UNIVERSITY OF GÄVLE

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The Role of Supply Chain Management in Humanitarian Logistics during Natural Disaster

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Abstract

Natural disaster hits and damages the lives thousand of human beings and their infrastructure. Natural disaster can not be stopped but we can minimize the volume of devastation and destruction caused by the disaster. Especially, in third world countries the level to respond the disaster is limited and narrow, so these countries have to suffer more then the developed countries, where as in developed countries valuable recourses and effective planning are existed to deal with natural disasters. So this thing insists me to write something just to get know how about all humanitarian and relief activities.

I have utilized the SCM Supply chain management practices and techniques in order to conquer barriers faced by logistician of humanitarian response/ relief operation during disaster. I will use methodology of empirical data technique, barriers will be discovered and analyzed then proposed solutions would be picked up from the literature of supply chain management for the barriers to effective humanitarian logistics.

There is a mixture of SCM principle from various organizations such as military, private sector and nonprofit organization in order to provide a utility to disaster/ response operations. The output of this research will show the easy makeup of SCM remedies to control the complexities and difficulties of logistics process during disaster relief operation in results and analysis chapter.

Thesis Supervisor: Lars Steiner

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Chapter # 1

Introduction

"A disaster is a great trouble in a society caused by material, environment or human beings losses that enhance creditability of exaggerated society to manage its own resources" **(38).**

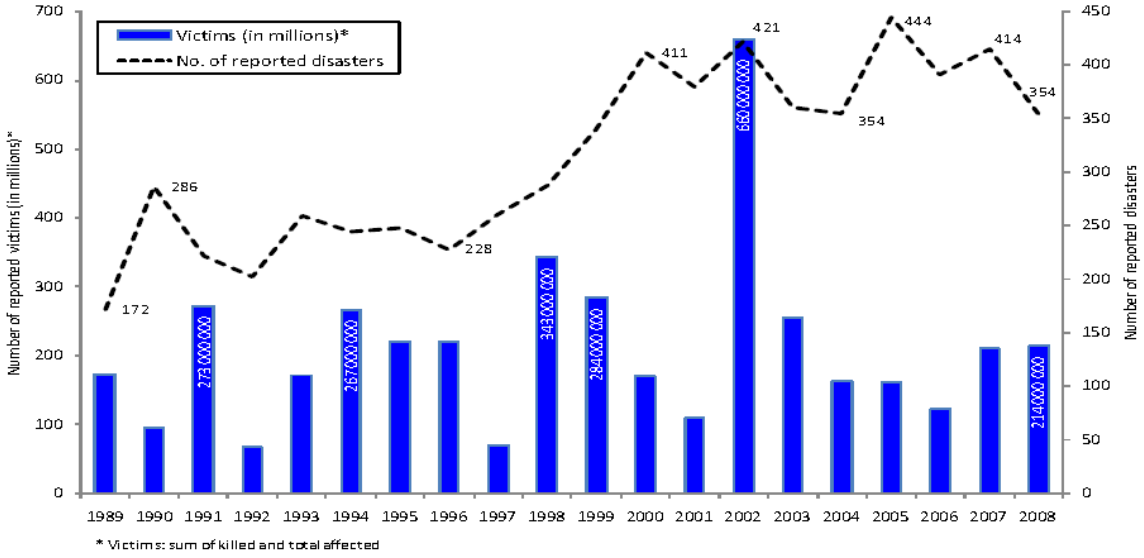
1.1 Disaster

Disaster as a result of human beings hazard or naturally occurred such as earthquakes, landslides, tsunamis, river and coastal flooding, fire in wild storms, sand storms and volcano drought are included phenomena in natural disaster hazards. Where as hazard caused by human begins are deliberated planned and on purpose, such as invade another country, illegally release of oil and nuclear condense etc. Mostly poor people affected a lot because of its smaller structure of capital resources and ability to save from its effected **(8)**

1.2 Background

At the start of 21st century, there is substantial increase of natural and human-made disasters. Natural disaster always harms nature, buildings and infrastructure, where as on the other hand natural disaster bring injuries and high level of death toll of human life, it also have bad impact on human resources, level of economy and business goes down and almost shutdown to every day life of public.

Figure 1: Trends in occurrence and victims



[Annual Disaster Statistical Review, 2008] **(21)**

1.3 Criteria and classification of disaster

According to the CRED (Centre for Research on the Epidemiology of Disaster) disaster is a situation or occurrence that overwhelms confined competence, compulsory demanding external support from national or international level. An Unexpected and surprising events that bring huge damage and devastation of infrastructure and human sufferings **(21).**

1.3.1 Criteria

To be declared a disaster; at least one of the following subsequent criteria should be met Ten or more then ten persons reportedly killed. Hundred or more then 100 persons reportedly killed. State of emergency is announced for the title of international assistance **(21)**.

1.3.2 Disaster

The word “disaster” derived from Latin language dis-and astro, it means “away from the star”. In another word, an event which is too responsible on unlucky astrological configuration **(9).**According to the united nation “An international disaster a severe distraction of the functioning of society, effects widespread human, material and environmental damage, that accelerate the ability of the affected society to cope with utilizing only its own resources **(40).**

1.4 Logistics

The flow of information and material from supplier to factory or plant for manufacturing Purpose then move to the end user (consumer) in a single chain, through creating effectiveness and efficiency in order to get the customer satisfaction **(41).**

1.5 Humanitarian Logistics

“To make a mobilization of persons, assets, expertise and information to the affected people caused, is called humanitarian logistics” **(2).**Humanitarian logistics have the same type of activities as compared with logistics activities at private sector such as transportation, tracing and tracking of shipment, custom clearance of shipment, information and documentation exchange and warehousing facilitation **(2).**

1.6 Management of supply chain

To make a finish good from the raw material then distributed to the end user (Organizations and consumers) through logistics system is called SCM. Retail outlets, manufacturing centers and warehouses are also participated and main players in supply chain management **(11).**

Different sectors such as government, non-government and private sector allocate resources, fund and expertise for the people caused by the disaster. “In order to make a better coordination and communication, different actors participated in order to provide relief assistance” **(4).**

Chapter 2

Purpose

2.1 Problem Description

There is no available structure of supply chain management activities and techniques that have relief solutions for the affected people caused by the disaster. Most of the time, logisticians in rescuing organization have to deal with various type of difficult and complex tasks that can produce loss of lives and resources too. So there is a need to develop better techniques and solutions for humanitarian logistics by utilizing the supply chain techniques and methods.

2.2 Research Aim

The aim of this thesis report is to develop a model for barrier conquering in humanitarian logistics and provide solutions to logistics problems faced by the response and humanitarian organizations during disaster. There are some barriers such as donation and funding issues, damaged infrastructure, unforeseen demand and complexity with personnel which rescuing organizations have to handle.

This thesis report will identify the barriers to effective logistics. This study will also discuss shortly about critical and significant requirements for immediate response. From the supply chain management techniques solutions towards barriers of effective logistics will be provided. SCM methods from other partners such as military, private sector and humanitarian organization will be presented.

2.3 Research Questions

1. To identify the barriers to humanitarian logistics of humanitarian organization during natural disaster?
2. To propose the Solutions to barriers through Supply Chain management Methods?

Chapter 3
Methodology

3.1 Research

Among other things, Research is an intensive activity that is based on the work of others and generates new ideas to pursue and question to answer. Research is also a process through which new knowledge is discovered **(26).**

3.2Data Collection

In this thesis research, I utilize the secondary data and literature review. Various article, journals and books related to supply chain, humanitarian logistics and relief organization were studies and analyzed. Through literature review, I was able to identify the barrier faced by the humanitarian logistics organization then tried to propose the solution through the supply chain techniques and at the end results and analysis has been presented.

3.3Research Approach

3.3.1Methodology on the basis of empirical data from different studies

In this study, I will do a literature review and empirical data to prove my research queries. First of all, I will do literature review to make better understanding with characteristics of logistics management, supply chain management and humanitarian logistics.

Then I will read, utilize and analyze the writing of other to interpret and develop my research study. So I will formulate my thesis research through empirical data. I will observe the previous research work related to my thesis, and then I will find some empirical work and use it into my research study.

3.3.1.1 Empirical data during the identification of logistics barriers

- (Gooley and Toby, 1999) discuss about uncertainty as when disaster come rescuing organizations have to face some uncertain situation. (Van der Vorst and jack, 2002) describe poor information consistency and complexity in decision making process during disaster so both writer studies lead towards **uncertain situation.**
- (Fred and Moody, 2003) talk about alternative route plans because of impracticable infrastructure during disaster. (Gooley and Toby, 1999) also discuss about damaged infrastructure and unusual conditions to carry food, refugees and relief goods towards disaster location so both author point out towards the **impracticable infrastructure**.
- (Donald F, Long and Douglas C, 2003) discuss about the relationship of inter organization and emphasis on joint rescue efforts. (PAHO, 2000) according to PAHO studies I come to know about lack of coordination at disaster place which create the situation more critical and worse. Both strengthen the **communication problem during disaster** site.
- (Anisya and Thomas, 2003) describes the lack of skilled humanitarian logistics staff and abilities during disaster. (Donald F, Long and Douglas C,1995) discuss about the shortage of skilled persons in the field of humanitarian logistics and humanitarian supply chain management, so both interpretations conclude on one point which is **human resources** issue during disaster.
- Douglas C, Long. 1997) say about the influence from donors for creating check and balance on aid. This process sometimes creates some problem to deliver goods effectively where as (Donald F, Long and Douglas C, 1995) discuss about organization's reluctance to push investment in information system to make speedy and accuracy. They also said that donor does not support in planes, trucks and vehicles which carried out the goods to the disaster point. So all emphasis on the **role of donors** and their way to handle funds during disaster.

3.3.1.2 Empirical data during the development of potential means trough SCM to conquer Barriers

- (David, Simchi-levi, 2003) discuss about the techniques of supply chain management and effects of SCM to reduce uncertain situation. (Stock, Douglas M and Lambert, 2001) emphases the role of effective planning and cooperation with partner organization in order to reduce the uncertain situation. (Stewart Julia. 2003) describe the role of captain at port on debark who monitor the shipment and sort out unnecessary goods before shipment. So all three authors are providing solution to remove **uncertain situation**.
- (Donald F, Long and Douglas C, 1995) and (Stewart Julia. 2003) write about the role of local authorities which are first source of response unit that provide relief immediately. (Andrew S. Natsios. 1995) describes about the important role of local people who work in big rescuing organizations, as they know about the culture, tradition, religion and other information so that local manpower are best source of immediate response. So I can say all three writers are emphases on the **role of local's people and their participation in disaster.**
- (Stoddard, Bruce, James, 2003) study show about the appointment of senior and seasonal staff in order to remove coordination issues and respond disaster quickly. (Toby, Gooley, 1999) discuss about the appointment of one person with strong authority entrusted him or her hierarchy of ruling communication to run disaster activities effectively. So both studies show about the **decisive command and control.**
- (jose Rodriguez and Guha-Sapir, 2008) describe the significant role of committing assessments in order to know wants and needs of effected people during disaster. (Stewart Julia, 2003) describe the problems and local people involvement and concerns included in assessment. According to Stewart' studies through assessment it is possible to identify about the scope, capacity and intensity of the crisis so both writers give strong empirical evidence of **damage assessment.**

- (David, Simchi-levi, 2003) discuss about the collaboration among all humanitarian organizations to organize the objective with contribution of reward and risks. (John Snow, 2000) highlight the collaboration plays as source of motivation, and all humanitarian organization involved rescuing activities can be motivated to work for charity purpose. (Stewart Julia, 2003) write the consequences of collaboration that world Economic Forum (WEF) initiated a step to keep the record of engineering and logistics organizations that have experience to work during disaster. so I can say that all three authors emphases in the role of **collaboration and cooperation**.
- (Anisya and Thomas, 2003) writer and highlight the sharing of information, performance measurement and better data processing through trained manpower with better know how of tools and communication infrastructure. (Donald F, Long and Douglas C. 1995) discuss about the successful logistics operations through logistics information system. (Stock, Douglas M and Lambert, 2001) emphases electronically data interchange that enhance productivity of employees and reduce the cost and manpower of administration. So all writer in this phase emphases on **advance logistics information system(LIS)**
- (Donald F, Long and Douglas C. 1995) discuss about the role of military during disasters and admired about the capabilities to handle the complex operations. (Jeffrys, Barry and June, 2002) highlights the coordination between military and humanitarian organization but to use the military during disaster should be last option. So I can say that both are agreed to make a **good relations with military** and agreed to use military option whenever needed.
- (David, Simchi-levi, 2003) introduce the concept of risk pooling that is to organize the stock from various positions into only one centralized depot. (Helo, 2000) introduce another process which indicates to make a contract with various suppliers for smaller batch size and suppliers from diversified sources. (John and Coyle, 2003) highlights the concept to procure goods urgent basis that can fulfill the customer requirements. John and Coyle describe the importance of safety stock during disaster that provide the solution against uncertain demand,

Production matters and lead time etc. so I can say all authors in this section have common views on better usage of **resource management**.

- (Anisya and Thomas, 2003) describe the activities of distribution function is to tie down stream's process in order to keep away from the delays. (Donald F, Long and Douglas C. 1995) (Stewart Julia, 2003) highlights the role of third party logistics which can provide wide range to services regarding transportation, customer clearance and other documentation. (David, Simchi-levi, 2003) highlight some other view which is "gateway" the function of gateway is to provide the quick and rush orders quickly by neglecting the role of warehouse and other distribution centre.

3.4 Scope and Limitations

In this research there are some barriers such as political, regional and global. But in this thesis research there is no solution for the above barriers. This purely focuses on the study of supply chain management, humanitarian logistics and how supply chain management overcomes the barriers. During literature review, I analyze that now humanitarian logistics organizations have started to act upon the methods of supply chain as SCM gives salutation to remove the barriers.

Statistically and quantitative method were not too much suitable for this kind of research. As reviewing the literature review related to humanitarian logistics. I come to know that there is very little literature which is related to operational level humanitarian logistics. This research also invites other people who want to start career in supply chain or for the student of logistics or supply chain, they can make further work on different perspectives of humanitarian logistics, humanitarian supply chain and its improvements.

3.5 Finding Validation

The results of this research thesis would be validated through the utilization of technique for qualitative approach which discussed in Creswell and John, 2003. To validate this thesis research I will use the triangulation, negative findings or information discrepant **(17).**

3.5.1 Triangulation

As the research development is increased, the literature develops and sorts different barriers to effective relief aid and various solutions. For instance the “impracticable infrastructure” is quoted as barrier to effective aid in different sources. As many other writers describe and consider infrastructure as a barrier, so it gives validity to the thought that impracticable infrastructure might be a problem. So most of the sources suggest and support to utilize the substitute transport method to overcome infrastructure problem, as it gives credibility to investigate in this part of supply chain.

3.5.2 Negative findings or information discrepant

What is not found in your research, it becomes the limitation of your research **(35).**The focal-point of this thesis research is based on the style of the relief organizations and its response in an unplanned way. Conditions and situation where preparedness and mitigation programme are unable to offer immediately affected population **(1).**

Chapter 4

Literature Review

"Manufacturing now competes less on product and quality, which are often comparable and more on inventory turns and speed to market."

John Kasarda, forbes, October 18,1999

4.1 Supply chain

Life cycle processes consisting physical, financial, information and knowledge flows whose purpose is to assure and satisfy the prerequisites of end-user with products and services from multiple linked suppliers. **(14).**

4.1.1 Supply chain management

The management of upstream and downstream association with supplier and customers to deliver greater consumer value at less cost to the supply chain as a whole. **(24).**

4.2 The characteristics of the supply chain management

Houlihan (1986) has described the necessary attributes. **(31).**

- The supply chain is comprehensive process for providing material, goods and services to the ultimate users.
- Association of all parties, including logistics operations from primary material supplier to end or final user.
- Supply chain framework includes operations such as procurement, production and distribution.
- Management expands across organizational frontiers to contain planning and control over operations of other organizational units.
- Establishment of joint information system accessible to all members constructing possible coordination between organizations.
- Associated organizations attain their own individual objectives through the performance of the supply chain as a whole.

The supply chain is expanding the limitation of logistics concept and construct an organizational system with its own attributes. With linkage of operational unites together, supply chain management has to confronted with complete scope of supply activities such as production, procurement and distribution.

"Traffic managers become physical distribution managers, who then turned into logistics managers and today are morphing into supply chain managers."

Francis J. Quinn, Editor, Supply chain management review

4.3 Supply chain processes

Supply chain can be visualized through various perspectives such as manufacturer, retailer or end user. **McGrath and Hoole 1992** described the five operating processes.

- Product. Designing of product decide production procedure. So it determines the perquisites of transport and logistics, time for delivery and inventory system.
- Production. Production and connected operations and processes add value to flow of product. To determine how production would take place also influences the inventory system, logistics and time for delivery.
- Procurement. Phases of manufacturing together are linked with procurement and purchasing. Actually purchase department played role of production executives.
- Distribution. Through distribution, a successful link is created between market and production department together. So distribution process influences the logistics through rapidly changing requirements for efficiency and services.
- Demand Management. Market related activities are performed through demand management such as customer order processing process, collaboration with market, demand forecasting and sales support activities.

4.4 Logistics Management

"The procedure of planning, implementing and controlling the effective, cost efficient flow of goods, storage, work in process inventory, finished goods and flow of information from point of start to point of consumption in order to satisfy the customer requirements" **(34).**

4.5 Functions in logistics Management

There are various functions involved in logistics in the flow of product from point of start to point of consumption **(28).**

4.5.1 Forecasting

It is always very difficult to estimate unknown demand. To estimate unknown demand is called forecasting. Long-term forecasting and short-term forecasting can be used. Long-term forecasting might be purposed at forecasting various years of business cycles for the business industry, where as short-term forecasting may be aimed to make forecast of specific products for coming week.

4.5.2 Management of Customer order

Function of Customer order management participate activities of responding to an offer request, collecting and formulating delivery plans, order verification and the registration of customer orders in company's database.

4.5.3 Transport Planning

Transport planning is referred activities of transportation when external transport is necessary to move products outside. The activities includes the selection of means of transportation, routing, sequence of routing, loading plans, selection of place for loading and unloading etc.

4.5.4 Procurement

Procurement is very important to carry raw material for the continuation of production process. Function of procurement is commonly divided into two phases. Strategic procurement and operative procurement. Strategic procurement refer for nominating the suppliers and making a long term agreements with supplier and informing supplier about long term material needs. Operative procurement refers to identify the sourcing needs on much repetitive basis and making an ensure of deliveries taking place correctly according to the agreement.

4.5.5 Internal transportation and material handling

Material handling function refers to move material and goods internally within a factory from one point to another point. Reception of goods, arrival checks, and movement of material internally, stock picking, packaging of finish goods, marking and dispatching of finish goods to the specific points.

4.5.6 Production

Production function gives a product with real values. It can be manufacturing, which consists of activities that influences flows in a workshop. Production is not important specifically for manufacturing in a traditional sense. It can be sorting of tasks and activities of packaging.

4.5.7 Storage

To keep the goods and materials safely in a store and warehouse is called storage. It refers to the physical layout of the warehouse and its designing (consist of techniques and methods for where and how various goods will be stored). Inbound deliveries and withdrawals from a warehouse is a part of material management function.

4.5.8 Freight transportation

Fright transportation planning refers to transport planning. In freight transportation mode of transport is selected. Transport modes are based on road, rail, sea, air and combine multimodal transport solution.

4.6 Characteristics of humanitarian logistics

Differences between humanitarian logistics and business logistics can be recognized now. In business logistics there is set of demand, suppliers and identified manufacturing sites, where as in humanitarian logistics all the elements are unknown.

Irregular demand and supply process and extraordinary factors in emergencies are elements of humanitarian logistics. Humanitarian logistics deals with people suffered from natural disaster or man-made disaster. There is no clear and stated linkage with reality and facts in humanitarian logistics. In humanitarian logistics all operations are done for one mission that is to save human beings and their infrastructure. Humanitarian logistics operations are performed in a uncertain situation and destabilized infrastructure with lacking of less electricity to minimum transport infrastructure. Most of the disaster is unpredictable to happen, so there is also no determined demand in humanitarian logistics. Large amount of material and goods have to push to the disaster location. **(12).**

Table 1: Humanitarian Logistics characteristics

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

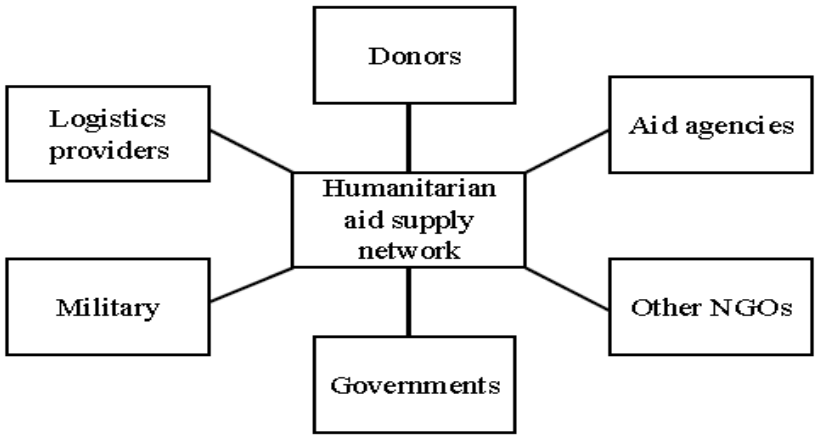
(Gyongyi Kovacs, Karen M. Spens, (2007) **(12).**

So in the above table shows the characteristics of humanitarian logistics, however, many characteristics may be associated with diversified types of emergencies.

4.7 Actors involved in the network of supply in humanitarian Aid

In humanitarian logistics there is no issue about profitability. In commercial logistics there three process including, management of demand, supply management and fulfill management. But here in humanitarian logistics many actors are involved to benefits of satisfying demand **(12).**

Figure. 2 Actor in supply network of humanitarian aid

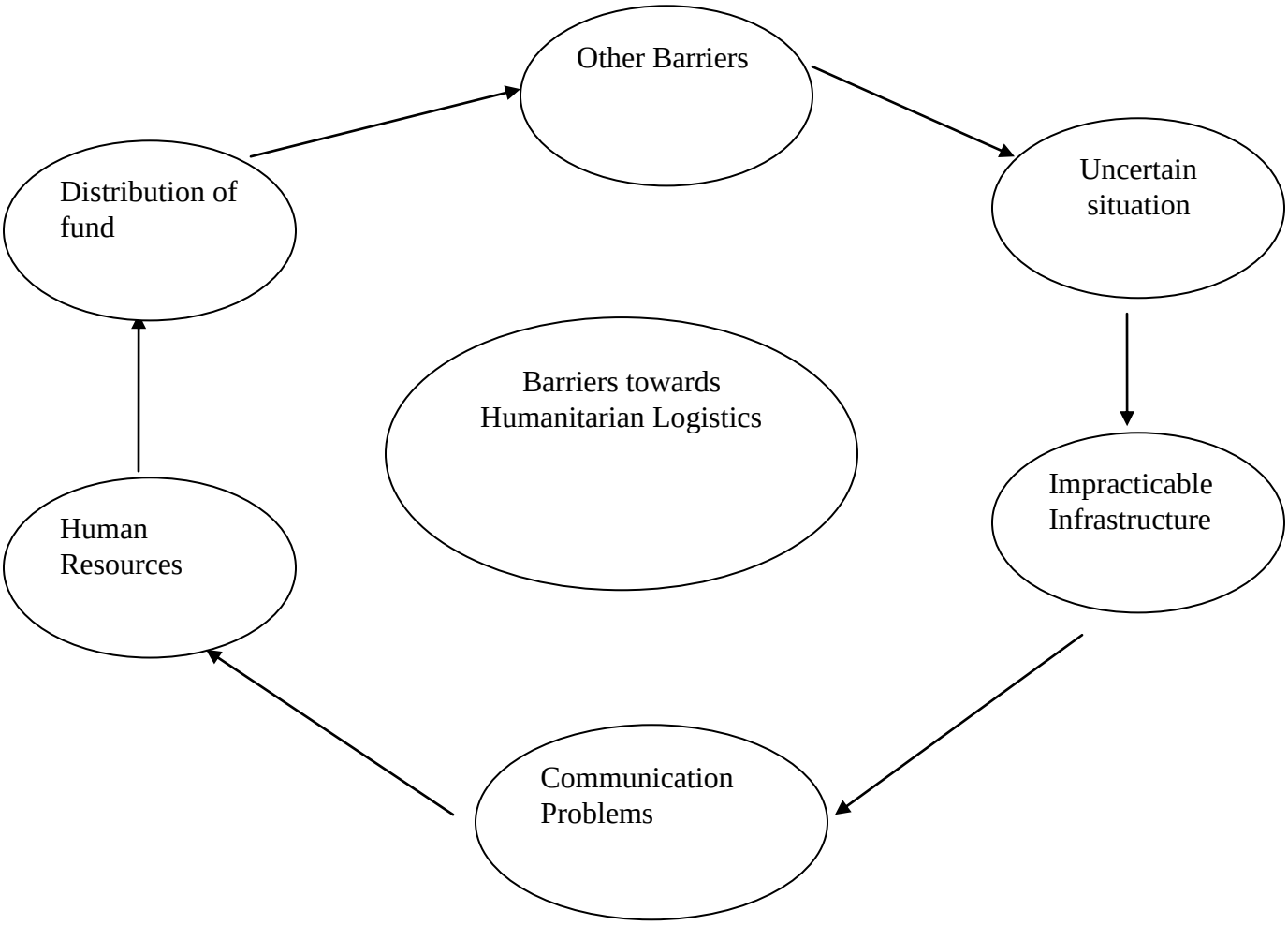


(Gyongyi Kovacs, Karen M. Spens, (2007) **(12).**

Chapter 5

Findings

Figure 3: Proposed Model for Barriers towards Efficient Humanitarian Logistics



5.1 Significant and critical requirements for immediate response

Humanitarian logistics have a vital and essential role in making of response and recovery phase during disaster. There are different resources which are more useful and valuable during disaster and these are also needed for the affected people in order to save their lives and sustain them until the initiating the rebuilding. So those critical and significant resources are following: "hunt and evacuate, rescue, food stuff, medication, facilitation of electricity, sheltering, pure water facility and blankets etc" **(30).**

In this way, the significance of logistics about disaster response can not be neglected. So it can be said that without the fastest preparation of Supply chain techniques for rescue resources, the effects of the disaster will be demanded highly damaging for the people.

5.2 Barriers towards Efficient Humanitarian Logistics

Following elements impact very negative on logistics that are involved in humanitarian purpose.

5.2.1 Uncertain Situation

Indecisive situation is big task in humanitarian logistics. As there is no conformity that when disaster will hit, how many people will become victims, what infrastructure will remain, what type of aid and supplies will be required. For instance during disaster uncertainty may come into existence and arise that what type of material and goods required, how much it would be need **(39).**

There are also some other elements which creates the uncertain situation such as; culture, poor information consistency, complexity in decision making, lengthy forecast prospects **(39).** If we see supply chain in relation to disaster, in a broader view we come to know that supply chain is much bigger and globally expanded, man-made and natural disaster both type disturb the supply chain **(7).**

But if we see commercial type of logistics, there is expected demand, all accessible information and data is available with cooperation among partners is full. The business of logistics to flow the relief goods is extremely irregular. We can see uncertain situation, when benefactor and donors declare disaster necessities and manpower in unnecessary

and incorrect kind. Inaccuracy in quality and quantity it takes time to assemble and sort out in a proper way. “At the time of disaster when rescuing organizations and other people trying to help and rescue the victim, they have to confront with unpredictable condition which creates logistical problem unconsciously” **(37).**United nation disaster programme (DMTP) describe that many disaster goods and material go through different countries demonstrated to be unsuitable and unnecessary which may be a barrier to effective necessary goods delivery **(38).**

5.2.2 Impracticable Infrastructure

Unusable transportation system and poor communication is also another barrier to efficient delivery of good. According to the DMTP, the success factor of humanitarian logistics depends on the extended level of investment in transportation and communication system and to what extend relief prerequisites has been regarded in planning **(38).** The intensity of disaster can harm the country’s existing infrastructure to the point where the transportation of humanitarian goods is to start. Sometimes the infrastructure of transport is extremely damaged and unusable circumstances and condition as it is impossible to carry on large number of refugee, vehicles, relief goods and shipments which have to send to the disaster locations **(37).** The logisticians should keep in mind about another option such as trucks, aircraft, rail and road. But same time it could possible that those routes may be blocked **(10).** which Every logistician has to deal with but after overcoming these barriers aid has to send to the victims of the disaster.

5.2.3 Communication problems

Degraded communication is also major barrier to effective delivery of disaster necessities. It creates an obstacle to take each other with diversified languages. Moreover during relief activities the existence of natural disaster can harm the communication infrastructure. So as a result teams and manpower engaged at disaster site have difficulties to make connections with their headquarters.

Long and Douglas C describes that language diversity may harm and slow the speed of delivery of materials. Every organization have different mind set to analyze and estimate

The situation, for instance few organization estimates a need on family basis, and few analyze a need per person basis. number of organizations use various and diversified terminologies for the delivery of disaster necessities and supplies, then as a result inter organizational relationships become more challenging then joint rescue effort instead of a foundation of support **(6).**

This is lacking in all organizations to coordinate together during disaster response and situation become more critical and worse with the presence of disputes among organizations, those reluctant to contribute information with each other that leads to the duplication of effort and wastage of all resources **(30).**Problems in communication also existed when the effects for the disaster leads towards mitigation. At the end of humanitarian logistics operation the deficiency of funds restrict the recording of best supply chain and logistics issues during disaster period in order to understand and analyze the success, opportunities and Failures **(22).**

5.2.4 Human resources

Undersigned training for personnel involved in disaster operation can affect logistics operation. Experts and field officers have to deal with large number of requirement during humanitarian efforts such as demand (wants and needs) from affected people,

Local government polices, stress from media and retractions from donors on the methodology how to deal with aid. There is a lack of managers and manpower who posses the abilities and skills in supply chain and logistic **(2).**

Mostly people have less knowledge and experience about logistics because they belong to those agencies or organizations which are involved in development process and these employees have background only in policy, strategic, planning or development. So it is difficult to find such people who are actually belong to humanitarian logistics or supply chain field **(6).** When natural disaster occurs, at the beginning humanitarian organizations of the affected country come forward along with different volunteer groups and organizations privately. Some other local or international development organization for initial rescue or evacuation. Especially youth involved in volunteer groups are not educated and much trained to deal emergency situations **(5).**In America the youth who

Participated in disaster operation is called “Private volunteer organization” where as rest of the world use this term as “nongovernmental organization” NGO (1). Impulsive nature of disaster creates a difficulty to employ the trained manpower. As far as volunteer staff is concerned they return back to their permanent position or job, as they serve for a short time.

5.2.5 Distribution of Funds

Another main barrier countered by the logistician’s officer and logistics staff in rescuing organization is comprehensive authority. Influence from donor in order to make a check and balance system with donated aid and makes ensure where and how the disaster material and good is being distributed **(5).**

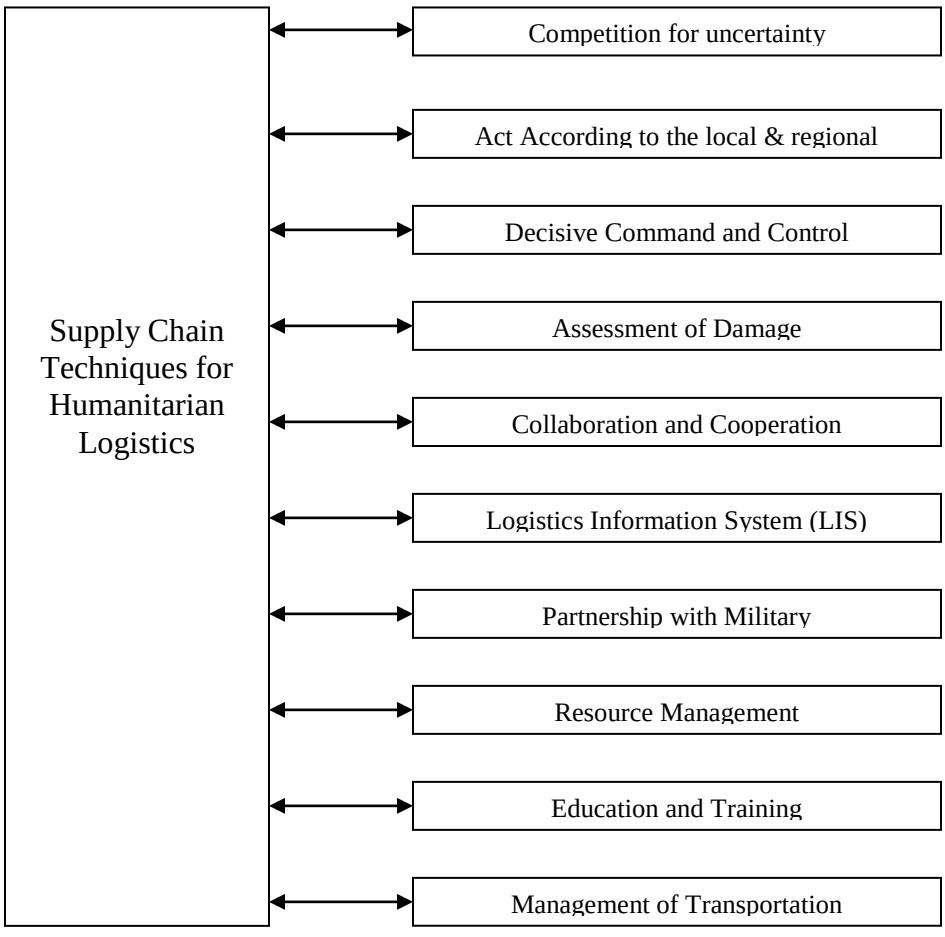
There are some factors through which distribution partners have to suffer as communication infrastructure, trained employees, appropriate equipment and warehouse facility to keep the aid goods safe and sound. There are disaster necessities available but due to various limited features in the distribution procedure, as humanitarian organizations are not in a position to deliver effectively. So most of the organizations are reluctant to push investment in information system in order to make a speed, accuracy and improvement **(6).**

Earmarked funds are purely for the affected people caused by the disaster. But there is no support for equipment and service support for the planes, trucks and vehicles carried out the aid and disaster necessities **(6).**Problems related to political and administrative perspective has triggered among propositions for logisticians, as earmarked funds directs and focuses the rescuing agencies to deliver the much disaster necessities to larger number of affected people but not focuses on improving the logistical operations **(6).** So donor’s earmarking about funding how disaster goods and materials distributed has restrained fastest process of humanitarian activities and relief works too, as they feel that aid goods can be stopped or postponed if donors requirements would not meet.

5.2.6 Other Different type of barriers

Every country has diversified food habits according to its own climate and culture. For instance some Muslims countries do not eat pork made products, where as non-Muslim countries eat pork products. So it should be carefully observed so that all segments of affected people can be satisfied, because food is very basic essential during disaster **(30).** There are some packaging standards as grain bag should be at least fifty kg. Because it is easy to carry for one person instead of bulky size. Temperature and moisture is big issue to sustain the quality of a product. Especially medicated goods such as medicine, blood and equipment related to medical needed special temperature and moisture implications. Difficult procedure of custom clearance and several documents are serious barriers. Accountability measure should be implemented strongly as disaster material travel from one country. Carrying good from one place to other place required movement, which can be easier if it can be tried to make collaboration with local government for special permits on disaster related movements **(36).**

Figure 4: Proposed Model for Barrier Conquering for Humanitarian logistics



5.3 Barrier Conquering of Humanitarian logistics through SCM

The purpose of supply chain management is to deal with suppliers, manufacturers, warehousing, internal and external transportation services, customer services and customer satisfaction, so that products can be delivered to right place, right time and right amount of quantities in order to satisfy the customers through efficiency and effectiveness **(7).** SCM is based on system theory, which allows managers to bring betterment and improvements into whole supply mechanism for all distribution networks. SCM also makes a connection among suppliers, vendors and end user of the product **(16).** SCM have characteristics which includes the information flow, customer service, customer relationship, estimation of inventory level and improved relationships with all partners **(16).**The manager should be aware of the following information such as; government polices organization emergency goals for disaster, donor's objective and polices security issues and proper check on disaster goods and material.

Council of logistics management (CLM) has defined five stages which will overcome the disaster's effects on supply chain and continuation of supply networks into the commercial sector. Simple, clear, well defined planning, appropriate mitigation tools, response and recovery are the stages described by CLM. He put mitigation on critical elements of the organizational supply chain such as production facilitation, network of suppliers and transportation, infrastructure, communication, pure water, electricity and other important and critical services **(27).**

Through well defined planning, it is possible to identify the critical area and vulnerability. Effects of natural disaster can be reduced through mitigation. In a broader sense it can be possible to review the countries which are more suspicious to disaster. Above discussed five stages of CLM can move from commercial to humanitarian and emergency humanitarian response. So now barriers which were uncovered and unsolved, here I will try to discover some solutions with selected review of SCM.

5.3.1 To compete the uncertain situation

Uncertainty has various sources. It is difficult to remove uncertain situation completely. SCM techniques can decrease the effects of uncertain situation **(7).**

There is also a method to utilize the information to predict the supply and demand. Effective planning and cooperation with partner organizations supports to tumble the uncertain situation **(34).** Inconsistent supply can make more complication and create worse situation. Stewart writes that it is possible to mange a wrong type quantity, World food programme (WFP) makes a use of captain at port on debark point to monitor disaster goods and materials and make a separation of useful materials. So in this way it is possible to eliminate the unnecessary material at the port before shipped **(36).**To sort out disaster supplies and necessities in the pipeline, which are more valuable and useful, then making a transportation of those necessities for the people affected by disaster. Even it is better if the effected country estimate and make assessment about basic commodities which are at the highest priority, then only those required materials should be transported which is highly valuable and constructive, because it was based upon the assessment and appraisal from effected country **(30).**

5.3.2 Act according to the local or regional scale

There are various authors they write about the authorities at local level, these local authorities are first source of response to provide relief for people caused by the disaster **(30) (36) (6).**

Through this process by involvement of local government, the effected people do not feel any hesitation which they can feel cultural differences from foreign mission. Economy of locals can be boosted up and local people can get a chance of employment. With the involvement of local bodies it is possible to be safe from foreign involvement and most of the logistical procedure which considered a burden can be minimized. Storing activities can also be minimized.

Sourcing for aid goods at local level can enhance the pride and self-respect that all humanitarian activities are being continued locally. On the basis of local's opinion about

the demand for aid, which often is more accurate and through it logistical planning also improves **(6).**So it is more recommend that logistical policy should be formulated at the regional level rather then globally at headquarter. Another benefit which is examine that every large scale development organization have some little manpower from effected country these work force are main source of knowledge, culture, traditions, religions and immediate information of people located in disaster areas **(1).** For these reasons the local level NGOs are given priorities and entrusted them with large number of disaster and humanitarian activities. Natsios is agreed that local NGOs can provide basic relief items which are so essential for life **(1).**So it is highly recommended that both regional and national level is robust means to deal with relief activities and also set a certain course of actions effectively and efficiently.

5.3.3 Decisive Command and control

It is considered that through improved communication, command and control can be possible to manage effective supply chain. Better communication and coordination can minimize the chances of variances come a crossed through the supply pipeline. Gooley suggested by appointing one person giving authority with strong and strict level of hierarchy based on ruling communication, doing all operational process and decisional authority **(37). "**Human coordinator can be utilized to make possible arrangements of communication and coordination. To appoint the senior and seasonal staff just for the sake of coordination and to react to crisis immediately" **(32).** In this way a chain of commend and control will be established and all responsibilities will be done through proper channel. Under commend and control it is possible to focus on one mission which will help to victim people as quickly as possible.

5.3.4 Assessment of Damage

Forecasting and information can be obtained from conducting valuable assessments. There is vulnerability assessment which means, a group of specialists are sent to the suspected region to document the response capabilities of locals, population status, demand and supply identification and infrastructure. Stewart says that there is an

involvement about analysis of issues, problems and local people concerns included in the assessments, although assessment are based to get basic understanding of supply and demand of the food stuff required by the victims of the disaster but also to know much about the scope, capacity and intensity of the crisis **(36).**Initially if no humanitarian relief personnel are there at disaster location, another assessment squad can be positioned to prepare initial report in order to provide right aid to the right people. After it when humanitarian organization experts arrive there, then with the help of reassessment mistakes can be removed.

Assessment usually consists of certain course of action, such as preparedness planning, data gathering, survey analysis, forecasting determination of reports and monitoring of activities. So information regarding above segments are required to obtain in order to unfold the above described elements. There are also certain methods of data collection by live visualizing and situation interviewed by the people. Collected data and information are so helpful for future development program and appropriate course of action.

By conducting assessment, all rescuing and life saving organization can prepare appeals and announcements for the particular type of wants and needs (e.g. food, medicine, water and supplies etc.) For future **(21).**

5.3.5 Collaboration and Cooperation

Collaboration is very important and significant tool of humanitarian organization during disaster. Collaboration of strategic joint venture among organization to obtain and organize the goals and objectives by contributing both reward and risks **(7).** Collaboration with other partner organizations for the purpose of purchasing and delivering the disaster necessities and aid goods. So by collaborating organizations will be in a position to bargain and get discounts because of the large quantities and material are required for each transaction.

During disaster it is most suitable to make a better collaboration by combining and conducting several organization's best potential and capabilities. Collaboration also works often as a source of motivation, for instance collaboration among venders, retailers, transporters and other carriers can be motivated them for humanity and charity purpose

(19). James Kunder describes that "a large and strong capability of the private sector in America either profitable firm or non profitable firm is a part of American government to improve human anguish when war end **(20).**He said that cooperation and collaboration between private (civil) and military was robust key of success to response quickly after gulf war second. In the network of disaster resource, World Economic Forum (WEF) initiated to make a record of engineering and logistics organization that have a experience to work in disaster situation and also those firms that have interest and passion to work more if disaster occurs in future. It is all from the result of collaboration **(36).**During disaster diversified organization works and every organization operates under different command and control at disaster location in order to provide facilitation for affected people and infrastructure. So coordination also attempts to prevent repetition of

Efforts among different aid and rescuing organization. Valuable coordination started before a disaster take place and carry throughout the event. Coordination is generally observed in an affirmative way. In the continuity of modification of natural disaster and man-made clashes constantly shapes new and diversified challenges, so coordination issues occurs again and again. Many writers argue that coordination is signification factor, because of potential achievements in program effectiveness as there is no harmony on what is meant by effectiveness.

5.3.6 Logistics information system (LIS)

Logistics information system has played a vital role in enhancing the coordination and collaboration among all partners. LIM involves a contribution of combine training, learning and capacity to store the data which is more valuable in maintaining an inventory level and forecasting of demand. Logistics information system is powerful factor in order to determine the successful logistics operation in emergency **(6).** United nation maneuver clearinghouse on internet called as "World Food Programme" and "the relief web" where as world Economic Forum (WEF) runs the "Disaster Resource Network".

Natsios describes that NGOs working on big scale have created information system, estimation and control system among various private organizations in order to monitor

and evaluate the performance of its projects **(1).**The essential purpose of electronic data interchange is to enhance productivity of employees, decrease the cost and manpower of administration, enhancement of information transformation, developed accuracy due to the fewer manual handing and improved level of inventory **(34),** Regular get-together with partners, consistent updates of website and communication greatly benefits the world food program of distribution network in Africa **(36).**But On the other hand if reporting is not timely happening, manpower is not trained to utilize the tools, infrastructure of communication is degraded then all system containing. Performance measurement system, sharing of information and data would be ineffective **(2).**

A recommended and strong information system facilitates the prediction methods based on the rate and intensity of previous disaster events and provides support to limit the irregularity experience in humanitarian mission. Logistics information system also recognizes the supply chain's strengths and weakness. Proven performance can be appraised and can be used as a gauge for formulating polices and practices. For instance "some indications from logistics system functions are to make a comparison of actual lead time with lead time (expected), frequency of emergency orders and stocks **(19).**

5.3.7 Partnership with Military

Military forces play a vital role during response and provide basic disaster goods and source for rapid response. it is also another type of collaboration due to the moral and political allegation of utilizing a non-neutral party in a humanitarian efforts. Military can play such specific roles which other humanitarian organization can not perform such as better information circulation, using of airlift if other options are not working, temporary construction of bridge and roads to carry relief goods, sanitation and security too. "Security and emergency response are two main stream capabilities of military. These two factors and tasks which humanitarian organization never met. Military has capabilities in complex operation and off course mission oriented **(6).**It is important that on the basis of objectives and goals, military and humanitarian organization should be settled down and to use military option should be the last option **(15).** The association between military and humanitarian organization has increased much importance,

exposure and potential. This association has enhanced the capacity that provided to increase the military' value for innovation and dedication for NGOs **(29).** It is important to classify the roles and responsibilities of military partners because military most of the time misses the objectives and mission statements **(1).**It is also important to say that military plays a vital role in order to provide relief activities effectively under the golden role of collaboration.

5.3.8 Resource management

The aim of the logistics network is to acquire the resources such as expertise, supplies, equipment then make it ready to deliver at the point of consumption (disaster location). To acquire the supplies and services is a base for assurance of demand. Procurement should be met the affected people's demands. Purchasing department should base the actions that are very necessary to procure the goods and services depend on the people's requirement **(16).**

Procurement process consist of following element such as; recognize the needs, classifying user prerequisites, taking the decision whether to make or purchase the services or items, choose how the items will be acquired, searching for market and venders, capturing the delivery and making a appraisal for the purchase **(16).**

Selection process of supplier is important as it leads to the construction of consistent and approachable channel. While at the time of purchase, logistics manager should keep in mind about the excellence of the product, worth, capability and strong financial background of the supplier and various enviable qualities (hidden cost etc) **(16).**To make a demand forecast is a common approach to remove the uncertainty about the demand, but it is whole correct, if consequences of the uncertainty are same, so organizations and companies establish the safety stock to safeguard from the uncertainty **(16).** Safety stock provides the solutions against the uncertain situation, variation in a production, lead time problems and giving a minimum level of stock to save stock outs under the supply chain disorders **(16).**

These above concepts can support to handle the unforeseen demand and undesirable events. There is also a danger or risk about the disaster necessities that might be positioned mistakenly at the wrong area, so it needs extra transportation sources to deliver the aid material whenever it is required elsewhere.

Another inventory management technique is risk pooling, which is utilized to combine the stock from different positions into only one centralized depot. The main benefit of the risk pooling is to make lower the inventory level as retail outlet do not have inventory to maintain the safety stocks separately. As result of risk pooling, there is enough time to reach the demand of the goods by consumer whenever consumer required **(7).** There is another inventory management process which allows contracting various suppliers with smaller batch size of goods and supplies from diversified sources, because large batch size, that creates problem such as long lead time etc **(13).**Small size batches are very easy to handle, produce and deliver.

5.3.9 Education and training

Any change in system or procedure requires some special training programme in order to generate the awareness and knowledge **(19).**Whenever change in organizational structure takes place, employees have to equip with the followings, **(19)**knowledge, explicit skill and approach

- mental and emotional potential and ability
- high motivational level
- information about equipments in order to perform the specific job
- self-esteem, incentives and rewards

Specialized manpower is the major elements for any of the successful organization in the world. Because without knowledge and special skills it is difficult to handle any organization or to face latest problems in the world.

5.3.10 Management of Transportation

Distribution function is a part of system management. The activities of distribution function is to tie with the process of down stream to keep away from the delays at handoff points in the network of logistics **(2).**There is quickest transportation process which permits to keep low level inventory because of more responsive system. Delay and setback can be minimized if system is combined in its distribution plan. Transshipment is another transportation method, which allows keeping and sharing inventories among all partners, as it distributes a load on transportation just to move the materials more then one place according to the need **(7).**Disaster necessities can be delivered through direct shipment. According to the commercial point of view, requirements for the emergency (direct shipment) can be emerged due to quick and rush orders from end users, that is normally needed from the "gateway" stock in order to ensure and maintain the customer service Level. The basic idea or purpose behind this concept just to facilitate the big suppliers and manufactures to ignore the warehouses and distribution centers **(7).** By selecting efficient third part logistics and freight forwarders, it is possible to get rid of the heavy and frustrated method of documentation and custom clearance procedures for the transportation of disaster necessities and aid goods **(36) (6).** Another plan which allows making a cooperation and collaboration with manufacture to design more compressed, solid and more focus on packaging so that it can reduce the transportation weight and safe guard from the diversified environmental conditions **(6).**

Chapter 6

Analysis

In this section of results and analysis, I will analyze the barriers to humanitarian logistics with possible potential results. I will also examine the role of Supply chain techniques to deal with barrier faced by the humanitarian logisticians during disaster. Here may be solutions can handle more then one barriers because of broader perspective of supply chain management.

6.1 Supply chain's Implications in humanitarian relief

Although possible suggestion have been discussed, but in this section I will try to be more specific towards solutions from supply chain perspective. Actually each main barrier has further more sub-barriers, so in this phase I will find answers to those sub-barriers too. Barriers discussed in literature review such as Uncertain Situation, Impracticable Infrastructure, Communication, Human resources, Right Allocation of Fund and other various sub-problems have been uncovered through literature review.

6.1.1 Uncertain Situation

Uncertain situation during natural disaster, there are also sub-barriers in uncertainty such as, unforeseen demand, unpredictable supply and illogical processes.

There are certain issues in unpredictable supply, which are mainly lead time, quality of aid and quantity. So SCM suggests retaining goods, equipments and labor staff locally **(6).**Through coordination and collaboration problems about the uncertain situation in demand can be solved **(7).**As coordination among partners engaged at disaster information can be discussed in order to provide right quantity and quality of disaster necessities **(33).**Contingency planning can also be utilized to determine the demand and supply of materials in disaster. Military can also bring down the lead time by using the airplanes for airlift the aid quickly and timely **(6).**

By bringing investment into distribution system, we can remove uncertain situation in supply **(6)** as developing administrative and logistics section parallel to monitor all activities, if above function unexpectedly fail to work these parallel system can work out without any dis-connectivity.

Direct shipment can be best option if any problem occurs at port **(7).** Establishment of Warehouses near to disaster area would be best service point to deliver the goods effectively **(6).**Assessment tool is very useful to recognizing the demand information through analyzing the loss and interviewing through direct people caused by the disaster **(36).**Accurate local sources can also direct to the humanitarian organization what actually they want to get or what are their basic needs. Through proper information from local aid agency uncertain situation in demand can be minimize **(6).**By sharing information and data to each partner organizations, identifying each other objectives and goals, analyzing performance measures and creating better networks to each other are best practice to help out the effected people effectiveness and efficiency **(2).**

6.1.2 Impracticable Infrastructure

There are also sub-barrier of impracticable infrastructure such as communication lines, warehouses, road, airstrips, etc. these sub-barrier are damaged by the disaster **(38).**So it creates hurdles and obstacles to carry out the logistics activities by humanitarian organization. These obstacles can be addressed to the procurement department and services can be retained from locals **(6).**

Military can give alternative route plan to delivery the aid goods if the roads are damaged, shipment can be carried out through **(6).** Partners can also seek other transportation plan to reduce the pressure and burden as well. Local purchasing can be done, the same things which are being imported, it takes time and cost too, so same things procured locally or nationally can save time and cost **(6).**Especially if transportation arrangement might be ready from local supplier or vendor as they know about the area very well under the circumstance when all infrastructure is damaged **(1).**

6.1.3 Communication problems

Communication problems occur as result of reliability of information and bad coordination. At disaster place various organization are working together, these organizations have almost one motive to help the needy people but these humanitarian organizations belong to different countries and diversified cultured people and manpower ,so they speak different language which become barrier and leads to lack of coordination and collaboration **(6) (30).**

With the utilization of logistics information system principle which allows to make a common data base and regulate the information transfer **(34).** Partners can make a collaboration In advance to work properly with cooperation **(7).**If there is a lack of information, it is also a communication problem. Through existed common information, Poor information and coordination can be tumble down **(6).** An appointment of coordinator with authority and looping the roles can facilitate the collaboration and coordination **(32).**Partners should jointly define the performance indicator and measures. Training of employees to get know how about the system is necessary and can be possible through logistics information system **(6).**

6.1.4 Human resources

The success of relief activities and mission is relying on successful human resources. But training and turnover at high level is mainstream sub-barrier in human resources **(2).** Supply chain management indicates and suggests that automation in data transfer has faster aftereffects and also propose to trim down the manual input to data system **(34).** Implementing strong LIS would make trouble-free but special training is required for employees so that they might understand the significant of inserting correct information into the system **(19).**In this way right disaster necessities and aid goods will be in range for right people. With introduction of recognition and reward the work is much valuable for the whole supply chain and it is highly related to high turnover **(19).**

6.1.5 Political affairs

Political affairs are important barrier during disaster. Because you are going to some specific country and you have to following rules and some restrictions. Earmarked funds posses vital supply chain connotation as it decrease the flexibility to devote and invest in important and significant logistics infrastructure that leads to slow down the logistics process as well as humanitarian relief too **(6).**

Donors have some conditions on the usage of fund, some humanitarian organization has to follow those rules which can lead towards slow process in logistics and some time creates delay **(5).**Supply chain management suggests that through collaboration and negotiation with donor can provide a chance for efficient and effective relief operation. Organization should concentrate more on core abilities and move toward the relief mission in combined manner **(7).**

6.2 Other Different type of barriers

Definite dietary necessities are also problem faced by the humanitarian logistics and affect the process of logistics **(30).**But contingency planning and procurement of food stuff from local companies are best options. By developing a Safety stocks of food nutrition as flour, grains and food preparation oil etc it can be possible to overcome on food related problem **(16).**

Packaging is also problem and some how requirements. Again contingency planning and collaboration with local suppliers can solve these problems, because local supplier can make a packaging according to the requirements **(6).** Robbery and shrinking of disaster necessities is also barrier to humanitarian logistics. More safe and secure warehouse can reduce these problems **(6).**Proper tracking and tracing by the utilization of LIS, chances to reduce the robbery and shrinkage of disaster goods **(34).** Documentation of transportation and custom clearance can be solved through selecting third party logistics. By acquiring the services of third party logistics, documentation, custom clearance and host government requirement related transportation can be solved. **(6) (36).**

Chapter 7
Conclusion

7.1 Significant for the current research

As in this thesis report I put effort to utilize the supply chain techniques in a relief, rescue and humanitarian field. So I put stone for further research in the field which should be more relevant and useful for practical purpose. As I worked in Taq Freight Management in Pakistan which provide logistics and supply chain solutions for industry, so now I will be in position to tell them how Taq Freight Management can implement its supply chain solution in humanitarian sector.

For the humanitarian logisticians, supply chain management is much significant as humanitarian logisticians can increase operational effectiveness, efficiency and saving the cost through better preparation, coordination and collaboration. So at the end I will just say that humanitarian logistics mangers can make a faster, efficient, accurate and effective delivery during disaster by adopting SCM methods.

7.2 Future Research

I think to continue the same idea as to utilize the supply chain for humanitarian logistics purpose. Surveys, field interview with affected persons and interview with supply chain experts for humanitarian logistics should be conducted.

We can make a research how supply chain techniques can be implemented to delivery goods to Afghanistan and Pakistani northern parts. Difference between commercial supply chain and humanitarian supply chain can studies for holistic view. How military can implement supply chain elements during disaster as in third world countries, where military is main source to rescue and evacuate the effected people initially. So the above questions can bring new horizons for supply chain management in humanitarian logistics as well as humanitarian relief activities.

7.3 End Comment

At the end I can say that supply chain management has vital role to make improvements, saving the costs, using various sources to fulfill the needs immediately during disaster. I will also recommend these finding and results for Taq freight management in Pakistan so that they might expand the business as well as put foundation by giving the services of supply chain to humanitarian organizations during disaster.

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