Engineering  
SE-501 90 BORÅS

Client: Roy Andersson, University of Borås, School of Engineering  
SE-501 90 BORÅS

Date: August 2011

Keywords: Supply Chain Management, Supply Chain Resilience, Humanitarian Aids Logistics, Relief Supply Chain, South West Asia Tsunami ...

## Acknowledgement

We would like to take this opportunity to dedicate our deepest unrestrained gratitude to all those who their generousities gave us the ability and possibility of taking this significant over.

It would be a pleasure for us to express our reverential appreciation to *our parents* who have the attitude and the substance of a genius: they continually and convincingly conveyed a spirit of adventure in regard to our research and studies, and an excitement in regard to our future. Without their guidance and persistent help, the creation of this dissertation would not have been possible.

We gratefully wish to convey our thanks to Department of Industrial Engineering and Quality in School of Engineering at University of Borås for giving us the permission to commence this thesis in the first instance.

We are genuinely indebted to our supervisors Senior Lecturer at University of Borås, School of Engineering and Swedish School of Textile, Dr. *Daniel Ekwall* whose aids, stimulating suggestions, and encouragements guided us through research for and writing of this thesis.

Furthermore, we would like to give our extraordinary recognition to, Dr. *Roy Andersson*, whose patient help and kindness enabled us to complete this work.

Ehsan Moeiny  
Javad Mokhlesi

September 2011

## **Abstract and Purpose**

Humanitarian logistics and relief supply chain management is a relatively new area of investigation which is typically associated with unexpected disasters that require immediate actions and responses. It can be defined as “the process of planning, implementing, and controlling the efficient, cost-effective flow and storage of goods and materials, as well as related information, from point of origin to point of consumption for the purpose of meeting the end beneficiary’s requirements” (Thomas, 2005).

In both man-made and natural disaster relief processes, humanitarian logistics and relief supply chain operations have been hampered by a lack of information and coordination between actors. Especially in sudden-onset disasters, humanitarian logistics and relief supply chain teams have to be deployed in situations with destabilized infrastructure and with very limited knowledge about the situation at hand (Beamon 2004, Long and Wood 1995, Tomasini and Van Wassenhove 2004). This lack directly affects effective performance in terms of validity and reliability enhancement in which an adapted resiliency management in relief supply chain strategies could offer a solution to cover the problem.

The purpose of study ahead is to underline the beneficial advantages offered by using resiliency methods in humanitarian logistics and relief supply chain operations, and enriching the existing benefits that relief chain management teams through the humanitarian logistics techniques have brought to satisfy the survival needs.

In fact, the end result of the research will be in both fields of humanitarian logistics and relief supply chain management, and the use of resiliency theories to overcome on barriers and difficulties during relief and aid operations.

**Keywords:** Supply Chain Management, Supply Chain Resilience, Humanitarian Aids Logistics, Relief Supply Chain, South West Asia Tsunami ...

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# **1. Back ground & Overview**

Well understanding of the supply chain definition and its related concepts is crucial to make a proper platform for jumping into more recently developed branch of management in field of humanitarian aids logistics and relief supply chain.

In this chapter a clear definitions of logistics and supply chain and its related managerial segments are presented. Considering these definitions, the research will go another step forward to introduce the humanitarian logistics and relief supply chain, and the factors which success or failures of relief supply chain are dependent on.

## **1.1 Logistics & Supply Chain**

Supply chain is mainly considered as sets of entities that are collected together in order to encompass their necessary resources to address the final consumers' needs.

According to Douglas H. Norrie (1992) "The supply chain (SC) encompasses all activities associated with the flow and transformation of goods from the raw materials stage (extraction), through to the end user, as well as the associated information flows. Materials and information flow both up and down the supply chain".

This definition expands the boundaries of the supply chain activities to not only flow of goods, but also the information. The need for efficient flow of goods is addressed by a crucial segment of the supply chain, which is called Logistics.

Based on the Council of Logistics Management (1991), logistics can be defined as the efficient and cost-effective process of planning, Implementing, controlling and integration of the inventory, warehousing and distribution systems as well as the related information to maximize the customer satisfaction and reduce the overall cost as the main part of the supply chain process.

The importance of information flow is also highlighted in this definition. The role of information flow has become crucial in the modern world where the supply chains are more complicated and keen to clarity.

Considering these definitions, Logistics and supply chain is expected to convert a raw form of materials or services to an expected form asked by the final consumers. This conversion is done through some processes that are planned and managed by participants of the chain. The more accurate and thoughtful processes are plans, the better productivity and consequently, and the better customer satisfaction have been resulted.

## 1.2 Logistics & Supply Chain Management

Limited resources and competitive markets have made the management of supply chains as an important field of research which the success or failure of a supply chain can be dependent on.

According to the Council of Supply Chain Management Professionals (CSCMP), “Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities with parallel coordination and collaboration along channel partners, which can be suppliers, intermediaries, third-party service providers, and customers.

What is crucial in management of supply chain is the integration and consolidation of resources to have more efficient and effective performance. Therefore, having a holistic view of the whole supply chain by considering it as a single entity is needed. By considering this fact and looking to the important role of final consumers, Supply Chain Management Center of Nyenrode University has formulated the most embracing definition:

“Demand and Supply Chain Management (DSCM) is the management of a network that links customers and suppliers as one ‘single entity’ with the objectives to create value and reduce waste through the voluntary integration and co-ordination of the objectives of three or more – and ideally, all the – independent parties in the network.

In essence, supply chain management integrates supply and demand management within and across companies. In fact, it is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance, and information technology.”

Logistics management defined by the Council of Supply Chain Management Professionals (CSCMP) as a part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers’ requirements.

Logistics management activities typically include inbound and outbound transportation management, fleet management, warehousing, materials handling, order fulfillment, logistics network design, inventory management, supply and demand planning, and management of third party logistics services providers.

### **1.3 Supply Chain Vulnerability**

The term supply chain vulnerability has equal importance to Variability, Velocity and Volume in the elements of the Supply Chain and evaluates the supply chain based on the acceptance level of disaster logistics' steps, which are planning, detection, mitigation, response and recovery.

Some authors divide the supply chain sources of risk into internal and external factors. They believe that the internal risk arises from the activities running within the supply chain and those conflicts or issues which are the outcome of interactions between the supply chain entities. These kinds of risks are resulted from invisibility, unclear market needs, and etc.

On the other hand, external risks are usually the outcome of interaction between the supply chain and its environment. For instance, terrorist attacks, natural disasters, and etc.

These sources of risk can influence the supply chain and make it vulnerable. The worst situation can happen when both internal and external sources cause the disruption simultaneously.

Globalization of the market, and tendency of the enterprises to increase the efficiency and responsiveness of the chain as well as their efforts to make the supply chain leaner and more agile along with growth in technology dependency will make the supply chains longer, complex and consequently more vulnerable.

### **1.4 Supply Chain Resilience**

The term resilience has been always one of the main concerns of managers, since the ability of an enterprise to confront unexpected events is the matter of success or failure. Since the number of events or causes of risk has grown, managers have become more and more interested in this subject.

The supply chain resilience is no longer limited to risk management. It's now the matter of being in the best position comparing to your competitors in order to not only be able to manage the risk, but also to benefit from disruptions.

“In our enormously complex world, disruption is an inevitability and resilience a requirement. Yossi Sheffi's landmark book offers managers a comprehensive approach to preparing for what cannot be predicted” (Sheffi, 2005).

Christopher differentiates resilience from robustness. He emphasizes that the term robustness returns to physical or constructional strength. He mentions that a robust system will not necessarily be a resilient one. the term resilience returns to ability of a system to return to its original state or move to new, more desirable state after being disturbed (Christopher, 2003).

## 1.5 Humanitarian Logistics & Relief Supply Chain

Humanitarian logistics is supposed to assist those people who are influenced by the disasters. The crucial point is that just those people who truly need this help must receive the assistance and it must be given based on the proportion of their needs. To assure that right part of the population will receive those aids, monitoring of the processes from the storage to the distribution step is needed. As Timothy Edward Russell suggest, it can be done through ID cards or giving women heads of foods for the family.

Thomas and Kopczak define humanitarian logistics as a supply chain focused on both efficient and effective distribution of services, goods and information, which its aim is to reduce the suffering of affected people.

The process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials as well as related information, from the point of origin to the point of consumption for the purpose of meeting the end beneficiary's requirements' and alleviating the suffering of vulnerable people is defined as humanitarian logistics (Thomas and Kopczak, 2005).

The main purpose of actor formation	To improve the suffering of helpless people, stakeholder emphasis with no distinct linkage to each other, influential and dominated role of NGO'S and government sector.
Three stages of setup	Preparation, response and reconstruction
Basic elements	Unpredictable demand, uncertain situation in emergency, activities at large scale and variable supply and supplier.
Supply chain phenomena	At large scale level disaster material are pushed to the specific disaster site immediately.
Infrastructure & transportation	Due to impracticable infrastructure less chances to provide quality food and medicine
Time constraints	There are chances of loss of lives because of time delay
Limited knowledge actions	Most of the time Natural disasters require immediate response, solution from supply chain requires to be designed and implement at once even knowledge of a situation is much bounded.
Suppliers	Bounded choice and undesired suppliers
Control elements	No control because of emergency situation

**Table 1: Humanitarian Logistics characteristics, (Kovaacs and Spens, 2007).**

Proper response to the humanitarian needs in case of disasters is considered to be mitigation and satisfying the initial and vital needs of the survivors. It must be done in the shortest time using the least amount of the resources to reduce the terrible effects of the disaster.

Humanitarian Logistics have irregular demand and supply process and numbers of effective factors in those cases are extraordinary. Sources of these disasters can be natural or man-made. But all operations follow the same goal, which is saving human beings. These operations are done in an uncertain situation and destabilized infrastructures. Most of these disasters are unpredictable and there is no estimation of the volume of aids that will be demanded (Van Wassenhove, 2008).

## **1.6 Resiliency in Humanitarian Aids Logistics**

Developing the resiliency idea in humanitarian supply chain asks for clarification of supply chain nature. The likelihood of natural disasters in the mother land of the researchers of this thesis subject as well as the growing number of related crisis all over the world encourage them to narrow their field of research to the humanitarian aids' supply chain. The significant differences between the consequences of natural disasters in under developing countries comparing to developed ones also asks for more researches that empowers the writers to magnify the sources of this deviation.

During the relief operations in disasters the performance of the humanitarian aids supply chain is affected awkward due to lack of coordination approaches and less joint and holistic supply chain strategies between operation management and human actors that are performing in the scene.

The huge number of involved governmental agencies, nongovernmental organizations, UN faculties, international institutes, manufacturers and 3rd party logistics providers which are various in the nature, size, abilities, specialties and performances, asks for coordination, cooperation and well management of the humanitarian roles in case of natural disasters. In fact, "only a collective strategy will be able to improve the performance of humanitarian supply chains, while the lack of it causes dramatic consequences for stricken populations" (Chandes & Pache, 2009).

This chapter was an introduction to the main segment of the thesis. Since Humanitarian logistics and relief supply chain is an interesting branch of supply chain management, and considering the frequency of natural or man-made disasters that has been increased in the last decades, we tend to narrow or research to this field and present more materials for the readers. Moreover introducing the role of NGO's international companies and involved institution will be one of this research's concerns.

Since the nature of these events has unpleasant consequences for the human beings, having a resilient humanitarian supply chain seems to be vital. So this thesis is about to introduce the resiliency in humanitarian supply chains and those factors that influence the performance of such supply chains.

Finally, this research will present one of the disasters as a case study and makes connections between the presented materials and outcomes and findings in a real case.

## **2. Supply Chain Vulnerability and Resilience**

Studying the supply chains' structure in order to find the weak rings that make the whole or a part of it vulnerable is of high importance. While dealing with humanitarian aids supply chain, the importance of detecting these weak points is more crucial, since any disruption in the process of assisting the affected population will result in losing more lives or intensifying the terrible consequences. Therefore, it's important to find those factors that make a system more vulnerable to disruptions. Removing those factors or limiting them will increase the supply chain resilience, which means the ability of those chains to recover to their initial or even better state in case a disruption will happen.

### **2.1 Creating Supply Chain Resilience**

Christopher suggests four main principals, which must be followed while making a resilient supply chain.

First, there are plenty of futures that must be merged into the supply chain. These build-in futures make the supply chain more capable of recovering itself to the previous stage in case any unpleasant event happens.

Second principle expresses the necessity of collaborative efforts in order to identify the risk sources. By finding the risk sources, removing those sources or preparedness for their consequences will be possible.

Agility is another principal that Christopher considered it to be vital for the supply chain resiliency. The more a supply chain is capable of quickly reacting to unexpected events, the more resilient it becomes.

Finally, the risk management culture is considered to be an important factor that makes a system more resilient. It's important to widen our perspective and not to limit the possible sources of the risk just within the supply chain. It's crucial to consider other supply chain or networks to be of high potential to impose the risk into our network.

In the following sectors these factors are expanded to an extent it becomes clearer to the reader.

#### **2.1.1 Supply Chain Reconfiguration**

Cost orientation has been the main aspect of previous generation of Supply chain. But growth in risk exposed to enterprises and increasing the severity of the consequences asks the entities within the supply chain to change their mindsets and look for re-engineering the chain. In the way to meet this goal, focusing on number of factors can facilitate the process.

### **2.1.1.1. Mapping the Supply Chain**

To realize weaknesses of the supply chain, it's crucial to picture it flawlessly. Thereafter, detecting the bottlenecks and limitations become more applicable. It's crucial to determine all the links and nodes and critical points if there is any. There are some characteristics that make strains for the supply chain. For example, Long lead-times, monopoly in supply, lack of visibility, and association of a link or node to high level of risk are some factors that make a part of the supply chain more crucial to be re-engineered.

### **2.1.1.2. Reconsidering Supply Approach**

Single sourcing approach in supply is likely to be chosen by some enterprises since it can reduce the costs and facilitate the quality control procedure. But it must be understood that single sourcing increases the vulnerability of supply chain. All the entities that are moving toward resiliency must take this fact into consideration that a balance between cost orientation and resiliency tendency must exist. Moreover, it's necessary to think of the ability of the suppliers for risk management as well as their consideration and plans for possible disruptions. Those who are more aware of the risk management processes are the ones who must be chosen as the partners to enhance the level of resiliency in the supply chain.

### **2.1.1.3. Applying a Proper Supply Chain Strategy**

Supply chain strategy must not limit the entities within the chain. Pure cost oriented supply chains may look successful from the financial perspective, but in case of any interruption, the consequences of that unexpected event can be severe and may impose vast amount of costs to them.

## **2.1.2 Collaboration in Supply Chain**

Supply chain was defined as number of entities that are related together where they form a network in which the transfer of physical goods and information is expected. Usually in such networks, the transport of goods is what most of the entities are likely to focus on. But the point is that in order to be able to mitigate the risk, confront the fluctuation of the market, and meet the new requests wherever it rises, it's crucial to create an atmosphere in which all the entities willingly share the information and necessary data that helps the other partners to see more steps forward.

The development of the term knowledge chain is the new concept which tends to magnify the role of information as one of the main competence that a chain must have. The process of experiencing , documenting them, recalling in case the same event happens, and the culture behind it which asks for visibility and tendency to share crucial and precise data are focused in creating a knowledge chain.

### **2.1.3 Agility**

The agility of a supply chain returns to its ability to respond to new changes rapidly. To make a supply chain the visibility of the velocity of the supply chain must be taken into consideration.

As it was discussed before the better the information are share the more the supply chain will become visible.

Velocity is dependent on the distance and time. To increase the velocity of the chain it's crucial to reduce the time. Time reduction can be addressed by following three main approaches.

At first, re-engineering some processes by simplifying them and increasing the parallel processes rather than series. Then, reduction of lead-time must be gained through selecting the proper source of supply and suppliers that are capable of responding to change in volume and type of requirements and by synchronizing the planes using the shared information. Finally, removing none value adding processes must be done by removing those processes that doesn't create any value that final customer will willingly pay for it.

### **2.1.4 Creating a New Culture**

Risk management culture is what must be created not only inside the firm but only in the wider perspective and through the whole network. The role of leadership must be seen as on of the factors that can help to validate the necessity of creating this culture and to speed up the process. Supply chain risk assessment must be also done to realize the vulnerable nodes and links. Finally, a risk management time must exist within the business to frequently update the supply chain risk information.

The presented factors must be prioritized as crucial in designing or improving the supply chains, because in case of natural or man-made disasters, a vulnerable supply chain can intensify the consequences of the disaster and increase the risk of losing more human lives.

After facing to any type of disasters, still there is necessary to manage the whole process intelligently. But even in this stage, there are plenty of issues that supply change managers must overcome.

## **2.2 Relief Supply Chain Management Challenges**

It's pointed out that more than half of the planet's 20 costliest catastrophes have occurred since 1970, due to (1) a world population that is quickly growing; (2) a larger concentration of assets (and people) in high-risk areas; and, (3) increasing social and economic inter dependency. These trends are combining to create an environment in which natural disasters are increasing in frequency and intensity.

The main challenge after disaster happening is; how to get the right amount of resources to the place of disaster to cover the initial needs of survivors in less amount of time which is the task of relief supply chain management team.

The following numbers of management challenges are constructed to point out some of the main areas, where management challenges exist in disaster relief supply chains and where opportunities exist for additional management research and study.

### ***2.2.1 Coordination and Decision Issues***

In place of disasters, the main role of leadership for international coordination, Corporation and prescribed procedures are in hands of united nation but, no international action can take place if the local government does not make decision and send request.

In fact, the role and main responsibility of the government (at the national/state/provincial/local/tribal levels) must be recognized in the event of a major international disaster. Even when permission is granted, there are still some occasional conflicts of authority and delays in decision making, due to distance, communication impediments or misunderstanding.

### ***2.2.2 Supply Chain Structure***

Some specific arrangements and trims on the supply chain format are needed to adopt and anticipate it over the different needs of the customers (survivals) and relief chain team members. In each particular disaster, some special organizations are involved based on severity, location, the nature of the disaster, availability of potential participants, anticipated needs and prescribed procedures. Thus the relief group's membership could change from one disaster to another, adding an extra dimension of complication to the coordination

For instance, when delivering aid in some regions of the world, cargo security is a significant issue. In other regions logistics alternatives may be limited due to strained relationships between nations. In others, some well-qualified organizations may not be permitted to enter the country or traverse a specific country or area en-route.

### ***2.2.3 Donation Independency***

The priority of quick response to the huge amount of requests for water, food, shelter, clothes and medicine supplies after disaster happening and during the initial phase of relief process, makes the importance and position of international donor organization bold and clear.

In fact, the amount and verity of the goods and services which the relief chain management team receive is often determined by; what the donors decide to provide although the relief chain managers can make precise the requests by identifying the more specific needs of the survivals. Moreover, some donors restrict where and how their resources can be used.

#### ***2.2.4 Information Uncertainty***

In the first hours after disaster, some information are not simply available and high level of uncertainty about disaster timing and location, victims' needs, donors' supply, infrastructure, and even relief group membership is governing the conditions. Due to, when information about the specific location of needs began surfacing, the compromised infrastructure significantly increased the difficulty of getting the right supplies to where they were needed.

#### ***2.2.5 Change in Priorities***

Although, the main efforts of the relief chain management team during the initial stage after disaster happening are centered around the high speed responding to the suffered human requests with the aims of reducing the amount of lives lost and demands uncertainty but, various reasons like; securing adequate supplies, finding sufficient shipping capacity, and getting to the disaster place hamper the relief chain organizations to respond as quickly as possible.

Consequently, the relief chain team's experience, supplies and inventory availability, and capability of the complex are the main field players which will push the enhancement of relief activities.

The policy of the rescue teams and relief chain management organizations will be shifted from push to the pull one and more demand driven, when the survivals been moved to the safety and infrastructures like main ways, stations, airports, hospitals and telecommunications maintained and stabilized. Seems, Private sector firms may also need to change their supply chain priorities over time, but rarely so quickly and radically as a disaster relief supply chain.

#### ***2.2.6 Changing Operational Needs***

As well as the priorities, the local conditions are highly dynamic and need changes over the time. Condition changing in the situation gives rise to shifting tensions between execution (responding to the needs and worrying about the compliance with regulations later on) and compliance (making sure that actions are done in accordance with the appropriate procedures and regulations).

#### ***2.2.7 Supply Chain Evolution***

Structures of the involved organizations, area of the relief chain team responsibilities', logistics and supply chain routines and elements, and personal approaches of management team should be shifted to meet the aftershock condition needs when the priorities and operational requests of the relief operations change.

Certainly, basic supply chains evolve by the occurred changes in; the customer base, the product line, the supply base, or the other conditions, but seldom with the rapidity of disaster relief chains change.

## 2.2.8 Self-Initiated Participants

Ordinarily, the relief chain management team is encountered with the number of uninvited, unexpected and inexperienced individuals, groups or even NGOs who come to the stage following a disaster.

Although it could be great to have a large number of unanticipated firms which integrate so quickly with an existing supply chain and while they are usually motivated by the best of intentions, but these efforts can create numerous problems. For example: (1) they compete for coordination, communication, logistics, and sustenance capacity like everyone else; (2) they often need more coordination effort since they did not participate in any prior planning efforts; and (3) they often disrupt the efforts of others.

## 2.2.9 Secondary Relief Chain Activities

Focusing on reconstruction and restoration of the infrastructures towards normalcy is the main request of the disaster's survivors after the urgency of the initial disaster response and the creation of conditions in which the affected population is safe.

The implication of this is that the restoration phase needs to be explicitly considered during pre-planning and execution of the response to the disaster. Explicitly taking into account the restoration phase during early planning could avoid some of the problems that arise after a disaster.

Resilience to Disruption in ...	Action	Advantages	Disadvantages
Supply	Use multiple and/pr local sources in different locales.	Spreads risk across multiple firms, multiple locations; local source protects against international supply shortages.	Higher cost to qualify supplier, lower volume leverage, no assurance additional supplier is more resilient.
	Use single source	Known supplier, high supplier commitment, leveraged volume.	Vulnerable to disruption unless supplier has multiple flexible sites, backup plans.
	Contract for supplier flexibility.	Contract obligates supplier in advance.	Potentially higher cost per unit, may entail fixed costs for "take or pay" committed volume.
	Modify inventory levels.	Right parts inventory and risk pooling may reduce inventory costs.	Requires periodic analysis by item as conditions change.
	Modify product to use standard parts.	Reduces part and inventory cost, complexity.	Costly to modify existing materials standards.
Transportation	Prepare for and use multiple modes.	Pre-disruption relationship ensures support during crisis.	May need to commit volume to the alternate modes to get access during disruption
	Use spot market for capacity.	Efficient transaction with no upfront or lasting commitment.	Unknown carrier means added risk, potential for high pricing.
	Use logistics providers to source transportation.	Providers have greater leverage and access.	Requires commitment (volume, cost) and relationship with logistics provider.
Production facilities	Use multiple sites, each making multiple products.	Enables shifting production around locations.	Requires standardization in production operations, additional capital for additional facilities.
	Modify inventory levels and policies.	Right finished-goods-inventory levels and risk pooling may reduce inventory costs.	Requires periodic analysis, potential redesign of supply network.
	Modify product to use standard processes.	Leverages common processing capabilities for lower cost, easy backup available.	Costly to modify product and production processes.
	Identify and contract backup production facilities.	Committed backup assured, potential to co-locate at supplier or customer.	Not dependable without contingency contract for the facilities in disruption.
Communications	Use full range of communication media.	Able to communicate in nearly any event.	Must maintain a broad range of old and new technology.
	Back up data.	Protects against data loss.	Still requires physical system in event of full system loss.
	Contract for backup IT system	Provides for near-term system availability.	Potential delay in immediate response to massive system disruption.
	Set up and operate parallel or mirrored IT system.	Affords immediate system availability.	Requires building, operating, and maintaining separate system in protected environment.
Human Resources	Develop cross-trained workers.	Enables shifting of employees and production as needed.	Must cross-train employees and modify work system to utilize multi-skilled employees.
	Modify production process for unskilled labor.	Allows rapid increase or decrease in capacity.	Requires simplification of production process, not always feasible.
	Back up knowledge.	Best practices captured and documented.	Requires significant investment to capture and maintain knowledge in useful form.

**Table2: Resiliency effects on Humanitarian Logistics, [www.husdal.com](http://www.husdal.com) ©2008, (Rice and Caniato, 2003).**

Apart from managerial difficulties, creating an effective and efficient humanitarian aids logistics is sentenced to be challenging and prone to suffering from different barriers which are explained below:

### **2.3 Barriers and Difficulties towards Efficient Humanitarian Logistics and Effective Relief Supply Chain**

This part of study is aimed to explore the barriers against efficient and effective implementation of humanitarian logistics and relief supply chain, like political, regional and global but in this thesis research there is no solution for the above barriers. Our research purely focuses on the study of supply chain management, humanitarian logistics and relief supply chain, and how supply chain management resiliency overcomes the barriers and difficulties during the operation after disaster.

The huge amounts of various international aids which are flooded into the place of disaster can wreak havoc. In fact, the quick and unplanned introduction of aids (specially feeding aids) can make national economy upsets, enhance the dependency level of the country, create consumer surplus, and impose additional cost for warehousing and maintaining.

In countries which are faced with natural disasters like earthquake, volcano, hurricane and flood, unplanned aids increase the level of dependency and expectation of the governments, communities and individuals for international relief chain and decrease the level of Preventive, supportive and survival actions of national, traditional and self-reliance aids' organizations.

Although huge amount of international aids can be useful in long run but, in a short run can make hardship struggle for national individuals to re-establish the former markets. In Ethiopia, aid groups brought in cooking-oil as part of a food program. This oil directly competed with local producers and drove them out of business (McLaughlin, 2004).

Based on the new modified logistics and supply chain management theories; increasing the effectiveness in the chain through the supporting strategies and decreasing the cost of the chain through the time and money efficiency management, revolved around the resiliency management factors to above disturbances and quickly restoring operations.

International Federation of Red Cross (IFRC) which had been founded in 1919 is the largest humanitarian organization in the world, and assists in responding to humanitarian crises with more than 186 autonomous National Societies (NSs) to provide cost effective and high quality responses for the maximum number of beneficiaries' (Gatignon, 2010).

Coordinating logistics during relief efforts is often a daunting task that can result in the loss of life and resources if not done quickly and effectively. In fact, there is not a unique recognized model of supply chain management which designed and appropriated by managers with in the humanitarian sector for humanitarian logistics and relief supply chain efforts for populations affected by disasters.

Executive Director for the Fritz Institute, states, “humanitarian logistics has much in common with corporate logistics, yet the best practices from the corporate world, or from other humanitarian organizations in many cases, have not crossed over” (Thomas, 2003).

Some of the main barriers facing humanitarian logistics and relief supply chain management teams are; unpredictable demand of the survivors, destroyed, degraded and impracticable infrastructure, human resource problems and difficulties with inexperienced personnel, economic issues, donation and funding distributions, and lack of the information and equipment.

Significantly, billions of dollars are wasted and millions of people are affected by unexpected natural disasters like floods, volcanoes and earthquakes yearly. Considered evidences show, the number of natural disasters is increasing and therefore, the necessity of researches and studies aimed on the role of humanitarian logistics and relief supply chain management been founded as a growing need.

Ahead research is aimed to identify and explain the main elements and players of humanitarian logistics and relief supply chain by using of published academic literatures and case studies associated with humanitarian logistics aid. A guiding framework for designing logistics and supply chain management system, humanitarian logistics and relief supply chain and the role of resilience in humanitarian logistics aid and relief chain management is developed and then an applied case study in South West Asia Tsunami to provide a guideline for organizational execution, development of the management system and effective humanitarian logistics and relief supply chain is investigated.

Pre-disaster activities are involved; preparation of procedural plans, manuals, staff, vehicles, communications, medicine, medical supplies, and other basic necessities but, at the While it happens, relief supply chain units are put into operation to transfer the appropriate, and medicine, medical supplies, and other basic necessities to Red Cross to serve for victims in disaster’s region (Chandrapraikula, 2010).

However, our research study reached to the point that a few number of humanitarian aid logistics and relief supply chain teams have prioritized for a high-performing humanitarian logistics and relief supply chain operations.

For the rest, environmental barriers such as the unpredictability of disasters and the nature of funding make consequences in employee-turnover, well define of manual processes, and weakness of the updated institutional learning which result inefficient and ineffective relief operation to beneficiaries.

In addition, the external pressures on humanitarian aid and relief agencies from donors, local humanitarian organizations, governments and corporations, as well as the internal limitations that have impeded progress in humanitarian logistics, intensify these consequences (Thomas, 2005).

**2.4 Humanitarian Logistics and Relief Supply Chain Steps**

Considering the number of organizations, workers and relief items arriving on the ground and concerning the struggle to coordinate relief efforts in order to most effectively reach those in need, there are some important steps which should be carried out during the disaster response operation under the humanitarian logistics and relief supply chain umbrella (Van Wassenhove, 2008).

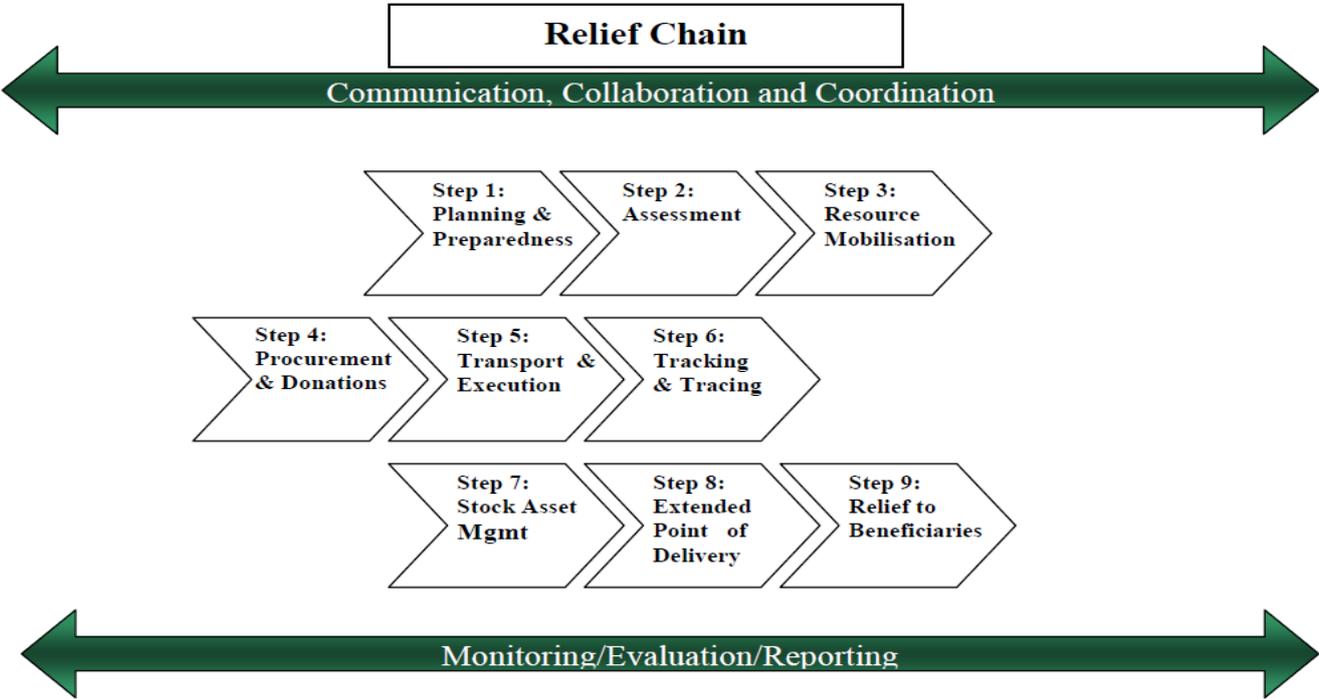


Table3: Humanitarian Logistics Steps, ( Fritz Institute, 2005).

**2.4.1 Planning & Preparedness**

This step is including some pre- disasters logistical procedures and activities which should be taken place. A plan includes what tasks are to be done, what part of the organization will be responsible, and how to procure needed resources. They must also have a national or regional plan based on the vulnerabilities of the infrastructure, the logistical support in the area, and governmental emergency response abilities.

Planning includes written contingency plans and procedures to respond to disasters. Usually governments have their own national and local plans including organizations, responsibilities, priorities, and main actions to take in case of disasters. Most of the plans include several scenarios based on the level of damage caused. Humanitarian organizations also have their own set of plans, which are usually coordinated with the governmental plans, but can also operate independently.

Preparedness is related to making the system of response ready to respond to catastrophic events. It is not possible to be completely prepared to face the impact of an earthquake. However, planning and preparedness allow for a far more effective response.

Planning for disasters is necessary at the organizational, national and international levels. Organizations such as the International Federation of Red Cross and Red Crescent societies (IFRC), World Vision International, Concern, Oxfam and various UN agencies operate a system of pre-positioning goods, vehicles and equipment at different hubs around the globe. These stocks are managed independently or under the banner of the UN Humanitarian Resources Depot (UNHRD).

#### **2.4.2 Assessment**

Assessment fulfills the roles of demand planning in the relief chain. After a disaster, assessment establishes the needs of the population, the local infrastructure capacity, the level and magnitude of damage to the infrastructure, and the local resources which are available to respond. They deal with giving the right amount of aid to the right people and play the role of demand estimation. They can be done by visual inspection, by asking people, by simulation or by sampling. There is some standard information used to assess the impact of disasters, including information such as, possible number of deaths and injuries, availability of local resources, public services like electricity, communications, and transportation services. Without performing a basic assessment, it is difficult to know what is needed, how much is needed, when it is needed, and where it is needed.

Assessments are generally composed of several activities: preparedness planning, survey and data collection, interpretation, forecasting, reporting, and monitoring. Preparation identifies what information should to be obtained. There are various methods used to obtain data. They range from visual inspection and interviews by specialists, to statistical sampling, to a checklist.

An assessment team reports the data analysis and thoughts about future developments to the appropriate parties. As assessments are just a snapshot in time, they should be revisited and compared with previous results. The report should include the current food, health, water and sanitation, and shelter situation. It should mention capability / capacity of local resources and if any effort at coordination is underway. Lastly, it should speak to the logistics, by describing how to get relief to people, the state of the roads, seaports, airports, and the costs and availability of transportation.

#### **2.4.3 Recourse Mobilization - Financial and Human Resources**

Before the response to a disaster begins, an organization obtains and sets into motion resources. Financial Resources and Donations Once the response operation is underway, organizations allocate available resources and begin requesting additional resources via the appeals process. Appeals for disasters can be carried out by a single organization acting alone or through broker organizations such as Global Impact. The media plays a vital role in

promoting appeals to the wider public thereby increasing the visibility of the organizations operating on the ground and what they need.

Human resources must be mobilized and they come in the form of professional humanitarian workers, volunteers, firemen, ambulance workers, police or military staff. Resources have different levels of training, skills, and affiliation. Training varies across organizations and within every organization. Governmental agencies are used to having full-time staff. NGOs have full-time staff and also short-term contracts to cope with increased needs.

#### **2.4.4 Procurement and Donation**

Emergency supplies enter the relief chain through different sources, forms, and locations. They can be given as donations, grants, or gifts-in-kind (non-monetary goods and/or services).

In-kind donations come in different forms and from several sources, using multiple channels. They may be planned or not. Planned donations usually respond to the needs identified during the assessment phase. Unplanned donations do not necessarily match with the needs of the disaster.

Often unsolicited donations are goods that are not a priority and have not been requested. Aid can be multilateral, administered by international institutions which collect resources from countries and redistribute them, or bilateral, given directly from a donor government to a recipient country. Procurement can be done at the local level or sourced globally. Goods can be acquired in many different ways such as in bulk or stored at the vendor until needed.

Procurement is carried out using available financial resources or credit. The goal of procurement in relief operations is to enable orders to be placed and delivered on schedule at a good price. When possible, governments and organizations prefer to buy locally to avoid delay times and try to help the local economy. However, some organizations prefer to use their regular suppliers to guarantee the quality and standardization of their supplies, or to get better prices.

#### **2.4.5 Transportation and Execution**

Transportation is critical to deliver aid at the right time and to the right place to assist those in need. It can involve global sourcing, drop shipment, military transport, commercial transport, non-commercial transport, third-party logistics firms, freight forwarders, charter aircraft, or even local transportation in form of planes, trucks, cars, boats, and even animals if necessary.

However, transportation is dictated by road conditions, fuel availability, airports' and ports' capacity after disasters. The kind of vehicles which can be used depends on the access routes to the disaster zone and the distance to other urban centers able to provide help. Flow capacity, which is the capacity along an access route, is an important variable in deciding the

plan for transportation. Transportation might include governmental vehicles, army, humanitarian, volunteers, and private sector partners.

#### ***2.4.6 Tracking and Tracing***

Tracking is a forward process to determine the path followed by aid from origin to destination. Tracing is a backward activity to determine where the shipment was sent. Tracking and tracing is not well developed in the relief chain. In fact, tracking is usually done in Excel. Tracing is not particularly beneficial for relief logistics. It is important to know what has been promised, what has been ordered, what is on the way, and what has already arrived. The resulting lack of visibility into inbound shipments impedes the task of receiving, clearing customs, shipping to intermediate warehouses, and distribution at each step of the supply chain.

In fact, tracking and tracing are related to the goal of delivering to the right people, to the right place and at the right time. Additionally, these processes are essential to show impartiality and neutrality in relief operations.

#### ***2.4.7 Stock Asset Management***

In the relief chain, stock can accumulate in many places. Collection sites can act as transshipment points, warehouses, and as places to prepare and pack goods. They can be located in impacted areas or near ports, border crossings, or airports.

Stock Asset Management is the process of organizing warehouses at certain points, and organizing the supplies held in those warehouses, for delivery. Warehouses and transshipment points should be located strategically to use the available infrastructure guaranteeing safety conditions for the assets and people. Usually during the response phase, warehouses are prepared. There were only two main storage points in Haiti immediately following the earthquake. These were located on the grounds of the presidential palace and next to the airport. Once the aid arrived at these points, it proved extremely difficult to transport it further to the population in need.

At this stage, notification of the receipt of the goods should be sent, records of inbound supplies should be maintained, and supplies must be secured to prevent theft and spoilage. Loads should be inspected to ensure that they correspond to the shipping papers and that they are not contaminated. If goods are contaminated, reverse logistics come into play. The goods must be returned, given to livestock, or destroyed.

#### ***2.4.8 Extended Point of Delivery and Relief to Beneficiaries***

An extended delivery point is an inland destination close to the affected area where goods can be stored before the final distribution of aids to beneficiaries to cover the relief supply chain goals. In most relief operations, supplies are brought close to the refugee camps for storage. Daily relief organizations bring food aids to camps, prepare it if necessary, and

disperse it. Points of delivery are chosen by taking the conditions of infrastructure after the disaster, access routes for assets and distance to beneficiaries into account.

In other words, it is often difficult to efficiently and securely deliver aid to the right people and organizations. There is a risk that supplies will fall into the wrong hands when being transferred between international and local organizations and end up on the black market instead of where they are needed. This highlights the need for multiple points in stock asset management.

During the first week following the disaster, delivery was a significant challenge. Four or five days following the disaster, food and water began to be airdropped to the victims in an attempt to overcome the problems of reaching people by land.

However, as mentioned previously, this led to some riots and violence as people clambered to obtain the necessary aids. As a result of this, the distribution strategy changed and convoys of aids were required to travel with security escorts but distribution was expected to normalize with the arrival of more aid, troops and humanitarian workers.

Humanitarian logistics endeavors to bring assistance to people affected by a disaster. This assistance must be distributed to those who truly need it in proportion to their needs in a culturally appropriate manner. To ensure these conditions are met, there must be monitoring, not only at the storage stage, but throughout the distribution of supplies. They take care to ensure vulnerable populations receive their share of the food distribution. This can take the form of distribution via identity cards or by giving female heads of household food for the family.

#### ***2.4.9 The Relief Supply Chain Umbrella: Coordination, Collaboration and Communication.***

Coordination, collaboration and communication among the organizations taking part in the natural disasters responses because of various goals and objectives including; Management of transportation, Supply chain techniques for humanitarian logistics, Education and training, Resource management, Partnership with military, Logistics Information System (LIS), Assessment of damage, Act according to the local & regional, Decisive command and control, and Competition for uncertainty.

Despite seemingly conflicting mandates, it is vital that those involved in the humanitarian operation find a way to collaborate in order to provide relief in a complimentary and efficient way. Without this, efforts are certain to be duplicated in some areas while entirely omitted in others. This would increase the sense of abandonment in certain sections of the affected population and hamper the overall relief operation.

### **3. Methodologies**

In order to achieve and fulfill the objectives of the research thesis, different methods and approaches for data collecting and information gathering are conducting in. As a starting point of study, in this chapter we try to describe the foundation and definition of research methodology to give the reader an overview of it in common then, we strongly focus on the applied methods and approaches in our research and case study. The purpose of this chapter is, to sharply clear the ways of data gathering for this thesis, the scientific approaches, methods of data gathering in our research subject and the barriers of the study in our research.

#### **3.1 Methods of Data Collecting**

There are different ways for collecting data and information. The most appropriate and common one's for data gathering in research methods are: surveys and literature reviews, talking with people and personal interviews, surveys via mail and phone, E-mail and internet surveys.

Survey and literature research is involved, review of company's information and documents, statistical and economical annual reports, market news, national and international trade publications and magazines, books and directories, online and internet based information. Although it is a bit hard to get update information by this way but, it is one of the cheapest ways for information gathering. Web search and internet based information are the fastest ways for collecting data.

In this study, a literature review for better understanding of humanitarian logistics and supply chain definitions and terms, supply chain vulnerability and resilience and an empirical data gathering through a deep and vast case study review have been done to address the research questions of the thesis by main focus on previous research works.

#### **3.2 Deductive and Inductive Research Approaches**

There are two different main approaches to address a problem or response to a question to receive a certain conclusion, Deductive and inductive approaches which should be used based on the volume of theories available within our title or subject of the survey.

Assumptions will be made from available theories to create a deductive approach, on which hypothesis and statements are done. Hypothesis and statements will be examined through various observations and experiments to come to clear and exact conclusions.

The inductive approach works based on reality and will be shifted from particular observations to a vast broader generalizations and theories with an empiric survey and research. In inductive approach, we try to distinguish prototypes and priorities of specific observations and measures, formulate some experimental and trail version of hypotheses which could be investigated and examined, and finally finish by developing some general conclusions or theories.

This study have been done based on the inductive approach with centering on the 2004 Tsunami in south west of the Asia case study by comparing the achievements of this case's researchers with the extracted definitions, schemes and strategies from the literatures. Thereafter, some general and universal solutions based on our findings for the same relief chain operations in similar disaster cases have been provided and offered.

### **3.3 Strategies of Information Gathering**

Primary or secondary information are two different types of data and information which can be gathered. Primary type of information is gathered by the researcher or investigator (him/herself), usually through face to face or personal interviews, library research and surveys, internet and web based surveys or questionnaires. The second one has already been collected, existed and documented by other Scientists and researchers and are available in different sources.

By attention to the main parameters of the primary information gathering strategy and regarding to our time banding and economical limitations, investigation directly at the place of disasters and also face to face interview with the members of the relief logistics and supply chain for better data collecting and information gathering were impossible.

To be able to assemble a strong theoretical and experimental bases for further researches and applications, a collection of secondary information and data is made from literature review of internet and web based humanitarian logistics and supply chain books, journals, relief logistics magazines and articles, international published researches and disasters case studies which were available in the internet and Borås Universities libraries'.

### **3.4 Qualitative and Quantitative Research Methods**

In general, qualitative research creates pure, exhaustive and applicable data and information that contribute to in-depth understanding of the context. Qualitative research is based on gathering, analyzing, and understanding data and information through observing what others do and say.

Quantitative research creates reliable population based and generalisable data and information which are well suited to establishing cause-and-effect affairs. Quantitative research method is a kind of research involves the use of organized questions where the response options are predictable and a large number of respondents are involved.

A Quantitative and Qualitative Methods of literature review in parallel with Deductive Research Approach on both published articles and reviewed case studies conducted to government and media documents and surveys are the bases to make the theoretical framework in this research.

Focus on the existing views and perspectives to develop the research through the relationship between human variables and abilities associated with organizational and operational variables within the supply chain resilience sounds crucial.

To improve the conceptual model, we strongly believe that, details and points regarding humanitarian aids in relief chain resilience will be obtained through some off-site and on-site interviews which should be attended to the research purpose.

### **3.5 Case Study Research Method**

Case study research method is an empirical qualitative method of research which usually been used to bold and extend the complexities and issues of the previous experiences and researches. With exact and detailed examining and investigating of the few number on rules, conditions, events, accidents, assumptions and their relation by the researchers and scientists, case study research method highlight the results of various contextual analysis of the above factors in real- life situations.

Researcher Robert K. Yin defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used (Yin, 1984, p. 23).

Although some scientists and researchers believe that validity and reliability of the research is in place of doubt by the way, majority trust it and continue to use the case study research method with success in carefully planned and crafted studies of real-life situations, issues, and problems.

Famous case study researchers such as Robert E. Stake, Helen Simons and Robert K offered the coming steps to follow to make the way of case study research method clear; determining and defining the research questions, selecting the cases and determining data gathering and analysis techniques, preparing to collect the data, evaluating and analyzing the data, and preparing the report.

Through the establishing of planned and targeted “how”, “why” and “what” forming questions, the framework and focusing points of the case study and research complexity and also, object and purpose of it, will be defined by the researchers and scientists.

These questions are usually about the conditions, situations, difficulties, faced problems and the weaknesses of the entire achievements in previous studies. Because of the intricately political, social, historical, geographical and economical effects of the research and study situation, and because of the limited number of events, conditions and relations on the way of an entire case study research, the researchers investigate and follow up the objects and purpose of the researches by the variety method of the information review and data gathering by availability of the sources.

Necessity of an aimed and formulated literature review and careful and determined definition of the research questions based on the previously conducted audiences, researches and studies seems comprehensible.

Then the researcher must be repeatedly refer back to the main objects of the study during the case selection process with the goal of satisfying the purpose of the study and answer the research questions posed. Data gathered is normally largely qualitative, but it may also be quantitative. Tools to collect data can include surveys, interviews, documentation review, observation, and even the collection of physical artifacts.

Well done maintaining and categorizing the relationship between the issues and the evidences are crucial; the researchers usually document, classify, and cross-reference all to be efficiently recalled for sorting and examination over the course of the study.

### **3.6 Validity**

Regarding to (Yin, 1994), There are three different experiments to examine the validity of a subject or research which are named as construct validity, internal validity, and external validity.

Construct validity is about establishing exact practical measures and seeks harmony between a theoretical concept and a specific measuring mechanism or process. In fact, validity means an instrument's ability to measure what is meant to be measured (Wiedersheim, Paul and Eriksson, 1991).

According to Yin (1994, p.35), "Internal validity is the extent to which we can establish a causal relationship; whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships".

To understand whether a research's finding or result can be generalized further than our subject or not, we can deal with external validity.

In order to cover the research validity, we had tried to protect the external validity of our thesis by using numerous library and internet based sources of evidence and different methods of data gathering through literature study together with focus and deep study and investigation on the 2004Tsunami in south west of the Asia case study to cover the research questions.

The main focus of the third chapter is to cover the literature review and theoretical parts of our research to answer the validity requirements of our subject.

### **3.7 Reliability**

Reliability is the extent to which a study's operations can be repeated, with the same results (Yin 1994, p.36); also Reliability involves the accuracy of the chosen research According to Wiedersheim-Paul and Eriksson (1991). In fact, the reliability of a study is acceptable if

another researcher can conduct the same research and carry out the same results. Researchers should provide the same result at different times if the conditions are identical.

Reliability through the case study research method refers to the stability, accuracy, and precision of measurement. Exemplary case study design ensures that the procedures used are well documented and can be repeated with the same results over and over again.

This research was performed in both theoretical and practical perspectives and we tried to use more scientific literatures also more case studies, therefore an acceptable level of reliability could be verified.

Evidently, statistically and quantitative method of research are not quite suitable for this kind of case study research, as reviewing the literatures and documented cases related to humanitarian logistics and relief supply chain. This research also invites other students of logistics and supply chain to make further work and investigation on different perspectives of humanitarian logistics, humanitarian supply chain, relief supply chain and theirs' improvements (Soy, 1997).

## **4. Case Overview**

Main focuses in this part of our research work are laid on the practical stage in order to achieve the desired and expected results of interests. Based upon the defined and explained terminology and methodology acquired in this research, the processes and results of the relief humanitarian logistics and supply chain which implemented in 2004 South West Asia Tsunami will be discussed.

### **4.1 South West Asia Tsunami**

On the morning of December 26, 2004, an earthquake with the estimated magnitude of 9.3 in Richter scale and death toll amount of more than 300,000, tore through the seafloor of northwest Sumatra forced billions of tons of seawater upward by the movement of the sea floor and for fourteen hours more than twelve countries had been rushed by this Tsunami on the eastern coast of Asia.

The economic impact of this disaster was deep and long lasting. The UN's Financial Tracking Service (FTS, real-time database of humanitarian aid managed by OCIA) covers UN funding as well as outside appeals such as, NGO funding, bilateral aid, in-kind aid, and private donations. FTS tracks contributions, actual payments of funds, commitments, contractual obligations between donors and recipients, and uncommitted pledges, announcements of intended contributions (Russel, 2005).

OCHA reported \$2,745,763,468 USD in contributions and commitments for Tsunami relief and recovery efforts with an additional \$4,105,817,979 USD which had been pledged but not yet committed (FTS, 2005), that means totals \$6.8 Billion USD for relief and recovery.

International humanitarian logistics and relief supply chain agencies activated their assessment groups and supplies to provide the basic necessities and emergencies to large numbers of people in need. Large amount of relief goods flooded airports and warehouses in the affected regions and downstream, relief supply chain organizations struggled to locate warehouses to store excess inventory to ensure the efficient and cost-effective flow and storage of goods and materials for the purpose of alleviating the suffering of vulnerable people (Thomas, 2005).

### **4.2 Problems during Humanitarian Aids and Relief Efforts**

After any type of disasters, a set of organizations and people from both local and international segments rush to control the situation and prevent it to become more catastrophic, but managing this huge volume of aids and number of volunteers is something more challenging. Moreover, based on the characteristics of the area like the culture, geographical position, valid infrastructures, and etc. the assistant teams may confront more issues. The following segment will explain some of the issues in South West Asia Tsunami (2004).

South Asia Earthquake Appeal Date: October 9, 2005				
Status Update: Final Date: March 18, 2006	Operation Total (Weighted)	Priority 1 Housing	Priority 2 Kits & Sets	Total Op Target
<b>Percent of Appeal Coverage (in quantity of items)</b>				
After 1 week	63%	61%	77%	
After 2 weeks	47%	45%	18%	
After 1 month	74%	73%	51%	
After 2 months	91%	92%	71%	
After 3 months	93%	99%	100%	
<b>Percent of Items Delivered (in quantity of items)</b>				
After 1 week	6%	1%	4%	
After 2 weeks	9%	5%	2%	
After 1 month	33%	27%	8%	
After 2 months	48%	46%	19%	
After 3 months	67%	72%	47%	
<b>Donation-to-Delivery Time</b>				
Mean (# days)	33	35	29	
Median (# days)	28	31	24	
<b>Financial Efficiency</b>				
(Donor Cost - Budget Cost) / Budget Cost	-5%	-11%	30%	
Actual CHF Spent - Budget CHF	(3,510,849)	(5,209,538)	1,810,531	
Transportation Cost / Total Product Cost	10%	N/A	N/A	
<b>Assessment Accuracy: Revised Budget / Original Budget</b>				
After 2 weeks	131%	118%	365%	
After 1 month	139%	123%	377%	
After 2 months	148%	127%	493%	
After 3 months	158%	127%	493%	

Table4: South West Asia Tsunami Appeal Coverage, (DA VIDSON. A. L., May 2006).

#### 4.2.1 Unsolicited Goods

Unsolicited goods donated by individuals, groups, and corporations can be ineffective and consume the precious relief time and resources. Due to both weight and the location of the people that need it, goods are location sensitive and expensive to transport therefore, goods need to be culturally and technologically appropriate.

In Sri Lanka, unwanted aid piled up at government buildings, aid agencies, and refugee camps. Many weeks after initial appeals for water, significant numbers of boxes of bottled water continued to arrive after the water and sanitation services were restored which were heavy and expensive to transport. Winter jackets, winter tents, expired cans of salmon, cologne, high heeled stiletto shoes, and sequin-studded black evening dresses were sent by well-meaning people and organizations (Barta & Bellman, 2005).

Some items, while useful themselves are not appropriate occasionally, for victims who living in camps without can openers were not easy consume the canned food donations, baby bottles could not be sent to refugees that lacked the ability to sterilize them, and other items like bath gel, lotion, and other western cosmetics, used clothes, kitchen utensils, and pots and pans are novel and confusing.

The victims of the Tsunami would be better served if money were sent to relief workers in the region that know the needs and cultural sensibilities of the people that they are serving.

Humanitarian logistics and relief organizations brought in dried beans to help feed those left homeless after a hurricane, while the dried beans were light and inexpensive to ship but the refugees could not find clean water and fuel to boil them for hours. Along the same lines, pork products were brought into Bosnia and Somalia to feed Muslims, who have religious restrictions on pork (J. Leaning, 2005).

Drug donations in emergencies are essential, but they can cause harm as well as good, information is in unknown languages, expired medicine or about to expire, and some do not correspond to the country's disease patterns. Refugees now look at the expiration date before they accept any medicine being offered them (Cohen, 2000).

#### **4.2.2 Foundations and Infrastructures**

During the humanitarian logistics and relief supply chain processes, damaged foundations, inaccessible infrastructures, and lack of the infrastructures needed for large-scale assistance lead to bottlenecks, delays, and congestion at entry points to the disaster area.

Tsunami were no exception, the water rushed ashore, it damaged the entire infrastructure in its path, coastal roads, bridges, warehouses, airports, ports, vehicles, and communications infrastructure, and when the water receded, it left debris covering everything, both infrastructure it damaged and infrastructure it left intact.

Lack of appropriate vehicles, insufficient fuel storage, runways too small to manage cargo planes, inadequate warehouse space, and scarce air traffic control and lack of infrastructure for a large-scale humanitarian logistics and relief supply chain operation coupled with damage to a portion of the infrastructure that did exist produced one of the biggest challenges - congestion.

In Sumatra, the major airports and seaports were open, but the infrastructure beyond them was damaged, Banda Aceh's small airport went from three flights a day before the disaster to round-the-clock traffic. Undamaged vehicles were in short supply and had difficulty moving through the region and just a few vehicles that could get through were large trucks that traveled on cleared roads and hence, could not reach those most in need, and limited storage space led to offloaded cargo that quickly filled available tarmac space. Communication problems and poor information technology infrastructure caused very limited visibility into incoming shipments.

#### **4.2.3 Political Issues**

Humanitarian logistics and relief supply chain operation faced with some unpredictable politicized constraints during Tsunami aid processes, because of both governmental and dissident groups wanted to control, arrange and manage the aid processes for areas of India, Indonesia and Sri Lanka.

India, as part of a deeply rooted political stance turned down the relief supply chain organizations, their Prime Minister informed President George Bush that they had adequate resources to meet the challenge for Tsunami relief operations and took the lead in providing aid to Sri Lanka and the Maldives (Duff & Brown, 2004).

Immediately following the Tsunami, relief aid started flowing to the hardest hit countries but, customs officials were not prepared to deal with this situation and most of the humanitarian aids and relief supply chain operations were delayed until the government could relax requirements and communicate new rules to customs officials.

Indonesian government denied the US military permission to land in Sumatra and threatened to deny visa renewals for relief supply chain groups in an effort to control access to

the area, they announced that it did not want marines of the U.S.S. Bonhomme Richard and Expeditionary Strike Group Five to come ashore (Baum, 2005).

In Sri Lanka, both the Liberation Tigers of Tamil Eelam (LTTE) and the government want to control aid flows, American warships were ordered to sail to the stricken region forced to reroute from Sri Lanka to the harder hit western coast of Sumatra.

All these political issues had lots of relief supply chain consequences and humanitarian Aid logistics groups complained that dignitaries traveling to the region to view the devastation impeded the distribution of relief supplies choked at the airport.

#### ***4.2.4 Evaluation***

Directly after a disaster, estimation and determination on the nature of the disaster must be done, the extent of the damage, the initial needs of the victims, the secondary threats to the population, the local response capacity, the need for international assistance, and the means for delivering any needed assistance. The recommendations must be clear, concise, timely, practical, and operational. They become blueprints for planning disaster response activities (USAID OFDA, 1998, UNDAC assessment procedures, 1995).

After the Tsunami, the hardest hit parts of Sumatra were impossible to visit without helicopters or light planes, and because of damaged infrastructure and dangerous conditions the assessment team keep themselves away from the areas it needs to visit in order to do a thorough job.

Trained staff can make a huge difference. Local staffs who speak the language and know the customs and the population improve the accuracy of assessments. In the aftermath of the Tsunami, local people were not trained, were victims themselves, or were involved in direct relief activities and were therefore not available. This impacted the quality of the assessments (Hilarie Cranmer MD, 2005).

#### ***4.2.5 Competitors of the Scene***

The importance of resiliency management will be obvious when legions of humanitarian aid logistics and relief supply chain organizations flock to the scene of a disaster to help those in need, they all need many of the same items concomitantly and each one sets up its own supply chain and starts procuring necessary supplies. This multiple relief supply chains can make a competition and engaged them in a form of market-based survival.

In Indonesia, competing supply chains compounded the severe shortage of vehicles. Early on, every vehicle on the market was purchased. This forced other groups to import vehicles from abroad, slowing the relief effort. These competitive problems are not limited to the region. During the first week following the Tsunami, there were stories about hardware stores in Guam and Singapore being emptied out of almost everything in stock. Organizations came in and bought all the shovels, hammers, nails, lumber, and generators (Baum, 2005).

#### ***4.2.6 Financial Issues***

The financial response from public and private donors to the Tsunami was unprecedented. However, before relief can begin to flow, the financial supply chain must be put into place.

This is a difficult process in the beginning and takes time. Meanwhile, available cash reserves are quickly depleted. Before the processes for money transfers are in place and agreements with local banks and merchants are formalized, organizations can struggle.

In the first few days, cash flow problems abound and less developed banking infrastructure forced worldwide financial organizations to use their creativity. NGOs reported difficulties during the early stages of their Tsunami response, while financial resources were available but they encountered problems with cash availability because banks were closed in Jakarta due to Christmas holidays and weekends which complicated cash transfers from Europe and made it difficult to enter into agreements with merchants.

## 5. Conclusion

Logistics and supply chain operations in field of humanitarian aids and relief procedures is an underdeveloped state and the lack of recognition, and the absence of a fulfilling professional career path for people who perform the humanitarian logistics and relief supply chain functions is tangible.

As a matter of the fact, the natural disaster happening cannot be avoided, but its consequences can be mitigated through a holistic resilient management of the relief supply chain operation. Therefore, our research figure out a platform; to raise the profile and understanding of humanitarian logistics and relief supply chain management knowledge in related organizations, encouraging a professionalization of the resiliency disciplines in relief operations, and strengthening the corresponding functions during the humanitarian aid logistics processes after disaster happening.

The above research concluded that, regardless of the nature and variety in type and level of disasters, each one typically shows distinct stages including; ramp-up, sustaining and ramp-down and each stage demands different responses.

Ramp-up stage refers the first 48 hours after the onset of the disaster in which getting access to the field and setting up the relief operation to survive the alive victims as fast as possible, is the highest priority and the main responsibility of the involved relief chain operators.

During the sustaining stage, humanitarian logistics and relief chain teams focus on implementing their secondary survival and aids operations, while cost and efficiencies through resiliency management gain importance inside the rapidness.

In the last stage, ramp-down, relief management teams are focusing on their exit strategies including; transportation activities, finalization of relief operations and resignation of the tasks to local humanitarian logistics operators.

In continue this research study presented results and evidence of supply chain resiliency management participation from multiple sources to make the humanitarian logistics and relief supply chain more efficient and effective.

The intent was, to build the theory that supply chain resilience can be used in humanitarian logistics during the processes of survive and relief. We greatly hope this research in both theoretical and empirical formats improves the management strategies in humanitarian logistics and relief supply chain activities. Therefore, some recommendations will be offered for continued improvement as below:

1. Disaster Resiliency Management Policy: Developing a disaster resiliency management policy had been figured out through our research and investigations. It is of utmost importance to categorically analyze the relief operational learning so as to develop a

disaster resiliency management policy among the humanitarian aids logistics and relief supply chain teams.

2. **Comparative Advantages:** Onset of disaster happening, the relief supply chain organizations lacked the appropriate expertise or technical capacity for damage assessment and quality control to be involved in all stages of the response including; assessment, disbursement of relief operations and reconstruction items, inspection, and monitoring survival functions. Therefore, working on comparative advantage for the greatest benefit of affected victims of the disasters seems crucial.
3. **Cooperation with Local Governments:** Local governments played a key role in decision making and implementation of the humanitarian aids logistics and relief supply chain operations and closer cooperation with the local governments are set against the backdrop of the humanitarian aids processes and relief supply chain suffering.
4. **Cooperation within Relief Organizations;** Better linkages and cooperation within the relief supply chain organizations have been crucial issues for well maintaining and close cooperation between the new, large, short-term and the long-term relief processes to speed up the efficient and effective management of the survive operations.
5. **Decentralization of Decision-making:** In case on national disasters, balance between speed and quality of the relief operations is vital. Which is hard to balance against the backdrop of emergency relief needs is the radical shift in priorities of the people involved the relief supply chain operation in the aftermath of a disaster. One strategy in which relief operation teams may have been able to move more swiftly, but without compromising the speed and quality achieved through the survival processes, would have been through the decentralization of some decision-making and bringing them to the field offices.
6. **Coordinate with Other Actors:** During the relief supply chain processes and victims survival operations, establishing a coordination system with other players of the scene and enabling the system for sharing of imposed issues and problems, and coping strategies in the context of humanitarian aids logistics is considered.

Moreover, based on the investigation among the logisticians from global, national and regional relief supply chain organizations about their resiliency management aspirations, the most significant priorities were; well defined management structure, knowledge-based field with a clear career track, collaboration with peers across organizations and the ability to demonstrate the value of humanitarian logistics with unambiguous measures and metrics that tie with inter organizational strategies.

The detailed recommended strategies for humanitarian logistics management improvement are as follows:

1. Creating a professional resilient logistics community; to enable humanitarian aid logisticians to share their knowledge, capabilities and experience on common issues, and to create a consistent powerful voice with all the stakeholders in the scene.
2. Investing in standardized training and professional certification; to build a pool of humanitarian logistics and relief supply chain professionals that share common processes and vocabulary, promoting professionalism, and collaboration to above disaster.
3. Focusing on metrics operation and performance measurement; to empower the logisticians to demonstrate and improve the efficiency and effectiveness of the humanitarian aids and relief supply chains.
4. Communicating the strategic importance of humanitarian logistics management; to enable logisticians to create awareness of the contribution that humanitarian logistics makes, and to obtain needed funding and resources.
5. Developing flexible resiliency strategies in conduct with technological solutions; to improve responsiveness by creating visibility of the information and materials pipeline and increasing the effectiveness of people and processes through better management of the scene.

Finally, the study above emphasize that humanitarian logistics and relief supply chain has the opportunity to increase the contribution during disaster relief supply chain operation, and improve this contribution by implementing initiatives in the areas of knowledge management, technology, measurement, community, and positioning.

Only a supply chain resilient management strategy will be able to improve the performance and effectiveness of humanitarian logistics and relief supply chains operation, while a lack of it imposed huge dramatic consequences for stricken populations.

And, a resilient humanitarian logistics and relief supply chain management will be achieved through an empirical mechanism with providing time banded and analyzed information and establishing of shared and invested communities of expert humanitarian aids logisticians.

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