



**A TECHNOLOGICAL BUSINESS MODEL FOR FAIR  
DISTRIBUTION IN HUMANITARIAN AID SUPPLY  
CHAINS: A SYSTEMATIC LITERATURE REVIEW**

**FATIMA EZZAHRAA ZELMATE**

Master's Thesis

Graduate School

İzmir University of Economics

İzmir

2021

**A TECHNOLOGICAL BUSINESS MODEL FOR FAIR  
DISTRIBUTION IN HUMANITARIAN AID SUPPLY  
CHAINS: A SYSTEMATIC LITERATURE REVIEW**



**FATIMA EZZAHRAA ZELMATE**

A Thesis Submitted to

The Graduate School of Izmir University of Economics

Master Program in Logistics Management

İzmir

2021

# ABSTRACT

## A TECHNOLOGICAL BUSINESS MODEL FOR FAIR DISTRIBUTION IN HUMANITARIAN AID SUPPLY CHAINS: A SYSTEMATIC LITERATURE REVIEW

Zelmate, Fatima Ezzahraa

Master Program in Logistics Management

Advisor: Assoc. Prof. Dr. Aysu Göçer

Co-Advisor: Assoc. Prof. Dr. Özgür Özpeynirci

February 2021

Humanitarian information management is becoming clearly apparent in the crucial role of shaping a fair humanitarian assistance and making decisions effectively. The emphasis of this study is on the fairness of the distribution of aid and the latest technologies as a possible answer to the lack of fairness in current humanitarian aid delivery. The inefficiencies that are currently holding the effectiveness of the humanitarian aid supply chain are outlined in the literature review. Three separate key chains are split into the supply chain: donors, intermediaries and recipients. The problems encountered in each unique chain are analyzed. This study highlights technology and its potential for the humanitarian aid industry. In addition, developing a technological model for fair humanitarian aid supply chain is aimed in this thesis.

A systematic literature review is carried out as a method for extracting aid flows connecting humanitarian supply chain partners; to help build a technology driven humanitarian aid business model; a model to be supported by the latest technologies. This study brings as a result potential that has the technology to support our model in order to improve the transparency and decision making among the humanitarian aid supply chain partners hence provide a fair humanitarian aid distribution.

Keywords: Humanitarian Supply Chain, Relief, Fairness, Information Sharing, Coordination, Transparency, Technology.



# ÖZET

## A TECHNOLOGICAL BUSINESS MODEL FOR FAIR DISTRIBUTION IN HUMANITARIAN AID SUPPLY CHAINS: A SYSTEMATIC LITERATURE REVIEW

Zelmate, Fatima Ezzahraa

Lojistik Yönetimi Yüksek Lisans Programı

Tez Danışmanı: Doç. Dr. Aysu Göçer

İkinci Tez Danışmanı: Doç. Dr. Özgür Özpeynirci

Şubat 2021

Günümüzde insani yardım bilgi yönetiminin kararların etkili bir şekilde alınmasında ve adil bir insani yardımın sağlanmasında önemli bir rolünün olduğu açıkça ortaya çıkmaktadır. Bu çalışmanın önemi, mevcut insani yardım dağıtımındaki adalet eksiliğine karşı adil bir yardım dağıtımını öne sürmek ve en son çıkan teknoloji fırsatlarındanda faydalanmak üzerinedir. Bu çalışmanın literatur taraması kısmında, insani yardım tedarik zincirinin mevcut olan verimsizlikleri hakkındaki araştırmalara yer verilmektedir. Bağışçılar, araçlar ve bağış alacak kişiler bu tedarik zincirinin uç ana kilit noktasını oluşturmaktadır. Her bir zincirde karşılaşılan sorunlar kendine has olarak analiz edilmektedir. Bu çalışma, teknolojinin insani yardım üzerinde önemli bir etkisinin olduğunu vurgulamaktadır.

Buna ek olarak, bu çalışmada insani yardım tedarik zinciri için teknolojik bir model geliştirilmesi amaçlanmaktadır. En son teknolojilerle desteklenecek, teknoloji odaklı insani yardım iş modeli oluşturması için insani yardım tedarik zinciri ortaklarını birbirine bağlayan yardım akışlarının ortaya çıkarılması için sistematik literatür taraması gerçekleştirilir. Bu çalışma, insani yardım tedarik zinciri ortakları arasında şeffaflığı ve karar alma sürecini geliştirmek için çalışma modelimizi destekleyecek uygun bir potansiyele sahip teknolojiyi geliştirmektir, böylelikle adil bir insani yardım dağıtımını sağlanabilecektir.

Anahtar kelimeler: İnsani tedarik zinciri, yardım, adalet, bilgi paylaşımı, koordinasyon, şeffaflık, teknoloji.





To My Parents

## ACKNOWLEDGEMENTS

This thesis is a real test for me. Since I am not familiar with all areas of the humanitarian aid supply chain, it is hoped that the introduction of systematic assessment will lead to the continuous learning of new things and the development of new knowledge acquired. Although I sometimes ask myself if I am suitable for this job, I am very happy to have succeeded and I am satisfied with the knowledge and skills that I can develop.

I thank both my advisors Associate Prof. Dr. Aysu Göçer and Associate Prof. Dr. Özgür Özpeynirci, for helping me to finish this study. I would like to express my gratitude to Ms. Aysu, because she did not give intelligence experts the opportunity to handle this analysis, nor did she give her the opportunity. I want to thank Ms. Aysu for her open attitude and quality response. Your command of systematic criticism is very important when considering the method of a systematic review and subdividing it into natural progression. I am thankful to Mr. Özgür for keeping me up with the latest humanitarian articles. Also proposing recommendations and strategies for better conduct of methods problems. Without which, this analysis wouldn't be the same as Representative analysis, as I believe it will be. I admit that, for me, the best option is to get to work with researchers, who had previously worked together, as well as advisors, as this contributed to a cohesive research approach and therefore a more comprehensive view of the aims for me. Eventually, I would like to thank each of my advisors for their enthusiastic responses and for presenting and supporting my opinions.

I want to especially thank my relatives for their support and trust in me. In addition, I would like to thank my comrades for their encouragement in the long-term "Turkish experience". They encouraged me to take advantage of challenging opportunities, see all the possibilities at a glance and help manage this review technically. I would like to thank my people for their help, trust and encouragement when I was down. Maybe I would like to thank my relatives, mainly because they added flowers from this business and shared their opportunities and knowledge with me in their spare time.



## TABLE OF CONTENTS

|   |      |
|---|------|
| ABSTRACT.....   | iii  |
| ÖZET .....  | v    |
| ACKNOWLEDGEMENTS .....  | vii  |
| TABLE OF CONTENTS.....  | viii |
| LIST OF TABLES .....  | x    |
| LIST OF FIGURES .....   | xi   |
| LIST OF ABBREVIATIONS .....   | xii  |
| CHAPTER 1: INTRODUCTION .....   | 1    |
| 1.1 <i>Research aim and objectives</i> .....  | 3    |
| 1.2 <i>Research questions</i> .....   | 5    |
| 1.3 <i>Originality and significance of the study</i> .....  | 6    |
| CHAPTER 2: LITERATURE REVIEW .....  | 7    |
| 2.1 <i>Humanitarian aid</i> .....   | 7    |
| 2.2 <i>Fair aid delivery</i> .....  | 8    |
| 2.3 <i>Humanitarian aid supply chain</i> .....  | 12   |
| 2.4 <i>Transparency for aid distribution fairness in humanitarian supply chain</i> .                                    | 14   |
| 2.5 <i>The role of donors in humanitarian aid supply chain and the challenges<br/>preventing the aid delivery</i> ..... | 16   |
| 2.5.1 <i>Donor disintegration as a clear obstacle to aid delivery</i> .....   | 16   |
| 2.6 <i>Intermediaries role in humanitarian aid supply chain and effectiveness of<br/>aid delivery</i> .....             | 18   |
| 2.6.1 <i>Transaction costs in aid delivery</i> .....  | 18   |
| 2.6.2 <i>Right time aid delivery</i> .....  | 20   |
| 2.7 <i>Recipients: Last mile distribution challenges</i> .....  | 21   |
| 2.7.1 <i>Surpluses and shortages of aid delivery</i> .....  | 21   |
| 2.8 <i>Technology in humanitarian supply chain</i> .....  | 23   |

|            |   |    |
|------------|---|----|
| 2.8.1      | <i>Introduction of the new breakthrough technology</i> .....                  | 23 |
| 2.8.2      | <i>Blockchain technology and humanitarian aid</i> .....                       | 25 |
| CHAPTER 3: | METHODOLOGY .....   | 27 |
| 3.1        | <i>Systematic Literature Review</i> .....                                     | 27 |
| 3.2        | <i>The Preferred Reporting Items for Systematic reviews and Meta-Analyses</i> | 28 |
| 3.3        | <i>NVIVO</i> .....  | 31 |
| 3.3.1      | <i>Definition of aid flows categories</i> .....                               | 33 |
| 3.3.2      | <i>Definition and role of humanitarian aid actors</i> .....                   | 36 |
| CHAPTER 4: | ANALYSIS AND FINDINGS .....   | 37 |
| 4.1        | <i>Data analysis and findings</i> .....                                       | 37 |
| 4.1.1      | <i>Aid flows among humanitarian supply chain actors</i> .....                 | 37 |
| 4.2        | <i>Disaster phases</i> .....  | 39 |
| 4.2.1      | <i>Aid flows in aid preparedness phase</i> .....                              | 40 |
| 4.2.2      | <i>Aid flows in aid response phase</i> .....                                  | 42 |
| 4.2.3      | <i>Aid flows in aid recovery phase</i> .....                                  | 43 |
| 4.2.4      | <i>The supported aid flows in humanitarian supply chain</i> .....             | 44 |
| CHAPTER 5: | DISCUSSION.....   | 46 |
| 5.1        | <i>HABUTEM for transparent and fair humanitarian aid supply chain</i> .....   | 47 |
| CHAPTER 6: | CONCLUSION.....   | 50 |
| 6.1        | <i>Academic implications</i> .....  | 51 |
| 6.2        | <i>Practical implications</i> .....   | 51 |
| 6.3        | <i>Limitations and further research</i> .....                                 | 51 |
|            | REFERENCES.....   | 53 |

## LIST OF TABLES

|  |    |
|--|----|
| Table 1. Protocol for database search .....                          | 29 |
| Table 2. The frequency of aid flows .....                            | 32 |
| Table 3. Humanitarian aid flows connections among HSC partners ..... | 35 |



## LIST OF FIGURES

|   |    |
|---|----|
| Figure 1. Model of a Humanitarian Supply Chain.....                     | 11 |
| Figure 2. PRISMA Flow Diagram for articles selection.....               | 30 |
| Figure 3. Aid flows among humanitarian supply chain actors .....        | 37 |
| Figure 4. Aid flows in Aid Preparedness phase .....                     | 40 |
| Figure 5. Aid Flows in Aid Response phase .....                         | 42 |
| Figure 6. Aid flows in aid recovery phase .....                         | 43 |
| Figure 7. Supported flows in HSC .....                                  | 44 |
| Figure 8. Proposed HABUTEM model for fair aid distribution in HSC ..... | 49 |



## LIST OF ABBREVIATIONS

|              |  |
|--------------|--|
| HA:          | Humanitarian Aid   |
| HABUTEM:     | Humanitarian Aid BUiness TEchnology Model                          |
| HASC:        | Humanitarian Aid Supply Chain                                      |
| HSC:         | Humanitarian Supply Chain  |
| INGO:        | International Non-Governmental Organization                        |
| LNGO:        | Local Non-Governmental Organization                                |
| LSPs:        | Logistics Service Providers  |
| NGO:         | Non-Governmental Organization                                      |
| OR/MS:       | Operations Research / Management Sciences                          |
| POD:         | Point of Demand  |
| PRISMA:      | Preferred Reporting Items for Systematic reviews and Meta-Analyses |
| SLR:         | Systematic Literature Review                                       |
| UN Agencies: | United Nations Agencies  |

## **CHAPTER 1: INTRODUCTION**

According to the Emergency Events Database, the incidence of events classified as disasters has almost tripled in effect and intensity in the past four decades (Thomas and López, 2015). The provision of the correct assistance to the people who need it at the right time and place depends massively on the humanitarian organizations that respond to the disasters and help ease the suffering of the victims. These actions are critical in the case of communities and individuals who are homeless and without permanent shelter. A large amount of focus is given additionally to the supply chain of disaster response. The main function of this team is to convert resources into tangible goods and services which can be distributed efficiently and at a fast pace for it to be consumed by the people who require it at different places (Larson and Halldorsson, 2004; Thomas and Kopczak, 2005).

The future looks desolate, unfortunately, with forecasts estimating that disasters would increase by five times in the next 50 years, and they would be more severe in the future as well (Thomas and Kopczak, 2005). This forecast puts humanitarian organizations under more pressure to keep up with the incidence of disasters and meet the needs of the people affected. As a result, a larger amount of effort is being put into developing a better system of humanitarian responses by the organizations and donors to help mitigate the damage and negative consequences of disasters (Samii, 2008).

According to the United Nations (UN), the most challenging time is being witnessed by the world right now as almost 37 countries are adversely affected, 125 million people require humanitarian assistance, 60 million people have been forced to leave their homes, and \$20 billion is required to assist them (United Nations, 2018). The amount of money required for the assistance of victims is increasing annually as the number of people affected is also on the rise, which puts enormous pressure on the humanitarian organizations to be efficient in their operations. Therefore, the funds have to be used wisely. Trillions of dollars are spent on aid every year, but the condition of people does not seem to be improving.

Senior OCHA officials highlight, in addition to managing the complexity of actors within the humanitarian system effectively, that humanitarian information management and use of technology would have a significant effect on the development and quality of future humanitarian assistance, (Altay and Labonte, 2014).

Altay and Labonte (2014) stated that information is a key component that connects all stakeholders participating in the relief efforts. Admittedly, in order to encourage better coordination and cooperation among humanitarian actors, considerable progress has been achieved to the technology and network infrastructure.

Celik and Corbacioglu, (2010) admit that the use of technology can empower sub-units working throughout complicated processes to establish network connectivity that strengthen the sharing of information and perception, and then at the same time easing decision-making and coordination.

The definition of humanitarian aid is the provision of aid that is independent, impartial, neutral, and directed towards those in immediate danger (Rysaback-Smith, 2015) .The effectiveness and fairness of the distribution of aid is widely questioned. The system of humanitarian aid has not been consistent in providing optimal results (Scott, 2014).

Political science, philosophy, economics, and OR/MS (Operations Research/Management Sciences) research have been discussing the fairness for some time now. It has led to the evolution of the term equity in this context, being used for the first time by Savas, (1978) to measure the performance of the services. Since then, the fairness of distribution has grown significantly in OR/MS models and their operations.

The OECD (Organization for Economic Co-Operation and Development) has defined the effectiveness of humanitarian efforts as the measurement of the extent to which purpose has been achieved, or if the output can be expected to reach this purpose. The investments in humanitarian aid must be targeted towards achieving the best possible result, which is why effectiveness is important (Scott, 2014).

Equity is more important in the context of a service to communities and non-profit work like healthcare and humanitarian services. The results of a survey on the objectives of humanitarian aid services was presented by Gralla, Goentzel, and Fine (2014) which displayed the fact that the primary target of the decision makers of humanitarian services was the effective distribution and that demand be satisfied. The next most important goal is equity, followed by cost efficiency at the end. On the other hand, other studies show that the equity objective is only pursued by very few such services (Holguin-Veras et al. 2013; Anaya-Arenas, Renaud, and Ruiz 2014).

This thesis will examine the humanitarian supply chain (HSC) aid flows effectiveness and use of technology, proposing a humanitarian aid business technology-based model developed on the basis of the aid flows. For which, the identification of the humanitarian aid supply chain (HASC) partners and the links connecting them among the supply chain, is necessary to help build this technology supported model. As the literature lacks to provide a comprehensive answer to the above-mentioned aim, a systematic literature review had to be conducted as a methodology to outline the aid flows and the searched answer from the studied articles.

### ***1.1 Research aim and objectives***

This thesis aims to discuss the fairness in the delivery of humanitarian aid (HA) through an analytical perspective. The review of literature will analyze the complexities of HA distribution and the various obstacles in the path of equitable distribution. In the empirical perspective, the literature review will examine the current technological usage in the process of HA. The thesis will also examine how the contemporary humanitarian aid supply chain (HASC) has been avoiding equity in the distribution of aid by classifying the chain of supply into three main categories of distribution, namely, donors, intermediaries and recipients. All issues related to the HASC will be linked to these chains and sub-chains of distribution which will address the problems of effectiveness and transparency.



One of the major solutions to the issue of efficient delivery of aid that has been put forward by policy makers and scholars is the usage of new technologies. Connecting the current supply chain of humanitarian aid to the technology is a pertinent challenge in this thesis.

Theoretically, there are numerous chances to optimize the supply chain and delivery of humanitarian aid through the technology, which makes it crucial in research.

The part of technology in the stages of the delivery of aid will be analyzed and steps to improve its efficiency will be outlined. The point to take note of in the thesis is the fact that this new technology is still nascent and is in the process of being developed and improving daily. The terms humanitarian assistance and disaster relief will be used interchangeably with humanitarian aid during the course of this thesis.

The study the flow of aid in humanitarian supply chains is the main objective of this thesis, by developing a technology driven business model for equitable distribution of aid among the recipients and making efficient use of the technology in future endeavors.

The aim of the research in relation to the humanitarian aid supply chain is as follows:

- To develop a technology driven humanitarian aid business model to improve the effectiveness of humanitarian aid supply chains.
- To propose an approach to improve the transparency for fair distribution of humanitarian aid among beneficiaries through multiple supply chain partners.

## ***1.2 Research questions***

A major obstacle in the provision of humanitarian relief in many circumstances such as a natural disaster is the lack of demand signals. Since nobody is present placing orders and there is no point-of-scale data, the provision of humanitarian aid requires the actors to assess the situation and make priorities regarding the place and people who are in most need, and quantity of the relief required. This results in many supply chains which are inter-connected and very complicated to manage at the same time.

There can be major repercussions if the relief is not provided efficiently and in a fair manner (Balland and Sobhi, 2013). For example, there were reports of poor performance of aid and shortages during the 2004 Asian Tsunami (Telford and Cosgrave, 2007). There was also inefficient coordination, which caused higher costs and longer time to respond when the number of beneficiaries was less.

From this information and based on the research objectives, a few research questions were developed as follows:

- What are the challenges facing the effectiveness of the humanitarian aid business?
- What are the connections between the HSC partners and how they are distributed among disaster phases?
- How a technology-based business model in HA can be build? And how can technology driven model achieve fairness and transparency within the HASC?

### ***1.3 Originality and significance of the study***

Past literatures have not delved deeper into the fairness of humanitarian aid in the context of technology as the findings and sources were insufficient in the research. The method used was Systematic Literature Review on the links connecting the humanitarian aid supply chain partners and enhancing the fairness in the distribution of humanitarian aid. This method of review has accounted for major breakthroughs in comprehending the distribution and flow of humanitarian aid.

For an equitable system of humanitarian aid supply, this thesis aims to propose the technology driven humanitarian aid business model. Systematic literature review has been done to make this possible and understand the flow of humanitarian aid that connects the actors in the main supply chain, namely, the donors, intermediaries and recipients. All the intricacies within a specific theme are examined in a systematic literature review. Denyer and Tranfield, (2009) have shown how various scientific methods can be used to analyze the existing literature in a better manner which is a major part of systematic literature review.

The players of HASC can be identified comprehensively by the systematic literature review, which is a qualitative method that analyzes the links between the players as well. It thus categorizes the links into three models of disaster stages to better understand the partners involved and see the extent of transparency and fairness of the system.

## CHAPTER 2: LITERATURE REVIEW

The humanitarian aid supply chain will be discussed in this chapter with emphasis on the transparency of the system and fair distribution. Additionally, the impacts and significance of the technology will be discussed in the context of effectiveness in the supply chain of humanitarian aid.

### 2.1 *Humanitarian aid*

There is an annual increase in the expenditure on humanitarian aid (HA) which has reached over a trillion dollars. The main crises that have contributed in the increase of this amount include:

*“Demographic, social, environmental, and geo-political shifts, along with the advancing use of technology, globalization and increasing inequality”* (Scott, 2014, p.2).

It is mostly developing countries that are more adversely affected by these crises and they do not have the adequate resources to assist their people. Thus, the requirement of humanitarian aid keeps increasing. In 2017, US\$27.3 billion was used in humanitarian aid but it did not lead to a decrease in the requirement of relief, as this massive sum of money was not enough to mitigate the damage caused to millions of people (OCHA, 2012). Thus, scholars and policymakers are critical of the efficiency of humanitarian aid.

There are various channels of humanitarian aid, with the government being the most significant one. There are two types of channels that can be chosen by the government to fund for relief, which are: 1) bilateral, that deals with the delivery of aid from the donor nation to the developing nation and encompasses dealings with NGOs. In addition, 2) multilateral, that is conducted by just one financial institution to account for development, like the World Bank (Gulrajani and Honig, 2016). Both these channels meet development and humanitarian conditions and it is quite normal for the same countries and sectors to be targeted by their activities. There are number of organizations that are actively involved in the funding of donors for humanitarian relief, as the delivery of aid is not just from bilateral from one donor nation to the developing nation, or in a multilateral fashion from the donor nation.

It also does not travel from the international financial institution (IFI), to the developing nation. There are numerous steps in the process before the aid reaches the people who are actually in need of the assistance (Development Initiatives, 2018).

Often during the situation of a crisis, private funds are asked for to help in financing the aid. Thus, a major channel in the distribution of aid is private funding. The transfer of private funding involves NGOs on either national or international levels, and consists of individuals, companies, trusts and foundations (Development Initiatives, 2018).

The explanation of the concept of fair humanitarian aid is crucial prior to discussing unequal distribution of HA in this thesis. The most intrinsic factors to equitable and fair aid are the objectives, intentions and goals of the participants (Ross, 2011).

## **2.2 Fair aid delivery**

Just and fair decision-making thought processed are a requirement for distribution of relief. The fairness principle states that:

*“every individual has a unique incorruptible view which cannot be devalued by society”* (Rawls, 2009, p.3).

The scope of this principle relates to impartial and equal distribution in the case of HA. According to the Humanitarian Charter (Sphere, 2011, p.19):

*“The provision of assistance has to be based on the needs of the affected people and the proportion in which it is required”.*

This fair distribution plays a huge role in determining the credibility of the responsible organizations. This becomes difficult in circumstances when scarce resources hamper the provision of impartial assistance and giving proof of the actions.

There are different ways of talking such situations. For instance, Oxfam-Mexico is an NGO that provides relief during disasters. It categorizes shortages in supply based on equal division of rations to deliver them to rural communities. Even though this practice cannot be extended for all organizations, it has its benefits, out of which three have been explained here. The first is the vulnerable condition of the people to whom there may be a delay in delivery of aid.

For these cases, a partial delivery is highly advantageous. Secondly, assuring the affected communities in case of shortages is important, along with keeping their support and tracking the development of their situation. Lastly, the lack of impartiality can lead to aggression and conflict in the communities (Anaya-Arenas, Ruiz and Renaud, 2018).

In situations where a partial delivery is being done, there are three important considerations to be kept in mind. Firstly, the demands of everyone should be met. So, the aid needs to be distributed equally, keeping in mind the proportion in which it is required by the people. As a result, the quantification of equal distribution should be a matter of the percent of demand satisfied, or the percent of shortage of demand. Secondly, the timeframe of satisfaction of demand needs to be widened to include deliveries over a period of time.

There might be a number of planned deliveries that get affected by shortages in supply, so the managers should endeavor to maintain their level of supply as close as possible to the needs of the people for each period of time, since the amount of time spent in waiting is a factor that adds to the cost of deprivation too. Viegas (2001) raised this concern as temporal and longitudinal equity was introduced for fair situations over time in the case of road pricing. Holguin-Veras et al. (2013) further analyzed the deprivation costs in terms of their effect over time in situations of scarce resources. Schilling (1994) stated that equity is when a demographically, spatially or temporally formed group gets a fair part of the allocated resources; highlighting the fact that time played a role too. Thirdly, every point of demand (PoD) should maintain the same response time, irrespective of the objective of minimizing distance. It is true that it can be tough to access certain locations based on the spread of population and geographical conditions, but this principle can be carried out by having at least one distribution center in every location, to ensure that every PoD is provided with the aid within a given period. The upcoming section evaluates the distribution plans by proposing variables that can be considered in the assessment.

To measure the performance of the supply chain networks, Beamon and Balcik (2008) introduced a new framework of analysis. According to this method, the requirements of a distribution network to be classified as good are high levels of effectiveness, efficiency, flexibility and equity.

However, it did not propose any equity measure. Schilling (1994) puts forward a proposal of twenty ways to measure the degree of equality in distribution depending on the location. Some of the methods included adapting Rawls's principles for distance equity, along with range, variance, coefficient, and mean of absolute deviation. It also included a summary of seven traits of equity, namely, computing convenience, tractability of analysis, appropriate management, scale invariance, normalization, impartiality, and efficiency safe.

Gralla, Goentzel, and Fine (2014) conducted a survey to find the priority in determining locations for equitable distribution and resource allocation. The survey showed a 70% - 30% proportion. It indicated that even though vehicles were always preferred to be sent to all the locations, more trucks were sent to high-priority locations, the proportion being 70% of the vehicles sent to high-priority and 30% to other locations. There is an interdependence between supply chain management and logistics. However, the difference between the two lies in the fact that logistics is a small part of supply chain management. Supply chain is a vast subject, dealing with the connections between the consumer and the supplier, while humanitarian logistics partakes in the efficient management of goods. There are a few intrinsic factors in the humanitarian supply chain of aid, which lead to the obstacles in the path of fair distribution of aid. Some of the activities that are a part of the supply chain of humanitarian aid are:

*“Preparation, planning, procurement, transportation, storage, tracking and customs clearance”* (Da Costa, Campos and de Mello Bandeira, 2012, p.600).

The presence of a large number of stakeholders and the multiple goals and targets of aid distribution makes the supply chain of humanitarian aid very complex (Da Costa, Campos and de Mello Bandeira, 2012).

The complex nature of the supply chain is demonstrated in Figure 1. It becomes quite apparent that the number of stakeholders is large which can in turn make the process of coordinating among them very tedious and time consuming. Efficiency becomes a very important factor in such scenarios, to ensure that the distribution of aid is not negatively affected during this situation.



Figure 1. Model of a Humanitarian Supply Chain. (Source: Da Costa, Campos and de Mello Bandeira, 2012)

The lapse in efficiency takes place at the micro, meso and macro stages as evident. There are major obstacles the aid workers need to endure, ranging from loss of financial aid due to transaction costs, donor disintegration to uncertainty among the recipients. All of these issues arise due to the failure in the system of transparency in the supply chain of humanitarian aid. For further analysis of the topic, there are three divisions in the supply chain, namely, donors, intermediaries, and recipients. The most crucial problem, which has been analyzed in this thesis, is the case of the lack of transparency in the process. It leads to a major inefficiency in the aid process and causes obstructions in its flow. As stated before, the complex nature of the supply of humanitarian aid arises because of the fact that it does not travel from the donor to recipient directly in the case of private, bilateral or multilateral funding. There are several agencies, which the aid needs to cross through before arriving to the targeted destination, which includes IFIs, national or international NGOs, ministries, etc. There are at minimum two levels of recipients, namely, the first intermediary level, including the NGOs and other organizations, and the later level recipients, which comprise the people in need of the humanitarian aid during disasters (Development Initiatives, 2018). There is a risk in transparency due to these different agencies which can create



issues regarding tracing the deliveries which is why points have been raised by the aid agencies to make the delivery of aid more direct. This would reduce the number of stakeholders in the supply chain as well. The Grand Bargain, which is an agreement between the providers and donors to allow greater reach of aid, has set a target for 2020 to have not more than one intermediary agency for at least 25% of the humanitarian aid to make the delivery process more channeled (Development Initiatives, 2018). The humanitarian aid in 2017 was channeled through only one intermediary directly to a national or local NGO in only 3.6% of the total instances. Therefore, humanitarian aid agencies have just two more years to achieve a 21.4% rate of growth to stick to the target. A method of assisting the means of delivery to be more direct is to amalgamate the aid, which is in kind, like water and food, to the transfers that are in cash. Cash transfers have greater advantages as they reduce wastages in the in-kind aid, and provide autonomy to the recipients. This is why most aid agencies are turning to cash transfers. There is still a lack of transparency though in this kind of transfer, which makes it uncertain if the recipients have received the aid.

### ***2.3 Humanitarian aid supply chain***

There is still a large scope as there has not been a lot of research into the humanitarian supply chain in contrast to business supply chains. Existing research has depicted the humanitarian supply chain to be quite unstable as there are a few instances of the supply chain breaking down at the end of the recipient (Oloruntoba and Gray, 2006). International organizations and governments need to be involved to help get the aid to the people who really need it, as well as assist in the modes of transport (Oloruntoba and Gray, 2006). There are the obstacles of administrative blockages and logistical nightmares that the delivery of aid needs to face, such as bad infrastructure and bureaucratic stakeholders. However, it is not the case that all stakeholders or third parties would create obstacles. For instance, many local NGOs can assist the aid in reaching the destination, as they are aware of the conditions that are prevailing there. Despite the administrative obstructions, NGOs can support the supply chain as they can assist with the on-ground delivery of humanitarian aid.

Both parties in the supply chain of humanitarian aid, i.e. the donors and recipients, believe that the efficient nature of delivery of the aid is a priority. However, the prevalence of logistic and supply chain management problems causes many issues in the process. Three groups can be formed to simplify the supply chain, namely, donors, intermediaries and recipients, and each group faces difficulties in the process.

There are a large number of donors, including individuals, firms, governments, and international NGOs. A large number of channels for donating the aid are present too, which passes through many intermediaries such as IFIs, national and international NGOs, and organizations in communities. Thus, there are many organizations between the donor and recipient of the aid (Da Costa, Campos and de Mello Bandeira, 2012). This thesis concerns the people who are living in the affected regions and who need the aid. The people in need often go under the radar, as they are not able to identify themselves since they have experienced suffering from the disasters. It becomes very difficult to provide the aid to the victims and recipients because in many cases the victims lose their houses, access to financial services and their essential documentations. There is a state of turbulence and chaos at the time of disasters with numerous missing people and casualties. Therefore, identification of people for humanitarian aid is tough as there is a loss of identity in a way at the time of disaster. This is why many aid agencies choose to select their recipients as national or local NGOs. It is quite apparent that there are several problems that the delivery system of humanitarian aid needs to overcome.

This thesis aims to resolve the issue of aid fairness by evaluating and studying the difficulties inherent to donor, intermediaries and recipient in the supply chain. Specific problems that expose hurdles for the justice of humanitarian aid distribution will be highlighted for each problem. Description and analysis of each of the three chains mentioned above will be given along with the problems that come with it. The predominant issue of the lack of transparency in the supply chain will be discussed prior to the complications of each chain. The lack of transparency disturbs the impartiality of aid in such a manner that it becomes problematic for an individual to track the aid. Furthermore, it is tough to identify the areas of glitch and where the bottlenecks are. This issue will be further discussed in the upcoming sections.

## ***2.4 Transparency for aid distribution fairness in humanitarian supply chain***

As previously mentioned, humanitarian aid delivery system has a chief problem i.e., lack of transparency. Due to the significance of aid transparency, it has been positioned high on international grounds. The call for improved, more transparent and accessible data from the stakeholders is high in both developing as well as developed states. (IATI, 2018). It is assumed that better reach to data will assist in keeping growth performers responsible. The accessibility of information and stats will consequently benefit in enlightening the efficiency of aid since it turns out to be easier to detect where aid gets lost in the probable, simultaneously on a countrywide and global level.

It seems impossible to achieve full transparency in a complex system having several actors and donations involved. Since there is added consciousness of the expenditures of humanitarian aid, contributors and supporters pressurize humanitarian aid administrations. These organizations are under inspection to look after the entire operation showing that the procedures have to be more transparent than before. (Van Wassenhove, 2006).

Approximately 80 per cent of the humanitarian aid operation is logistics, hence it is understood that in order to achieve better transparency and improved aid delivery supply chain management is required. Lack of transparency in aid is present since in between others, the greater quantity of intermediaries along with the donor disintegration and the under the circumstance that specific receivers are usually not known puts it under risk.

Transparency in aid is vital as complete and all-inclusive data provisions improved analysis, synchronization and assessment (Ingram, 2018). This is critical for reporters, strategists and specialists. When transparency is not present, the tools lack to: enable association amongst various finance associations, to guarantee active usage of capitals as well as in order to hold organizations answerable (Ingram, 2018). Transparency will not resolve the complications completely that occur in aid; nonetheless, it will reinforce improved verdict, management and collaboration. It is also required to expand the efficiency and productivity of the aid distribution.

It is renowned that to ensure fairness in aid, transparency is an imperative factor. Complete and all-inclusive data permits the actors indulged in the delivery of aid to track and identify the aid needs to be distributed. More the data, better the distribution of resources by the actors (Ingram, 2018). It is quite understood that full transparency in the aid supply chain will ensure optimization of the aid delivery. There will be evidence of transaction losses of money, dishonest administrations or merely insufficient distribution. This will benefit from avoiding holes and repetition. Thousands of millions of dollars are lost annually. Irrespective of the criteria due to which aid is lost i.e., either because of aid exchangeability, corrupt management, or any other reason, growing transparency will recognize the hurdle and probably assist in its elimination. One of the reasons that lack of transparency is a predominant issue is because it impacts and affects all chains of aid supply. The actual amount of money collected is not clear from the start until the end and the exact amount of donation that is received by the needy. In addition, the number of intermediaries is not precisely known along with the actual recipients apart from the local or global Non-governmental Organization. Consequently, it has become vital to point out hurdles and bottlenecks in the supply chain since now; the main point of focus is not merely the result but the entire HSC process.

The scarcity of capitals and resources as well as competition for subsidy increase the importance of clear-cut Human Supply Chain. Data allocation in logistics directs towards a surge of the administrative capital, efficiency and efficacy of Disaster Relief Operations. Interest and non-interest-based organizations are both undertaking pressure internationally to be transparent.

In humanitarian logistics, the most important stakeholders are the donors with the most superlative power. They are driven by a definite determination of giving reserves to the HOs in order to decrease disaster hazards. If the operation and processing of capitals are deprived in any association, the supporters can cease subsidy. The contributors long to receive better perceptibility, transparency and liability. Successful HSC can be recognized by the impartial distribution of relief items. It decreases risk, charges and periods as well as has the potential to save lives and lessen the misery. Thus, humanitarian logistics should be just, quick and safe. Every chain and its problems are analyzed in the upcoming sections.

It can be seen that various issues and problems transmit from one stage of the chain to the other in line. Glitches in the initial chain can result problems in the later stages of the chain. The partition of the three chains is perceived to make a transparent impression, not to forget that the chains are interconnected and so are their problems.

## ***2.5 The role of donors in humanitarian aid supply chain and the challenges preventing the aid delivery***

Now, in this section, the part of donors in the humanitarian aid supply chain and their encounters to gain precise post-disaster data to distribute their aid, were emphasized.

### ***2.5.1 Donor disintegration as a clear obstacle to aid delivery***

According to (Knack and Rahman, 2008, p.1):

*"The Marshall Plan worked because there was one donor, the United States, and the United States set up rules that ensured the Europeans would themselves take charge".*

In every part of history, the "Marshall Plan" gained admiration and approval. It was generally recognized as an achievement and regularly after every couple of years, new Marshall Plans were launched (Knack and Rahman, 2008). If modern development help is compared to the Marshall Plan, they both are completely different. Currently, several joint and multidimensional association as well as hundreds of Non-Governmental Organizations are operating in the aid business (Knack and Rahman, 2007). In contrast, recipients got aid from a mostly single donor that used to be usually the government, like the case in the Marshall Plan, in the start. As per (Knack and Rahman, 2008, p.333), in the modern era of aid, the funds are distributed

*"in the form of hundreds of separate donor-managed projects in each recipient nation".*

In 1960, a typical fund receiver got aid from two sources. This number rose to 28 in 2006. (Knack and Smets, 2013). The question arises, why are there so many donors predominant in the HA industry these days? The need for help is generally called after a disaster in humanitarian aid.

Consequently, it is problematic for contributors to commit in advance since they cannot promise to have a fit answer (Clarke and Dercon, 2016).

As a result, whenever a disaster happens, loads of governmental as well as non-governmental organizations and aid agencies get involved. This related to the theory that when several contributors donate to the aid flow in a particular state, the recipient state is less likely to experience any hindrance in case anyone donor fails to collect an adequate amount of funds. (Gutting and Steinward, 2017). In that way, the contributor has petite recognition stake since the concern for accomplishment is joint on the donated aid.

Consequently, presumed donor fragmentation results in aid delivery. Recently, donor fragmentation is seen to have a growing tendency. The main problem for HA delivery system is still the formation of a stream of aids from diverse contributors (Da Costa, Campos and de Mello Bandeira, 2012). Especially, as the actors tangled in the distribution keeps rising annually, it turns out to be even harder to create this flow. The foundations of subsidy can be intercontinental or countrywide, that is not at all times timely, valuable or proper (Da Costa, Campos and de Mello Bandeira, 2012). As previously stated, the donor can be an individual or any governmental or non-governmental organization. They can donate "in-kind" aid or cash. Especially in "in-kind" donation, it becomes very problematic to track the donation amount, as there is a lack of overview in donor coordination. Any person can assume it as a challenge for associations to keep a record of the quantity of aid done to a specific cause in times of receiving donations from diverse sources at different times. Donor fragmentation has thus proven to have a deteriorating effect on aid. (Gutting and Steinwand, 2017). It also has various side effects like the absence of probability and synchronization that impacts other chains in line as well.

The supply chain is inadequately transparent at the donor chain. One of the reasons is the arrival of donations from diverse flows, directing aid over unlike networks and recipient states have no idea of the amount of donations coming to them along with the donating state. The incapability of contributors to sufficiently answer emergencies hence outcomes in a failure of inheriting states to efficiently retort to disasters.

Donor fragmentation not only produces a dearth of an error on the reserves that received by the inheriting state, but it is also likewise well-thought-out to be a persistent matter since the charges are so high for heir nations that it cuts aid productivity (Frot and Santiso, 2011).

In this regard, aid in terms of "cash" helps in decreasing the problem as it cannot be wasted like other aids (food items and clothes). Nevertheless, cash transfers usually generate complications at later chains like the failure to track the transfer and the accumulation of intermediaries.

## ***2.6 Intermediaries role in humanitarian aid supply chain and effectiveness of aid delivery***

"Intermediaries" are the associates of the HSC and they are making efforts to improve the transaction charges, which is one of the major issues with executing numerous technologies revolution. The transaction cost will be discussed in detail later.

### ***2.6.1 Transaction costs in aid delivery***

Numerous multilateral as well as bilateral organizations along with dozens of Non-governmental organizations are part of aid delivery. The aid reaches the intermediaries after moving from the initial chain i.e., the donors. The intermediaries get that aid from either the government or the private flow, which are the two major donor flows. Intermediaries can be categorized as "multilateral" associations like the International Red Cross, the community division, public-private corporations and NGOs. They can be global or local level in the beneficiary republic. Nonetheless, one outcome of it is that the official networks by which they help come to have to deal with several fiscal channels. Therefore, the transaction costs rise that comes along with these economic networks. The fiscal value of aid is an extremely argued matter subject in the global market.

The efficacy of aid is reduced by transaction costs since it decreases the sum of help that is to be given to the needy people. Nevertheless, there is no track record of the amount of aid lost in transaction, just because nobody knows about it.



According to (Williamson, 1996), the transaction cost is described as the costs of running an economic system. However, there are various conflicting descriptions to it as well. As per Paul and Vandeninden, (2012, p.2), the description of aid transaction costs is:

*"do not rest on theoretical grounds and may actually lead to misinterpretations"*.

Keeping production competences in focus, literature reasons that dropping aid transfer expenses will surge aid efficiency (Ashford and Biswas, 2010). Aid officialdoms struggle to rise aid efficiency by plummeting the essential of these outlays: *"inept donor practices"* (Paul and Vandeninden, 2012, p.2). The large costs of transfer emphasize the status of varying the distribution system in aid. Another convention on why the worth of relief is pointedly lesser when it gets to the receiver as compared to when it left the benefactor is for the reason that the aid drifts over several official channels i.e., the intermediaries. At its turn, donor fragmentation underwrites to this great number of middlemen as every single donor has a changed technique in distributing aid and a diverse partiality of the aid destination. Numerous worldwide discussions have positioned on the subject of transaction costs. In order to reduce costs, several attempts have been made because this decrease will recover the sustainability of aid. Transaction costs befall at all stages of the support process. Transport charges are related to each of the three humanitarian assistance chains. As a result, many aid organizations require better coordination between member companies to reduce transaction costs. Transaction costs include, for example, organizational costs. Large brokers also increase management costs and transaction costs. Administrative departments and detailed aid organizations within the donor government incur any transaction costs. These are called abnormal transaction costs. This happens when assistants exhibit severe bureaucratic and political behavior (Paul and Vandeninden, 2012). This happens when modern professional assistance is used or when donors collect data because of donor competition. There is no need to lose financial aid (in some cases) and avoid unnecessary bureaucratic or political costs. In any case, it must be understood that not all transaction charges are negative. In addition, improving the aid transfer framework also involves operating costs, like administrative costs. As per (Ashford and Biswas, 2010), they believe that aid organizations have not put adequate pressure on the issue.



There are many secrets about transaction costs. In any case, when reducing transaction costs is just an innovation aim, it is not clear which specific costs must be controlled (Ashford and Biswas, 2010).

For instance, several people who receive help take advantage of this. In addition, in order to reduce distribution cost, you cannot reduce wages. In turn, as transport can be disrupted, this can lead to a greater shortage of aid. In addition, especially in humanitarian assistance, exemplary transport assistance is a key factor in implementing assistance.

### **2.6.2 *Right time aid delivery***

Disaster situations require exemplary responses. In a short time, workers can mitigate disasters to meet the basic needs of victims. Speeding up humanitarian operations is not only a necessary condition to help people affected by disasters, but it must also not allow other channels to happen. Experts believe that part of humanitarian projects is the fruitful implementation of supply chain plans and practices (Da Costa, Campos and de Mello Bandeira, 2012). In general, the team reached consensus on disaster prevention and donation that the present humanitarian aid structure cannot provide satisfactory relief and quick reply to emergencies (Fleshman, 2006). Humanitarian aid in the event of a disaster often goes unnoticed and opens up many possibilities. Aid did not cover all requests and was not completed on time. To help as quickly as possible, speed response tools and other tools for moving objects can be expected to have been developed (Swithern, 2014). Humanitarian funds are overwhelmed by the unpredictable climate and are already developing. It is cruel and unpredictable and requires resilience (Oloruntoba and Gray, 2006). People generally appreciate speed because the victim is unable to stop (Walton, Mays and Haselkorn 2011). Speed is essential for good disaster response. In any case, responding quickly to calamities is a daunting job since numerous contributors and mediators have personal hierarchies as well as modus operandi (Oloruntoba and Gray, 2006). The more mediators involved, the longer it takes to respond that way. In principle, the issue of speed is not difficult amongst donors, intermediaries and recipients, but it is likewise true in governments or global organizations.

Humanitarian programs are still underestimated and developed. Organizations pay a small price to improve the strategic humanitarian model. Of course, because the humanitarian council does not imply on logistics.

The more intermediaries are involved, the longer the response therefore takes. The problem of speed is not per se a problem that exists between donors, intermediaries and recipients; it also exists within the governmental or international organizations. Humanitarian logistics remain understudied and under-planned. There is little overhead provided by the organizations for improving the humanitarian logistic models.

The focus of the humanitarian plan is to save lives and manage complex and destructive disasters. Therefore, speed is the most important driving force in the supply chain. Later, saving time became a big problem. To compensate for the lack of adequate performance in moderate traffic, aid organizations predict that this speed will be insufficient (Oloruntoba and Gray, 2006). After all, the humanitarian supply chain must be flexible and disaster-friendly. The faster transfer of aid through intermediaries will bring positive results to beneficiaries through convincing conversions.

## **2.7 Recipients: Last mile distribution challenges**

The recipient is HSC's final customer. They are called "*the last mile*" distribution and seek to obtain their supply in the correct quantity and quality planned. This section presents the mechanical equipment that solves these problems.

### **2.7.1 Surpluses and shortages of aid delivery**

Donors want to help in all disasters. However, when conditions are catastrophic, it is usually unclear what is needed to help. There are basic products like water, food and medicine. Nevertheless, when it is hard to determine the impacted person, it is problematic to define the needs of the affected person. Donors and mediators can distinguish between requests. Aviation will typically provide basic products or assistance in various catastrophic situations (Fessler, 2013).

The disaster donations are not only regularly collect humanitarian aid items, like water and nutrition but also personally donates old clothes or toys. In-kind assistance is often misleading, mainly since donors are unaware of the needs of the affected people and there is a lot of assistance in place. Therefore, this last series of problems can be traced back to the main chain problem. This is a way of increasing the scarcity of humanitarian aid. The disaster response team sought the answer to this question. The human response usually stems from donations in kind (Harvey, 2007). Since not all food is needed for emergency relief, charitable organizations must switch from generous donations to cash donations. Money is not only an option for food aid but also a kind of physical object (in the same place). They have different requirements and opportunities for different areas of humanitarian assistance when making donations. For example, this can affect the local market because the funds allow beneficiaries to buy shares in the local market, instead of receiving state aid from donors. In addition, the individuals involved can be more nutritious because they can buy the products they need instead of accepting donor orders.

Therefore, the durability of supporting equipment can be increased in a practical way. Reduce transport and transportation costs (Harvey, 2007). As a result, cash operations responded to disaster faster than the delivery of relief supplies. As mentioned above, speed is an important part of powerful tools. When all conditions are equal, the contribution of humanitarian assistance is to transfer funds, promoting 6% or less of global donations (Harvey, 2016). Money gives individuals more decisions and orders to solve their problems. In-kind support cannot meet your requirements and the recipient usually provides in-kind support to purchase the necessary items (Harvey, 2016). Studies have shown that if money is used instead of food, 18% of people will benefit from outside intervention (Harvey, 2016). After all, if the shift from *in-kind assistance* to cash can make assistance more effective, why didn't it happen on a large scale? This is due to a lack of confidence that money will not fall into unacceptable hands. After all, the general lack of transparency is critical to change. Another problem is that the people affected are generally no different. Since humanitarian assistance is provided for disaster relief, beneficiaries often revolt. Therefore, it is difficult to identify people, as they often say that they have mislaid character is written and there is no relevant report to classify them. Today's identity often appears on factual reports, such as passports and birth certificates.

These files are generally readily available in developed countries, but certainly not in many developing countries. Due to uncertainty about privileges and participation in monetary policy, people face frightening factors when they are unsure of their legal status. Individuals who are monitored frequently remain the most vulnerable and most miserable. Nevertheless, it is very tough to look up these individuals and provide sufficient help, exclusively in the supply of money. Reliable data is needed to let the service provider know if the assistance has achieved its intended purpose. Without an identity document with access to money management, it is difficult to track where and where help is needed. In turn, the creation of staff under the influence of digital references will ensure that talented individuals earn money, whilst donors can track where the money is spent, which is what donors depend on.

## ***2.8 Technology in humanitarian supply chain***

There has vital role of technology been observed during the major humanitarian catastrophes – from the most initial phases until the last phase of disaster response and analyzing the longer-term reconstruction phase. The mechanisms of generating timely information have enhanced by the use of technology which observed by key issue in humanitarian logistics. Optimization level and models could be also enhancing by using such information effectively in humanitarian logistics operations. Since technologies play an essential role in numerous phases of disasters (Serrato-Garcia, Mora-Vargas and Murillo, 2016). Next, the concept of the new breakthrough technology is presented. The result will show how this technology can help improve the humanitarian supply chain. To understand how this technology supports our humanitarian aid business technology driven model, it is an indisputable requirement to understand this technology.

### ***2.8.1 Introduction of the new breakthrough technology***

Recently, some seemingly inspiring technologies have been developed and are increasingly considered by representatives and aid workforces. This technology is regarded as "blockchain". It was established in 2008 when the Bitcoin cryptocurrency was presented to the world. This technique was initially invented for digital currencies, but additional possible applications are being explored.

Blockchain may be the next big problem in the future of technology and general-purpose computers (Kshetri, 2017). Tapscott's blockchain description is explained as follows:

*“An incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value”* (Tapscott, 2016).

Blockchain also called "*distributed ledger technology*" (Kshetri, 2017) provides many things to individuals, organizations and governments, interest in technology is growing rapidly (Kshetri, 2017). In any case, not everyone wants blockchain or digital currency. The negative effect of blockchain is that the amount of energy consumed by technology is impressive. Compared to many countries, computers or programs that monitor data transmission and the use of more electricity.

There are two types of management: unlicensed blockchain (anyone with a computer and internet can collect data) and allowed blockchain (limited ability to manage blockchain) (Reinsberg, 2018). There are advantages and disadvantages to using these two management models. Similar to identity management, the unmodified blockchain is very suitable for distributed computing applications. Blockchain can be considered technology that:

*“Entails important system changes in the social, economic and political spheres, including those on the international scale”* (Szkarłat and Mojska, 2016).

With development, blockchain is mainly used in the private sector in the international field. Walmart, one of the world's largest retailers, is using blockchain to ensure the safe exchange of Chinese pork. This should accompany the development of pork and make the environment safer (Nash, 2016). Others continue to explore the potential of blockchain. IBM explores gem development and Toyota MotorCorp. is considering using technology to track auto parts (Nash, 2016).

So far, blockchain has recently been used in supply chain management, real estate libraries and e-government (Reinsberg, 2018). In the following years, blockchain gained prominence in the assistance area. Blockchain appears to be committed to the development of the industry because it is committed to providing financial assistance, improving the creative process and making management more

transparent (Reinsberg, 2018). The possibilities for using the blockchain seem endless, but the blockchain is still in its infancy. Therefore, there are still many tests to be performed. However, many organizations and decision-makers are interested in technology. To be fair, the focus of development assistance is on the blockchain. For example, the United Nations has a certain understanding of blockchain, and more than seven United Nations materials have tested blockchain activities as another form of transportation assistance (Riani, 2018). The next section will focus on the possibilities offered by blockchain as a humanitarian aid tool.

### ***2.8.2 Blockchain technology and humanitarian aid***

A few years ago, several companies revealed the potential of blockchain. The differentiated cycle provided by the technology (inhibiting middlemen through blockchain technology) can destroy almost any industry. Many blockchain fans also agree with these views, believing that blockchain is the next breakthrough in the humanitarian aid industry (Purvis, 2017). Like cash flow, blockchain technology can be used to transfer financial aid. Since the blockchain is a digital record, it cannot provide physical assistance. Therefore, blockchain can be easily used to transfer funds in the human supply chain. Whilst aid organizations primarily promote the direct exchange of aid by transferring funds and returning donations in kind, blockchain can improve the aid sector by making aid digital and adaptable for the future. So, given that it is difficult to remove obstacles to circulation, blockchain is protected from extortion and a way to prevent the loss of financial aid to corrupt governments. In the past, aid agencies were reluctant to take monetary measures without confidence. They are concerned that money will fall into unacceptable hands and fail to achieve the desired goal. Blockchain can respond to this concern by stating that it cannot be minimized by allowed blockchain.

The technology is fully transparent and can track funds. If the blockchain allows more aid organizations to transfer funds, fewer donations will be wasted, and the transport of aid will be more sustainable because groups that are more vulnerable can get the help they deserve. No one is shocked that the opportunities offered by the blockchain are not praised. After all, when using an unlicensed blockchain, the advantage of the blockchain approach is that it is a dubious distributed structure.

Therefore, in theory, it can eliminate the inevitable problems in the human supply chain. The ultimate focus of decision-makers and aid workers is to track every dollar of aid from donor to recipient in order to identify bottlenecks in the supply chain. Blockchain can conduct transparent transactions, thereby helping to improve supply chain transparency.

Blockchain can be used in various shapes and sizes. In theory, blockchain can be used for humanitarian aid in the following ways:

*"Information management, aid coordination, crowdfunding management, supply chain monitoring, cash flow scheduling and humanitarian financing"* (Riani, 2018).

Next, the blockchain provides digital ID storage for vulnerable individuals in distributed digital files. Blockchain provides digital identification linked to a digital wallet for vulnerable groups. With this digital identity, they can easily access society and monetary government without real verification. In any case, this seems to be a great opportunity, we must remember that the identity of vulnerable groups is very important information that we must hide. This is what makes humanitarian workers wary of new technologies. Humanitarian aid agencies, including governments, have not yet used blockchain internationally. That is why international aid organizations mainly develop experimental models and look for different methods in the technical field. Aid organizations are closer to the land than the government. In this way, an increase in the use of blockchain technology in principle in the last two supply chains is remarked.

In the next chapter, we will discover the aid flows stated in the literature that are technologically supported and help enhancing the transparency within the HSC and how can blockchain contribute to improve them.

## CHAPTER 3: METHODOLOGY

In this section, the methodology followed to search extensively into the literature for the aid flows that build our humanitarian aid business technology-based model; was explained. A systematic literature review method was preferred for this aim in which “the Preferred Reporting Items for Systematic reviews and Meta-Analyses” PRISMA diagram is used for the articles screening. Afterwards Nvivo was used to analyze the articles and extract the aids flow connecting the humanitarian supply chain partners.

### *3.1 Systematic Literature Review*

In order to cover as many important files as possible and establish various commitments based on the selection of emergency response tests, it is necessary to follow a systematic approach. This section examines the method used to select the elements of the project: the systematic review method (Kitchenham 2004; Staples and Niazi 2007; Tranfield, Denyer, and Smart, 2003).

Although the concept of systematic review started in clinical practice, it has recently been applied in management. Tranfield, Denyer, and Smart, (2003) suggest that systematic review is an important part of the evidence for development. The main reason for this approach is to improve the nature of the evaluation process, organizing the research in a systematic, transparent and reproducible way.

Defining the theme of the framework is essential in any problem assessment process, which is the preference of the research team. In addition, a reasonable agreement can clarify the evaluation process and eliminate the tendency for criticism. Support researchers' transparent, predictable and prospective research objectives, participation and prohibition, and fair and public display of their own analytical methods and results. In addition, the protocol report increases the potential for downsizing and provides more operational consistency.

Systematic literature review approach is used to build the humanitarian aid business technology-based model by answering the question: How can the technology-based HA fair distribution can be achieved?



Moreover, to identify the players of the HSC from a very comprehensive view and identify the links and their themes that are connecting those partners.

### ***3.2 The Preferred Reporting Items for Systematic reviews and Meta-Analyses***

"The Preferred Reporting Items for Systematic reviews and Meta-Analyses" is what PRISMA stands for (Moher et al., 2009). Used to report items for systematic reviews and meta-analyses. The PRISMA statement includes a 27-component program and a four-stage flowchart (Moher et al., 2009). In this thesis, the four-phase flow diagram as shown in Figure 2 is used to identify the batch of articles studied to build our technological model.

In this dissertation, WEB OF SCIENCE was used as the search engine. For each journal, any paper that had at least one of the following words in the entire text of the paper was considered a potential paper for this review: "aid", "relief", "humanitarian" as shown in Table 1.

As presented in Figure 2, during the initial search and primary identification, 2940 research papers with the abovementioned keywords were found. Then only the following journals categories were included: Management, Operations Research Management Science, Environmental Studies, Social Sciences Interdisciplinary, Public Administration, Business, Area Studies, Ethics, Environmental Sciences, Communication, Social Issues, Multidisciplinary Sciences and Transportation.

Thus, only the articles and reviews were accepted as document type. Finally, we limited the publication period to 5 years from 2014 to 2019. With this final step, 684 articles and reviews were selected.

Subsequently, some articles were excluded because of language barrier, duplication and accessibility. Each one of the rest papers was reviewed using title, abstract and keywords. We ended up with 537 to review fully. The last step was full text screening. So that after several iterations of the selection process, 207 articles remained for this thesis systematic literature review.

Table 1. Protocol for database search

| Research Keywords          | Journal Keywords       | Publication Year | Docs type |
|----------------------------|------------------------|------------------|-----------|
| Aid                        | Management             | 2014             | Articles  |
| Relief                     | Operations Research    | 2015             | Reviews   |
| Humanitarian               | Management Science     | 2016             |           |
|                            | Environmental Studies  | 2017             |           |
|                            | Social Sciences        | 2018             |           |
|                            | Interdisciplinary      | 2019             |           |
|                            | Public Administration  |                  |           |
|                            | Business               |                  |           |
|                            | Area Studies           |                  |           |
|                            | Ethics                 |                  |           |
|                            | Environmental Sciences |                  |           |
|                            | Communication          |                  |           |
| Social Issues              |                        |                  |           |
| Multidisciplinary Sciences |                        |                  |           |
| Transportation             |                        |                  |           |

There are types of analysis in systematic literature review such as narrative and meta – analysis. In this thesis, a qualitative analysis is used via the software NVIVO. To outline a comprehensive connections between the HSAC partners. Next, the analysis will be explained.

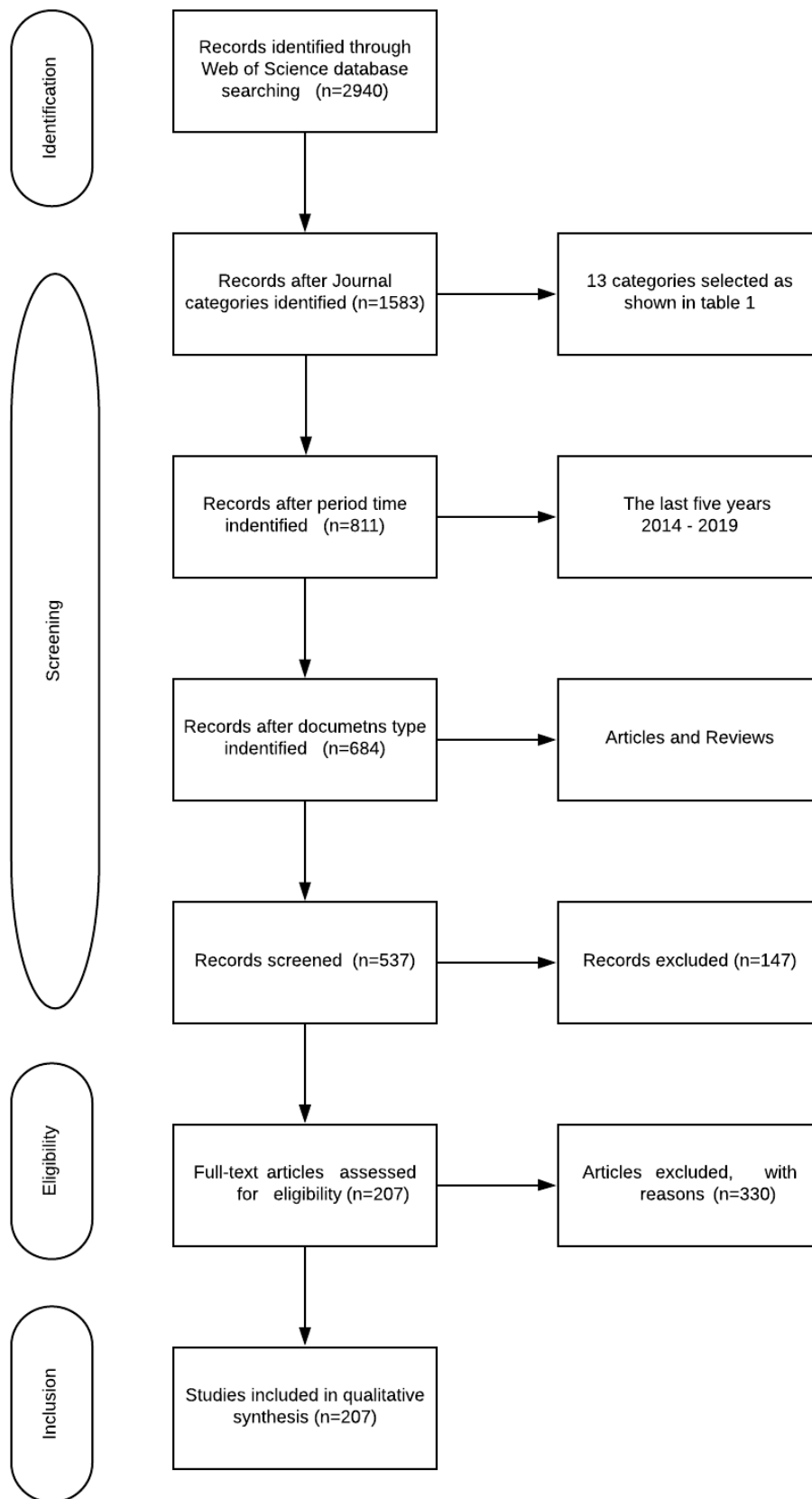


Figure 2. PRISMA Flow Diagram for articles selection. (Source: Moher et al., 2009)

### 3.3 *NVIVO*

Compared to the choice of traditional aggregated data, the amount of data collected through qualitative testing methods is very large and can be very large to accommodate important meetings and articles. It also seems difficult to manage and transform data. The tools that some qualitative scientists often use for this big project are evidence. Qualitative researchers have encouraged the use of software tools to analyze qualitative data (Azeem, Salf and Dogar, 2012). Professionals can use various software packages for qualitative research. Professionals can use various software packages for qualitative research. Computer assisted qualitative data analysis software NVivo is one of the most advanced data analysis packages.

NVivo is a "Qualitative Data Analysis (QDA)" software package provided by QSR International. With NVivo, qualitative researchers can plan, present and discover experiences with unmatched or unstructured qualitative data, such as interviews, public responses, newspaper articles, online media and web content, requiring in-depth analysis of small or large amounts of data.

The program simplifies the characterization, classification and data collection; analyzes the links in the data; integrates analysis through links, modulation, representation and modelling. Using search tools and research resources, scientists or experts can analyze patterns and evaluate information in a variety of ways. NVivo allows the use of codes and notes to annotate programs and collect data to assist with investigations.

For these reasons, Nvivo was decided for this thesis data analysis. The articles were firstly analyzed by word frequency query in order to bear out the flows or problematics clusters discussed and reviewed in the literature. Nvivo extracted 107 aid flow themes and 13 categories of them were high frequent as presented in Table 2.

Table 2. The frequency of aid flows

| Colors Ref | Humanitarian Aid links  | Articles | Frequency |
|------------|-------------------------|----------|-----------|
| ●          | Information sharing     | 201      | 97.10%    |
| ●          | Resources               | 191      | 92.27%    |
| ●          | Decisions               | 186      | 89.86%    |
| ●          | Performance Measurement | 185      | 89.37%    |
| ●          | Logistics               | 182      | 87.97%    |
| ●          | Knowledge Management    | 182      | 87.97%    |
| ●          | Relief Reporting        | 164      | 79.23%    |
| ●          | Coordination            | 160      | 77.29%    |
| ●          | Projects                | 127      | 61.35%    |
| ●          | Conflict of Interest    | 124      | 59.89%    |
| ●          | Funds (Donations)       | 116      | 56.04%    |
| ●          | Collaboration           | 103      | 49.76%    |
| ●          | Feedback                | 64       | 30.97%    |

Table 2 presents the high frequent words within 207 articles in which each color refers to a link. Then a coding phase was applied on article-by-article to encounter the themes and the partners they are linked to in the humanitarian aid supply chain and give a reason to their frequency in that articles batch.

### 3.3.1 *Definition of aid flows categories*

Before moving further in our research, the aid flows categories should be explained to what they refer to in the humanitarian aid sense. From 207 articles, Nvivo extracted 107 aid flows and 13 of them were very frequent, we classified them into 13 categories. The first category is “*information sharing*” Refers to any data shared among humanitarian supply chain actors (Kabra and Ramesh, 2016). The flow of information is meant to coordinate the physical flow and decision making in the humanitarian supply chain. The second category is “*logistics*”, it involves the mechanism of right products and services with better quality to provide it on right place and equal distribution to appropriate people. In genetic term, logistic is a term for the preparedness and planning to design, procure and management of transportation and all other needs. (Van Wassenhove, 2006). The third category is “*collaboration*”; the need of collaboration meets the global requirements of supply chain process including country level as well, but it is not only limited to networks that are physical in nature. According to the thoughts of Pettit and Beresford (2009), variety of organizations goes for collaboration which also include the different authorities local as well as globally, the private sector and military. Also, has been identified as major factor of success in humanitarian aid supply chains. The fourth category is “*resources*”; according to Kunz and Reiner (2012), Resources of two kind human resources and financial resources – Human resources associated with selecting and training of people for organization to make them skillful for the needs of organization, while financial resources are associated with obtaining more money and then utilizing it for the initiate of different organizational operations. (Kunz and Reiner, 2012). The fifth category is Knowledge management; according to Kunz and Reiner, (2012) knowledge management associates with management of different learning courses and experiences of all the humanitarian supply chain actors. The sixth category is “*performance measurement*”; based on Franco-Santos et al., (2007) performance measurement is considered as a compilation of indicators for quantifying success as well as a monitoring mechanism that provides input on the actions' outcomes. The seventh category is “*decisions*”; decision and actions made during the planning and implementation phases of relief distribution (Comes, Sandvik, and Van de Walle, 2018).

The eighth category is “*relief reporting*”; in their annual reports, humanitarian organizations detail their own results by revealing the amounts of their budgets spent on operating costs. (Haavisto and Goentzel, 2015). The ninth category is “*coordination*”; resources coordination (human resources, equipment and goods), actor coordination helps to unify policy (Tatham et al., 2010), minimize replication of operations (Nolte, Martin and Boenigk 2012) and decrease resource waste (Okhuysen and Bechky 2009). The tenth category is “*project*”; humanitarian actors – decision makers conduct relief project to improve its distribution whether using new technologies or strategies to develop the aid delivery performance. The eleventh category is “*conflict of interest*”; in the sense of humanitarian aid delivery, decision-making necessitates cautious trade-offs between a variety of conflicting goals (Abounacer, Rekik and Renaud, 2014). The twelfth category is “*funds*”; in any humanitarian endeavor, fundraising is critical. The disaster relief providers rely heavily on private and public donors to finance their procurement and logistics operations. Donor funds are obtained and allocated to finance procurement and logistics activities by the relief provider. The thirteenth category is “*feedback*”; complaints and actions are referred to as feedback. In addition, there are processes in place to identify and fix possible issues before, during and after the relief distribution (Jijelava and Vanclay, 2014).

As shown in Table 3 the extracted data was inductively analyzed and reduced to map the links connecting between humanitarian actors in the disaster phases: preparedness, response and recovery. The links were searched between the partners of the same chain or two different chains. In instance, donors and beneficiaries belong to two different chains and the links connecting them are extracted and coded. In addition, the 13 links that will build our model were searched if they are technologically supported. So that the model can explain how to improve them. The content analysis revealed interesting links as aid flows that will be presented in the next section.

Table 3. Humanitarian aid flows connections among HSC partners

|                                  | Information sharing | Resources | Decisions | Performance Measurement | Logistics | Knowledge management | Relief Reporting | Coordination | Projects | Conflict of Interest | Funds (Donations) | Collaboration | Feedback |
|----------------------------------|---------------------|-----------|-----------|-------------------------|-----------|----------------------|------------------|--------------|----------|----------------------|-------------------|---------------|----------|
| Technologically Supported        | X                   | X         | X         | X                       | X         | X                    | X                | X            | X        | X                    | X                 | X             | X        |
| Preparedness                     | X                   | X         | X         | X                       |           | X                    |                  |              | X        | X                    | X                 |               |          |
| Response                         | X                   | X         | X         |                         | X         |                      |                  | X            |          | X                    | X                 | X             |          |
| Recovery                         |                     |           |           | X                       |           |                      | X                |              | X        |                      |                   |               | X        |
| Donors-NGO's                     |                     | X         |           | X                       |           |                      |                  | X            | X        | X                    | X                 |               |          |
| NGO's - Donors                   | X                   |           |           |                         |           | X                    | X                |              |          |                      |                   |               |          |
| INGO - LNGO                      | X                   | X         |           |                         |           | X                    |                  |              |          |                      | X                 | X             |          |
| Decision Makers                  | X                   |           | X         | X                       |           |                      |                  |              |          | X                    |                   |               |          |
| Donors - INGO's                  |                     |           | X         |                         |           |                      | X                |              |          |                      | X                 |               |          |
| NGO's - Beneficiaries            | X                   |           |           |                         | X         |                      |                  |              |          |                      |                   |               | X        |
| Donors                           |                     |           | X         | X                       |           |                      |                  |              |          |                      |                   |               |          |
| Donors - Beneficiaries           |                     |           |           |                         |           |                      |                  |              |          | X                    |                   |               | X        |
| NGO's - Logistics Providers      |                     |           |           |                         | X         |                      |                  |              | X        |                      |                   |               |          |
| NGO's - UN Agencies - Government |                     |           |           |                         |           |                      |                  | X            |          |                      |                   |               |          |
| UN Agencies - Beneficiaries      | X                   |           |           |                         |           |                      |                  |              |          |                      |                   |               |          |
| UN Agencies - Donors             |                     |           |           |                         |           |                      | X                |              |          |                      |                   |               |          |
| Government - INGO                |                     |           |           |                         | X         |                      |                  |              |          |                      |                   |               |          |
| Government - NGO's               |                     | X         |           |                         | X         |                      |                  |              |          |                      |                   |               |          |



### 3.3.2 *Definition and role of humanitarian aid actors*

Before moving further in our research and analyzing the revealed aid flows links among the humanitarian supply chain actors. The definition and role of these actors should be clarified in the sense of humanitarian supply chain. First “*NGOs*”; according to Schwartz (2016) the relation between the Non-Governmental Organizations (NGO’s) and international humanitarian crisis and response is not new. Because we have analyzed the role of NGO’S as most crucial in governance of mitigating the humanitarian problem, as provider of logistics and partners to implement governmental and organizational policies as advocates, while providing the critics if necessary in any of case. Based on thoughts of Schwartz (2016) NGO’s also been observed as most essential and vital providers of assistance material, also provided the most crucial informational analysis of situations – often provided the in-depth analysis – policy making and advocacy. Second “*INGOs*”; International Non-Governmental Organizations (INGOs) have access to worldwide assets; however, they need knowledge and expertise in the newly impacted areas. (Crowther, 2001; Svoboda and Pantuliano, 2015). Third “*LNGOs*”; Local Non-Governmental Organizations (LNGOs), on the other hand, have depth understanding of their country's laws and beneficiary allocations, but they lack funding (Al Adem et al., 2018). Fourth “*donors*”; they are driven by a definite determination of giving reserves to the humanitarian organizations in order to decrease disaster hazards (Al Adem et al., 2018). Fifth “*beneficiaries*”; also called the last mile distribution of the humanitarian supply chain, are the people in need when the disaster occurs. They also contribute to the improvement of aid delivery by giving their feedbacks. Sixth “*LSPs*”; Logistics Service Providers (LSPs) are not only providing transportation services can but also offering warehousing, supply planning, storage, cross-docking, and technology management as part of their package (Vega and Roussat, 2015). Seventh “*decision makers*”; regarding to Orumie and Ebong (2014) decision makers attempt to come as close to a set of goals as possible, as decided by a set of satisfying objectives. They must coordinate a diverse set of activities in the supply chain when dealing with unknown capacities and needs, as well as inconsistent reporting phases.

## CHAPTER 4: ANALYSIS AND FINDINGS

In this section, the links extracted and coded are mapped regarding the three relief phases to show the big and detailed picture of the involvement of the partners of each HA chain. Thus, a description based on their frequency is outlined and supported by the literature statements.

### 4.1 Data analysis and findings

Conducting a Systematic Literature Review is to obtain exact and explicit results from the current aid flows in the literature. Pertinent information, facts and figures provide reliable statistics and findings on the topic and issue. In particular, the results of this thesis presents the main aid flows that are technologically supported in the literature. In which humanitarian system needs to be transparent.

#### 4.1.1 Aid flows among humanitarian supply chain actors

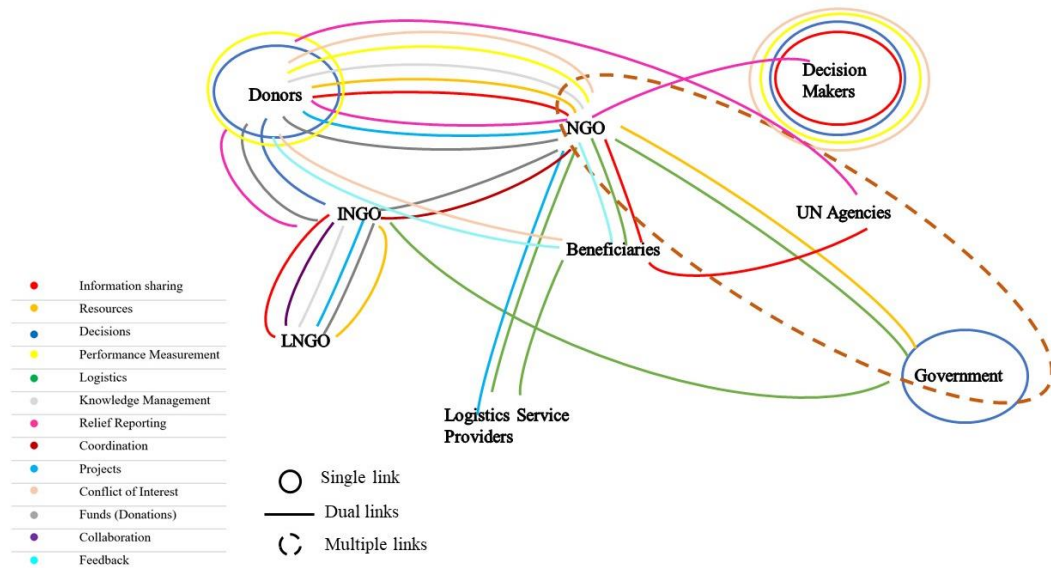


Figure 3. Aid flows among humanitarian supply chain actors

As shown in Figure 3 the literature stated that 69% of links are concentrated between donors and NGO's. Information sharing (97% of articles coverage), relief reporting (89%), resources (92%), knowledge management (87%) and projects (61%) are on the top links connecting the donors and NGO's.

38% of links connecting INGO and LNGO in terms of information sharing (97%), resources (92%), knowledge management (87% ), funds (56% ) and collaboration (49%).

Decision makers as a single actor are representing 31% of the links. Mainly discussed related to information sharing (97%), decisions (89%), performance measurement (89%) and conflict of interest (59%). It's not the only single link within the HSC, but also donors and government are contributing to decisions (89%), and performance measurement (89%) as single actors.

While donors and INGO's; NGO's and beneficiaries are sharing the same number of connection which is 3 links over 13 representing 23%. These links are mainly: Decisions (89%), funds (56%) and relief reporting (79%); and information sharing (97%), logistics (87%) and feedback (30%), respectively.

15% of links connections goes to donors and beneficiaries; NGO's and logistics service providers; NGO's and government. These five actors are sharing two different links among each dual relationship. The first group mainly connects in receiving feedbacks (30%) from the beneficiaries and conflict of interest (59%). The second group focuses on logistics (87%) and projects (61%). In addition, the last one are connected with logistics (87%) and resources (92%).

Donors and UN agencies; UN agencies and beneficiaries, INGO's and government; LSP's and beneficiaries are connected with relief reporting (79%); information sharing (97%); logistics (87%) for the two last ones, respectively.

A fundamental success factor is coordination of humanitarian operations, it represents 77% among the other factors, but as demonstrated the studies focused only on coordination between NGO's, UN agencies and government; NGO's and INGO's.

Although (Balcik et al., 2010) the process of coordinating international aid organizations (such as non-governmental organizations, "International Federation of the Red Cross and Red Crescent Societies, United Nations (UN)") and other important organizations operating within the global relief chain (such as donors, private sector companies, local governments, militaries, and local relief organizations) has shown special interest.

(Baharmand and Comes, 2018) stated that in the scope of coordination, LSPs are considered as facilitators of supply chain integration coordination, vertically and horizontally.

The model in Figure 3 is a generic one and englobes the aid flows among HSC actors. Where 69% of links are concentrated between donors and NGO's. The most important ones such as information sharing and funds. In the next figure, we will bear out the aid flows necessary in the aid phases as extracted from articles. First, we have to define the each of these phases.

#### **4.2 Disaster phases**

Management of disasters consists of four different stages; first is mitigation, second is preparedness for the situation, third is responding to situation and rehabilitation. The necessary precaution is required because the initial two stages occurs before the disaster. (Van Wassenhove, 2006).

The first two stages are crucial because they happened before disaster while it requires the major precautions to avoid any massive loss. First stages can cause the negative implications of disaster, so avoiding it through using the precautionary measures are necessary. The last two phases require attention but little than first two because it deals with short-term response after the occurrence of disasters. The first phase "*preparedness*" is vital because it deals with the activities and performances to mitigate the effects of disaster, while preparing before the disaster to manage the safety of people and infrastructure. It includes the mechanism of building the personal training centers, institutions and finding the appropriate measure to manage the situation of finances in time of any disaster. It also includes the preparedness of logistic centers and shelter zones, making of agreement with local governments for any kind of aid, drill mocks, preparedness of household and community equipment. Coordination in time of disaster and management of first aid, and understanding the warning messages is also important. The second phase "*response*"; according to Sheu and Pan; (2015), there is a constant need of effective response management and mobilization of resources at the time of disaster. Reporting for the affected area needs and information regarding the requirements of logistic support is necessary. Once the NGO's and governmental institutions receive the relief demand information, they attempt to send the resources to any of affected area within their reach.

The protection of community comes first to preserve the response employment of resources and emergency procedures to save the life, property and environment to mitigate any effect on social, economic and political structure of community.

It comes at the phase where humanitarian supply chain provides their services while giving the appropriate framework for any decision-making models (Vitoriano et al., 2015). The third phase “*recovery*”; Vitoriano et al. (2015) state that recovery includes the process and mechanism to restore the positive effects while mitigate the immediate impacts of disaster to stable the community conditions. Thus, provides the analysis of preparedness of community, their response and tasks that would be performed for recovery, it provides the information learn from the experiences to avoid any emergency in future.

#### 4.2.1 Aid flows in aid preparedness phase

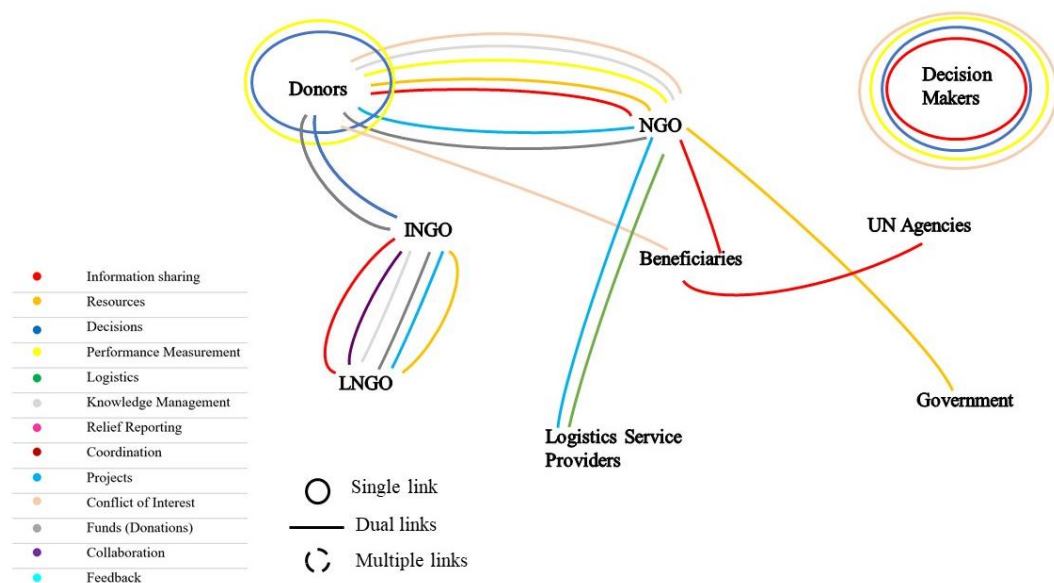


Figure 4. Aid flows in Aid Preparedness phase

In the preparedness phase the links are more focused between NGO’s and donors, INGO and LNGO. Information sharing (97%) is mostly connecting between donors, NGO’s, beneficiaries, UN agencies, INGO’s, LNGO’s and decision makers.

Logistics service providers, NGO's and donors work on projects (61%) to get prepared to disasters; natural or man-made. Adem et al. (2018) stated that at the preparedness phase, the HASC partners are prepared through a series of initiatives to conduct projects. As results of such projects, partners create guidelines, criteria or capacity-building programs in a number of aspects, such as quality of aid distribution.

Performance measurement (89%) in the studies is decided by the donors and decision makers and implemented by NGO's. While Donors and INGO's are more powerful to make decisions (89%) and share it with decision makers.

Aid resources (92%) are prepared by donors, NGO's (INGO and LNGO) and government such as in-kind resources or financial ones. In addition, NGO's and LSP's works on relief supply chain, especially on transportation, warehousing and inventory management.

To succeed the planning of the relief operations, the coordination is vital among the main humanitarian actors for the sharing of valuable resources, such as knowledge, funds, skills, products and humanitarian personnel. It is supported that coordination is a magic key that allows organizations to achieve a better value.

Baharmand and Comes (2018) assume that the humanitarian agencies, including international nongovernmental organizations (INGO)s, NGOs and other humanitarian actors, look for information to proceed with their operations and are standardized as seekers (who receive and act upon information). If humanitarian actors will go to the cluster lead for information, it would be quite reasonable to expect. It is also possible to obtain information from interactions with other sources, including media reports, donors, beneficiaries, local government, and other cluster leads. These sources outside of the cluster act as alternative carriers of information.

Baharmand and Comes (2018) find that HO's and practitioners prefer to use LSPs in preparedness (44%) more than immediate response (41%), mitigation (6%), and recovery (9%).

#### 4.2.2 Aid flows in aid response phase

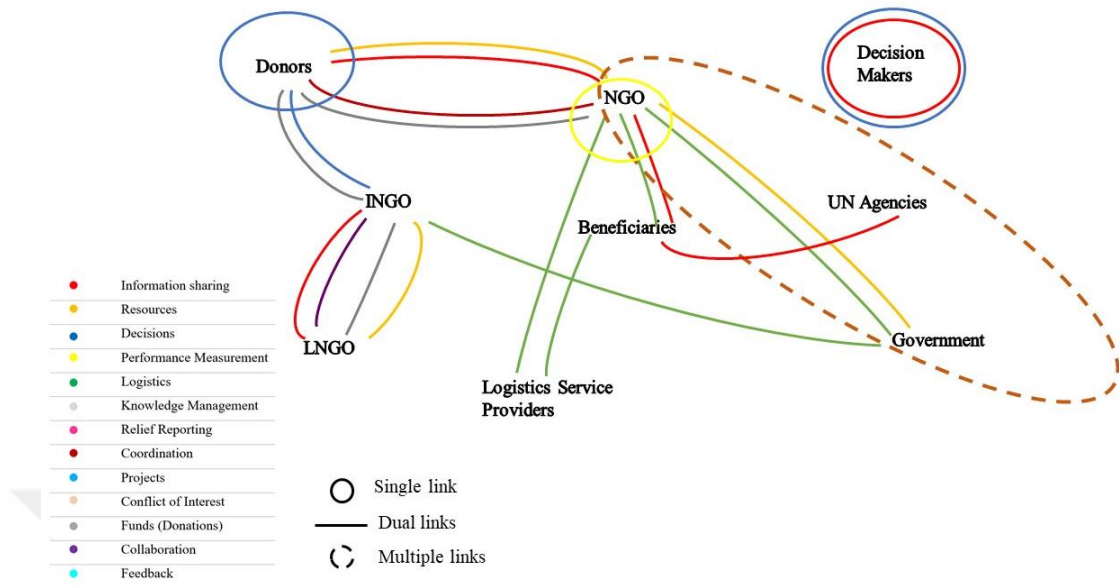


Figure 5. Aid Flows in Aid Response phase

As shown in Figure 5 and in response to the diversity and intensity of these disasters, humanitarian organizations are critical to delivering the right aid to the right people at the right place quickly to diminish unnecessary distress. That is why most of the links are between donors, NGO's, INGO's, LNGO's, UN agencies government, LSP's and beneficiaries. These actors are sharing their knowledge, information, resources, logistics services, funds, feedbacks etc.

The exchange of information still represents 96%, involving international organizations, non-governmental organizations, donors and recipients. As NGOs conflict with donor funding and criticize local media and assets, they often refuse to share information, which creates real obstacles to effective response (Bharosa, lee and Janseen 2010; Wakolbinger et al., 2011).

In view of the interview conducted with the Katrina Clearing Agency (Day and Sin, 2009), they believe that the data is unreliable, and their unwillingness to publish information along with its low priority becomes an obstacle to the flow of information.

The delays were noted in the collection and sharing of comprehensive data on the number, fields and activities and needs of humanitarian organizations, personnel rates and regional gaps. This delay is mainly due to the agencies unwillingness to discuss priority status.

The decision- making is affected by the complex systems as well as the information flows within and among their chains. The levels of coordination are also influenced within and across the system. A coordination link that connect between International aid agencies, Government NGOs by (77%). So if the humanitarian actors receive more irrelevant or less relevant information, decision-making become totally difficult if not unfeasible. For that, using the latest technologies is preferred to improve the navigation and location design to emphasize information critical to decision-makers throughout fast-moving events and to better mobilize support for breaking emergencies (UNOCHA, 2002).

#### 4.2.3 Aid flows in aid recovery phase

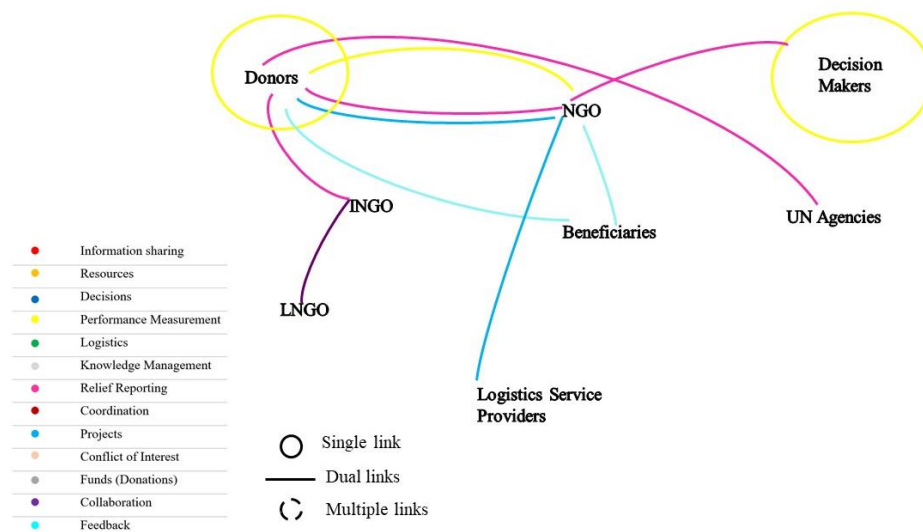


Figure 6. Aid flows in aid recovery phase

The final stage of recovery can be divided into a short post-response stage and an extended recovery stage that may take longer (Holguín-Veras, Jaller and Wachtendorf, 2012).



It can be seen in Figure 6 that most of the links are related to relief reporting from NGO's to donors or INGO's or decision makers, feedback from beneficiaries to NGO's or donors. In addition, donors, NGO's and decision makers work on the pre-set performance measurements. Donors, NGO's and LSP's work together on projects to develop solutions and find innovative technologies to improve the relief humanitarian supply chain.

McLachlin and Larson (2011) state that it is critical to share information and coordinate between all the actors. HASC partners' work together to develop the response and recovery phases. They coordinate and exchange information about the current situation, such as scales of interest and possible offers.

#### 4.2.4 The supported aid flows in humanitarian supply chain

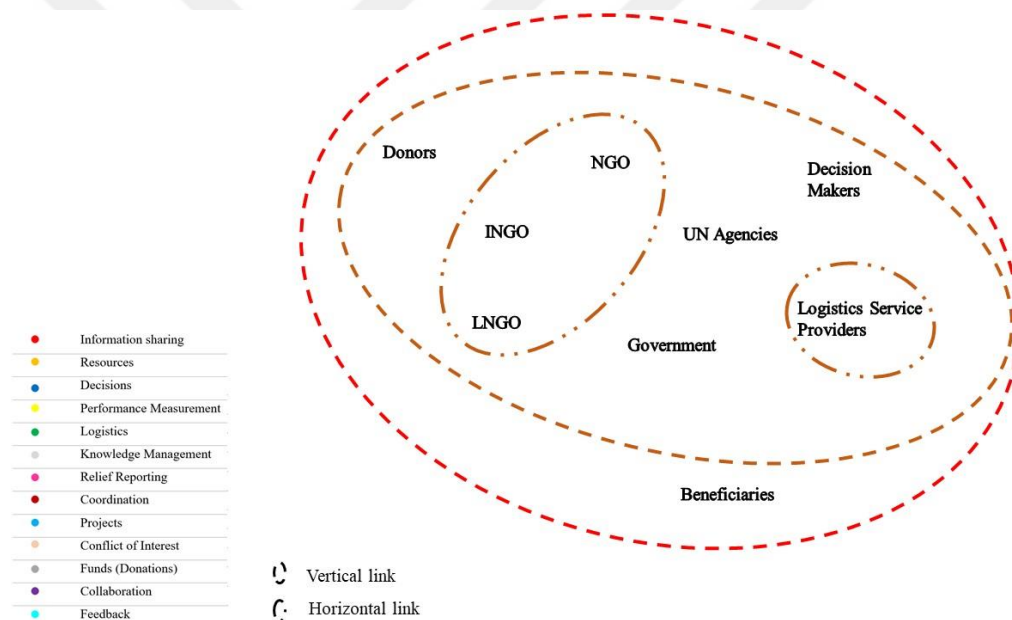


Figure 7. Supported flows in HSC

Based on the findings that were reviewed systematically. We propose next as shown in the Figure 7 that the information sharing and coordination as they are among the most leading flows within the HSC as they should involve every chain in the humanitarian system to achieve the transparency and hence the fairness in aid delivery.

Information is a key component that connects all parties involved in the humanitarian response. Indeed, remarkable improvements have been made to the information technology and communication infrastructure to facilitate better coordination and collaboration among humanitarian actors. In all cases, there are gaps in age, analysis and dissemination of data before, during and after the disaster. These gaps may be related to the concept of a humanitarian response, which can clearly be seen as an unpredictable picture. The flow of information is meant to coordinate the physical flow and decision making in the supply chain.



## CHAPTER 5: DISCUSSION

Some logics provide the meaningful difference between the two logistics i.e. humanitarian logistics and business. Logic of difference provide the characteristics of humanitarian supply chains as, their demands are unpredictable in regards of geographical characteristics, timing and types of commodity, quantity that would include the massive demand and varieties of services and products; lacking in initial starting resources in terms of supply, human resource capacity and other resources in terms of capital. There has been main observation of suffering of final recipients. Effectiveness is major objective i.e. reach out to beneficiaries as much as possible. These are the major factors while defining and formulating the strategies; process require equal transparency, which impose by major agencies externally and other donors (Vitoriano et al., 2015).

Some of specialized authors has provided the vast details in order to provide the analytical models regarding the same subject. As we can see that Balcik, Beamon, and Smilowitz (2008), has provided the different model that has recognize the process for the estimation of number and location of distributors as well distribution centers, also provided the mechanism to estimate the total quantity of products to be stored and necessary requirements in network of humanitarian logistics.

According to the proposal provided by Salmerón and Apte (2010), there is requirement of prior management of resources and capacity through formulation of models called stochastic optimization. In 2010, Lin (2010) has made an integrated programing model that has capacity for multiobjective functioning that provide the center of distributions as well as locate the temporary storages to increase the overall efficiency and performances.

In the same way, Tejada (2010) has formulated the model called meta model, it provides the assistance for the localization and allocation of support operations in response in case of hurricanes and other disasters. According to research, Görmez, Köksalan, and Salman (2011) has developed the model that associated with localization of centers and other POD's (point of demand) in Istanbul; it aims to mitigate any future earthquake effects, and maximizing the efforts of suppliers in distant areas. While, according to Jaller and Holguín-Veras (2012), there is need of

model that would contribute for the localization of POD, incorporating the social costs such as victim travels to propose the POD, the efforts during the Humanitarian aid in terms of time and services. The requirement of simplicity of parameters use for the POD localization execution to make it better for the decision makers. All of these models are more oriented on early warning systems, hence why the aim of this study is to build an aid distribution support framework.

The Humanitarian Aid BUiness TEchnology Model - HABUTEM model will be presented in this section. The HABUTEM model is a combination of the previous models explained in the analysis section. A model that cover the big picture of the aid flows that are connecting the HASC partners and their distribution within the system. HABUTEM is valid for each phase of the HASC.

### ***5.1 HABUTEM for transparent and fair humanitarian aid supply chain***

The supply chain has been classified in three main chains: donors, intermediaries and recipients. One of the main problems affecting the sustainability of humanitarian relief in the supply chain is the lack of transparency. There is a lack of transparency in all the strings, and some problems arise from that. In addition to the lack of transparency, donor well-being, transaction costs, agility and unnecessary assistance are also considered. Therefore, the allocation of aid flows to humanitarian aid supply chain's partners has been systematically reviewed and aid flows and key stakeholders have been presented.

As shown in Figure 8, the HABUTEM model presents the links that connects the humanitarian supply chain actors. On the top of these links, we found information sharing as it aims to coordinate the real processes and decisions in the aid supply chain. Whether on the preparedness, response or recovery phase these links were leaded by Donors and NGOs. Which can be explained by centralization of flows. Based on the heat map in Figure 8, more the number of the aid flows is higher more the color is darker. A centralization of flows is clear between Donors and NGO's; INGO's and LNGO's. Therefore, the bidirectional relation between Donors and NGO's is affecting the ultimate goal of distributing the aid fairly in the humanitarian aid supply chain. If we implement the technology, it would enable the transparency and decentralization of the aid flows; thus, the fair access to data.

In order to verify the consistency and acceptability of more informed decision-making programs, technology can also be used to utilize undiscovered data sources. In particular, technology-based forecasting markets provide detailed information about the verifiable potential of links that support major smart contracts. When people (such as recipients) can report specific cases and the experts in question do not have the ability, skill or motivation to make accurate reports, the use of technology will be extremely powerful.

The current demand for technology as a response to wider humanitarian challenges inspired us for this study, where statements and perceptions of technology are often raised throughout the overall lack of crosscutting analysis of technology, information and preparation processes. Emerging technologies are constantly being marketed as revolutionary that have the potential to significantly enhance humanitarian interventions through improved connectivity, more energy, greater flexibility and better knowledge. Commonly, such kind of reform discourse is frequent with regard to technological innovations that seek humanitarian challenges to address (Sandvik, 2017). It is clear now that technology is supporting our HABUTEM model by firstly decentralizing the flows between the HSC actors, then improving the transparency among the three main chains: donors, intermediaries and recipients. Finally being able to distribute the aids fairly.

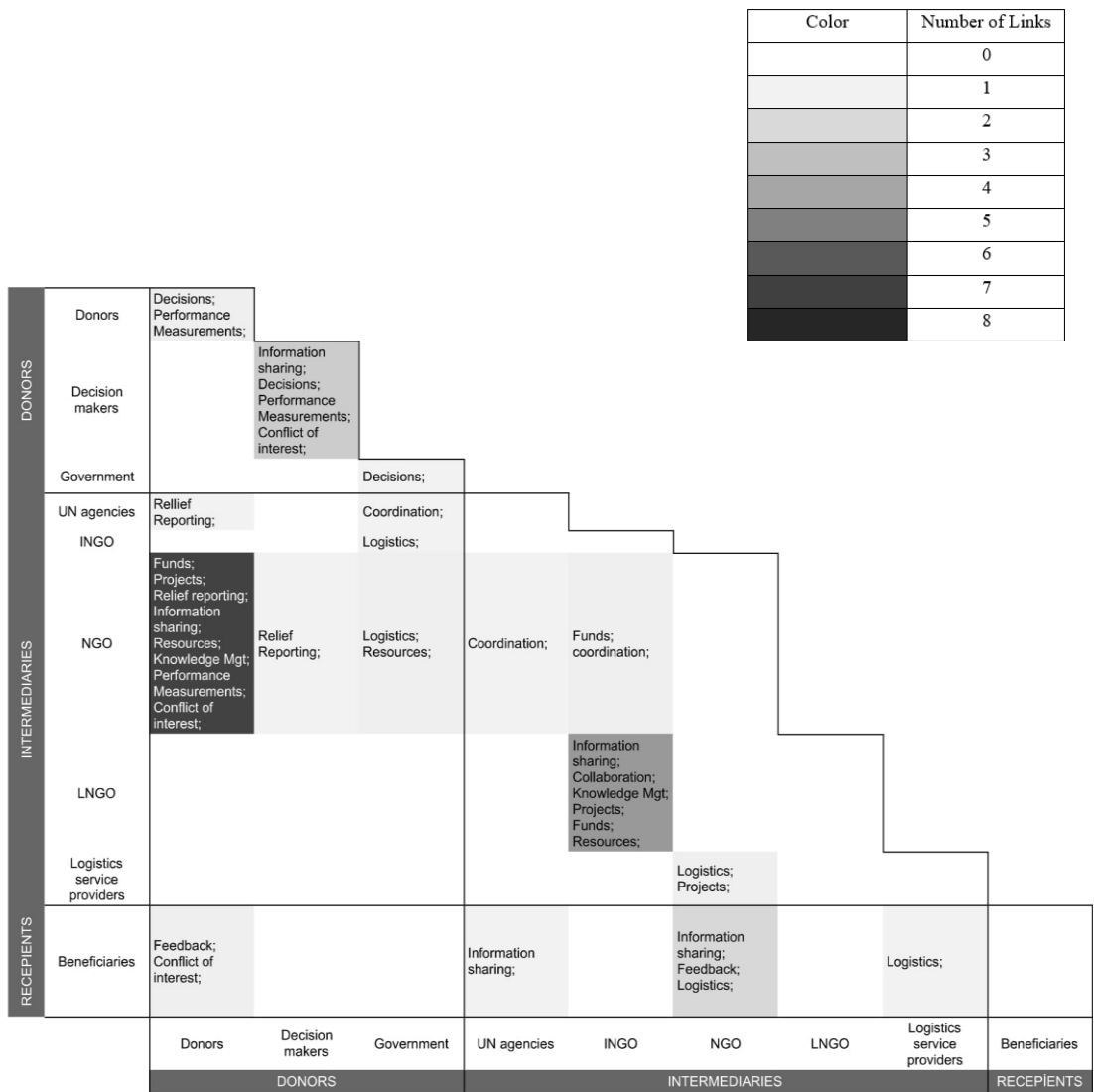


Figure 8. Proposed HABUTEM model for fair aid distribution in HSC

## CHAPTER 6: CONCLUSION

This thesis presents a systematic review of the literature on fairness of HSC aid distribution by dissecting the literature and extracting all the major aid flows that are technologically supported. The review focus in one of the main searched and fast-growing field of the last 5 years. A scientific research project was planned and implemented to examine more than 2000 references. A transparent, systematic selection process was then applied to highlight 207 relevant articles for review. By doing so, we were able to efficiently gather and present a detailed portrait of existing relief flows related to each disaster phase and then build our model.

The research questions stated in this thesis were “What are the challenges facing the effectiveness of the humanitarian aid business?” “What are the connections between the HSC partners and how they are distributed among disaster phases?” “How a technology-based business model in HA can be build?” “And how can technology driven model achieve fairness and transparency within the HASC?” The aim of this analysis was to solve the first question by analyzing the literature review’s secondary data. The supply chain of humanitarian assistance in the literature review was categorized into three basic chains: donors, intermediaries and recipients. The supply chain of humanitarian assistance in the literature review was categorized into three basic chains: donors, intermediaries and recipients. One of these chains has been related to the problems existing in the humanitarian assistance distribution system, such as donor disintegration, transaction costs, absence of equality and the delivery of inadequate aid. The underlying issue of lack of transparency has thus been clarified. Such issues are seen as HSC slowdowns, which really trigger the assistance to be far less effective and equal.

A systematic review was conducted as above-mentioned to bear out the aid flows, the pillars of HSC whether in preparedness, response or recovery phase, to achieve a fair distributed aid within a system that works with transparency that is supported by technology. In addition, proposed a HABUTEM model that can be supported by technology, which is explained in literature in response to the third research question.

Technology appears to have the ability to conquer the aid market, in principle. Since this technology has not yet been used in the state aid industry, it is difficult to predict whether it will dominate international design assistance. When cash flow is used instead of physical assistance, technology can increase transparency. Because it can improve information exchange, coordination and share with smart contracts.

### ***6.1 Academic implications***

This thesis contributed to the academic area by first addressing the fairness of humanitarian aid distribution in the context of technology as the findings and sources were insufficient in the research. Second by defining and analyzing the connections of aid flows among the humanitarian supply chain actors; in which a systematic literature review was conducted. Finally, this study proposed a generic aid flows model and other specific ones regarding disaster phases to support future researches.

### ***6.2 Practical implications***

This thesis contributed to the business area by first analyzing the aid flows and connections among humanitarian supply chain actors and support of technology. Second, by studying the contribution of technology implementation in humanitarian aid supply chain in order to achieve fairness and transparency. Finally, this study proposed a HABUTEM model that explains where technology should interfere and a model that can be taken into consideration while implementing technology in humanitarian projects.

### ***6.3 Limitations and further research***

This dissertation has some limitations such as the use of single database Web of Science, which might use at least two databases to gain access to much more various studies. Likewise, the author and advisors' decision may discourage some compelling contributions by only targeting academic journals. However, the generalizability of the screening process and validity of the study has been improved by the use of academic journals.



There are also limitations to the quantitative analysis of search terms that contribute to the description of all the most researched aid flows. Initially, a selection bias could be affecting the choice of search terms of each aid. Consequently, by knowing the word usage environment and implementing well-known counting methods, this risk can be reduced. Even if the author excludes keywords with confusing meanings, it can happen that some words are incorrectly assigned to a specific aid flow. To prevent this, obscure keywords have been excluded from the counter.

The effectiveness in humanitarian aid supply chain can start to improve by what technology has proven, so exploring the use of technology largely will be beneficial. For future research, it is recommended to study the possibility to use this technology on a global scale and what it might involve. On the micro scale, Technology provides interesting solutions, so it is important to discover what it can bring to the larger picture. Research should carry a leadership role in researching the potential of technology for the humanitarian relief field, because a majority of people will benefice from the optimized fairness of aid delivery.

## REFERENCES

- Abounacer, R., Rekik, M. and Renaud, J., (2014). *An exact solution approach for multi-objective location–transportation problem for disaster response*. *Computers & Operations Research*, 41, pp.83-93.
- Al Adem, S., Childerhouse, P., Egbelakin, T., and Wang, B. (2018). *International and local NGO supply chain collaboration*. *Journal of Humanitarian Logistics and Supply Chain Management*, 8(3), pp. 295-322.
- Altay, N., and Labonte, M. (2014). *Challenges in humanitarian information management and exchange: evidence from Haiti*. *Disasters*, 38, pp.50-72.
- Anaya-Arenas, A. M., Renaud, J., and Ruiz, A. (2014). *Relief distribution networks: a systematic review*. *Annals of Operations Research*, 223(1), pp.53-79.
- Anaya-Arenas, A. M., Ruiz, A., and Renaud, J. (2018). *Importance of fairness in humanitarian relief distribution*. *Production Planning & Control*, 29(14), pp.1145-1157.
- Ashford, R., and Biswas, S. (2010). *Aid effectiveness, transaction costs and conditionality in the education sector*. *International journal of Educational development*, 30(5), pp.481-487.
- Azeem, M., Salfi, N. A., and Dogar, A. H. (2012). *Usage of NVivo software for qualitative data analysis*. *Academic Research International*, 2(1), pp.262-266.
- Baharmand, H., and Comes, T. (2018). *Measuring the quality of humanitarian information products: Insights from the 2015 Nepal earthquake*. Switzerland: Springer International Publishing AG, pp.132-141. Available at *Advances in Intelligent Systems and Computing E-Book*. (Accessed 20 May 2019).
- Balcik, B., Beamon, B.M. and Smilowitz, K. (2008), *Last mile distribution in humanitarian relief*, *Journal of Intelligent Transportation Systems*, 12(2), pp.51-63.
- Balcik, B., Beamon, B.M., Krejci, C.C., Muramatsu, K.M. and Ramirez, M. (2010), *Coordination in humanitarian relief chains: practices, challenges and opportunities*, *International Journal of Production Economics*, 126(1), pp.22-34.

Balland, J., and Sobhi, N. A. (2013). *Humanitarian Relief Organizations and Its Relationship with Logistics Service Providers: A case study of UNICEF during the Mozambique flood disaster 2013*. Master Thesis. Digitala Vetenskapliga Arkivet (DiVA) Publishing.

Beamon, B. M., and Balcik, B. (2008). *Performance measurement in humanitarian relief chains*. *International Journal of Public Sector Management*, 21(1), pp.4-25.

Bharosa, N., Lee, J., and Janssen, M. (2010). *Challenges and obstacles in sharing and coordinating information during multi-agency disaster response: Propositions from field exercises*. *Information Systems Frontiers*, 12(1), pp.49-65.

Celik, S., and Corbacioglu, S. (2010). *Role of information in collective action in dynamic disaster environments*. *Disasters*, 34(1), pp.137-54.

Comes, T., Sandvik, K. B., and Van de Walle, B. (2018). *Cold chains interrupted the use of technology and information for decisions that keep humanitarian vaccines cool*. *Journal of Humanitarian Logistics and Supply Chain Management*, 8(1), pp.49-69.

Crowther, S. (2001). *The role of NGOs, local and international, in post-war peacebuilding*. CTTS Newsletter [Online]. Available at <https://rc-services-assets.s3.eu-west-1.amazonaws.com/s3fs-public/newsletter15.pdf> (Accessed 9 July 2019).

Da Costa, S. R. A., Campos, V. B. G., and de Mello Bandeira, R. A. (2012). *Supply chains in humanitarian operations: cases and analysis*. *Procedia-Social and Behavioral Sciences*, 54, pp.598-607.

Day, D. V., and Sin, H. P. (2009, August). *Leader development, identity, and goal orientation: a study of personal change trajectories*. In *Academy of Management Proceedings*. Briarcliff Manor, NY 10510: Academy of Management, 1, pp.1-6.

Denyer, D., and Tranfield, D. (2009). *Producing a systematic review*. In D. A. Buchanan and A. Bryman (Eds.), *The Sage handbook of organizational research methods*. 1<sup>st</sup> Edition. London: Sage Publications Ltd.

Development Initiatives (2018). *Global Humanitarian Assistance Report* [Online]. Available at <http://devinit.org/wp-content/uploads/2018/06/GHA-Report-2018.pdf> . (Accessed: 15 October 2019).

- Fessler, P. (2013). *Thanks, But No Thanks: When Post-Disaster Donations Overwhelm* [Online]. Available at <https://www.npr.org/2013/01/09/168946170/thanks-but-nothanks-when-post-disaster-donations-overwhelm>. (Accessed: 2 November 2019).
- Fleshman, M. (2006). *Fixing the humanitarian aid system*. *Africa renewal*, 19(4), pp.6-9.
- Franco-Santos, M., Kennerley, M., Micheli, P., Martinez, V., Mason, S., Marr, B., Gray, D. and Neely, A., (2007). *Towards a definition of a business performance measurement system*. *International journal of operations & production management*, 27(8), pp.784-801.
- Frot, E., and Santiso, J. (2011). *Herding in aid allocation*. *Kyklos*, 64(1), pp.54-74.
- Görmez, N., Köksalan, M. and Salman, F.S., 2011. *Locating disaster response facilities in Istanbul*. *Journal of the Operational Research Society*, 62(7), pp.1239-1252.
- Gralla, E., Goentzel, J., and Fine, C. (2014). *Assessing trade-offs among multiple objectives for humanitarian aid delivery using expert preferences*. *Production and Operations Management*, 23(6), pp.978-989.
- Gulrajani, N., and Honig, D. (2016). *Reforming donors in fragile states: using public management theory more strategically*. London: Overseas Development Institute.
- Gutting, R., and Steinwand, M. C. (2017). *Donor fragmentation, aid shocks, and violent political conflict*. *Journal of Conflict Resolution*, 61(3), pp.643-670.
- Haavisto, I., and Goentzel, J. (2015). *Measuring humanitarian supply chain performance in a multi-goal context*. *Journal of Humanitarian Logistics and Supply Chain Management*, 5(3), pp.300-324.
- Harvey, P. (2007). *Cash-based Responses in Emergencies*. *IDS Bulletin* [Online]. Available at [https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/8291/IDSB\\_38\\_3\\_10.1111-j.1759-5436.2007.tb00383.x.pdf?sequence=1](https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/8291/IDSB_38_3_10.1111-j.1759-5436.2007.tb00383.x.pdf?sequence=1) (Accessed 15 August 2019).
- Harvey, P. (2016). *Cash transfers: only 6% of humanitarian spending – what’s the hold up?* [Online]. Available at <https://www.theguardian.com/global-development>. (Accessed: 2 November 2019).

Holguín-Veras, J., Jaller, M., and Wachtendorf, T. (2012). *Comparative performance of alternative humanitarian logistic structures after the Port-au-Prince earthquake: ACEs, PIEs, and CANs*. *Transportation research part A: policy and practice*, 46(10), pp.1623-1640.

IATI (2018). *IATI Standard* [Online]. Available at <https://iatistandard.org/en/iati-standard/> (Accessed: 7 September 2019)

Ingram, G. (2018). *How better aid transparency will help tackle global development challenges* [Online]. Available at <https://www.brookings.edu/blog/upfront/2018/06/21/how-better-aid-transparency-will-help-tackle-global-developmentchallenges> (Accessed: 10 December 2019).

J Clarke, D., and Dercon, S. (2016). *Dull Disasters? How planning ahead will make a difference*. 1<sup>st</sup> Edition. Oxford: Oxford University Press.

Jaller, M. and Holguín-Veras, J., (2012). *Locating points of distribution in large urban disasters*. In *Transportation Research Board-90th Annual Meeting*, Washington, DC [Online]. Available at <http://transp.rpi.edu/~HUM-LOG/Doc/Vault/PODs.pdf> (Accessed 20 December 2019).

Jijelava, D. and Vanclay, F., (2014). *Assessing the social licence to operate of development cooperation organizations: A case study of Mercy Corps in Samtskhe-Javakheti, Georgia*. *Social Epistemology*, 28(3-4), pp.297-317.

Kabra, G., and Ramesh, A. (2016). *Information technology, mutual trust, flexibility, agility, adaptability: Understanding their linkages and impact on humanitarian supply chain management performance*. *Risk, Hazards & Crisis in Public Policy*, 7(2), pp.79-103.

Kitchenham, B. (2004). *Procedures for performing systematic reviews*. Keele, UK, Keele University, 33, pp.1-26.

Knack, S. and Rahman, A. (2007). *Donor Fragmentation and Bureaucratic Quality in Aid Recipients*. *Journal of Development Economics*, 83(1), pp.176-197.

Knack, S., and Rahman, A. (2008). *Donor fragmentation* [Online]. Available at [https://mpra.ub.uni-muenchen.de/28043/1/MPRA\\_paper\\_28043.pdf](https://mpra.ub.uni-muenchen.de/28043/1/MPRA_paper_28043.pdf) (Accessed: 12 December 2019).

Knack, S., and Smets, L. (2013). *Aid tying and donor fragmentation*. World Development, 44, pp.63-76.

Kshetri, N. (2017). *Will Blockchain Emerge as a Tool to Break the Poverty Chain in the Global South?* Third World Quarterly, 38(8), pp.1710-1732.

Kunz, N., and Reiner, G. (2012). *A meta-analysis of humanitarian logistics research*. Journal of Humanitarian Logistics and Supply Chain Management, 2(2), pp. 116-147.

Larson, P. D., and Halldorsson, A. (2004). *Logistics versus supply chain management: an international survey*. International Journal of Logistics: Research and Applications, 7(1), pp.17-31.

Lin, Y.H., (2010). *Delivery of critical items in a disaster relief operation: centralized and distributed supply strategies*. Doctoral Thesis. State University of New York at Buffalo. ProQuest Dissertations Publishing.

McLachlin, R. and Larson, P.D., (2011). *Building humanitarian supply chain relationships: lessons from leading practitioners*. Journal of Humanitarian Logistics and Supply Chain Management, 1(1), pp. 32-49.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., and Prisma Group. (2009) [Online]. *Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement*. PLoS medicine, 6(7), e1000097. Available at [https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1000097&utm\\_medium=email&utm\\_source=transaction](https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1000097&utm_medium=email&utm_source=transaction). (Accessed: 28 December 2019).

Nash, K. (2016). *Wal-Mart Turns to Blockchain for Tracking Pork in China*. Available at <https://blogs.wsj.com/cio/2016/10/19/wal-mart-turns-to-blockchain-for-tracking-pork-inchina> (Accessed: 25 August 2019)

Nolte, I.M., Martin, E.C. and Boenigk, S., 2012. *Cross-sectoral coordination of disaster relief*. Public Management Review, Nolte, I.M., Martin, E.C. and Boenigk, S., 2012. Cross-sectoral coordination of disaster relief. Public Management Review, 14(6), pp.707-730.

OCHA (2012). *Humanitarian Issues: How effective is the humanitarian aid system?* [Online]. Available at <https://www.unocha.org/story/humanitarian-issues-how-effective-humanitarian-aid-system>. (Accessed 20 August 2019).

- Okhuysen, G. A., and Bechky, B. A. (2009). *10 coordination in organizations: An integrative perspective*. *Academy of Management annals*, 3(1), pp.463-502.
- Oloruntoba, R. and Gray, R., 2006. *Humanitarian aid: an agile supply chain?* *Supply Chain Management: an international journal*, 11(2), pp. 115-120.
- Orumie, U. C., and Ebong, D. (2014). *A glorious literature on linear goal programming algorithms*. *American Journal of Operations Research*, 2014. [Online]. Available at [https://www.scirp.org/pdf/AJOR\\_2014032516123679.pdf](https://www.scirp.org/pdf/AJOR_2014032516123679.pdf) (Accessed 15 December 2020).
- Paul, E. and Vandeninden, F., 2012. *Foreign aid transaction costs: what are they and when are they minimised?* *Development Policy Review*, 30(3), pp.283-304.
- Pettit, S., and A. Beresford. 2009. *Critical Success Factors in the Context of Humanitarian Aid Supply Chains*. *International Journal of Physical Distribution & Logistics Management*, 39(6), pp. 450-468.
- Purvis, K. (2017). *Blockchain: what is it and what does it mean for development?* [Online]. Available at <https://www.theguardian.com/global-development-professionalsnetwork/2017/jan/17/blockchain-digital-technology-development-money>. (Accessed: 6 July 2019)
- Rawls, J. (2009). *A theory of justice*. Harvard university press. 6<sup>th</sup> Edition. Cambridge: Harvard University Press.
- Reinsberg, B. (2018). *Blockchain Technology and the Governance of Foreign Aid*. Working paper No. 505. Centre for Business Research, Cambridge University, 15(3), pp.413-429.
- Riani, T. (2018). *Blockchain for Social Impact in Aid and Development* [Blog]. Available at <https://humanitarianadvisorygroup.org/blockchain-for-social-impact-in-aid-and-development/>
- Ross, S. (2011). *The world food programme in global politics*. 1<sup>st</sup> Edition. Unisted States: Lynne Rienners Publishers.
- Rysaback-Smith, H. (2015). *History and principles of humanitarian action*. *Turkish journal of emergency medicine*, 15, pp.5-7.

- Salmerón, J. and Apte, A. (2010). *Stochastic optimization for natural disaster asset prepositioning*. *Production and Operations Management*, 19(5), pp.561-574.
- Samii, R. (2008). *Leveraging logistics partnerships: Lessons from humanitarian organizations*. Doctoral Thesis. Iran. Erasmus Research Institute of Management (ERIM)).
- Sandvik, K.B., (2017). *Now is the time to deliver: looking for humanitarian innovation's theory of change*. *Journal of International Humanitarian Action*, 2(1), pp.1-11.
- Savas, E. S. 1978. *On Equity in Providing Public Services*. *Management Science* 24, 24(8), pp.800-808.
- Schilling, D. A. (1994). *Equity measurement in facility location analysis: A review and framework*. *European journal of operational research*, 74(1), pp.1-17.
- Schwartz, E. P. (2016). *Humanitarian NGOs as instruments, partners, advocates and critics in the governance of international humanitarian response: complementary or conflicting roles?* *Asia Pacific Journal of Public Administration*, 38(1), pp.43-59.
- Scott, R. (2014). *Imagining More Effective Humanitarian Aid: A Donor Perspective* [Online]. Available at <https://www.oecd-ilibrary.org/docserver/5jxx3d16snf7-en.pdf?expires=1615185835&id=id&accname=guest&checksum=A80987A1CC66C537E31E2E8765921A98>. (Accessed 19 October 2019).
- Serrato-Garcia, M. A., Mora-Vargas, J., and Murillo, R. T. (2016). *Multi objective optimization for humanitarian logistics operations through the use of mobile technologies*. *Journal of Humanitarian Logistics and Supply Chain Management*, 6(3), pp. 399-418.
- Sheu, J. B., and Pan, C. (2015). *Relief supply collaboration for emergency logistics responses to large-scale disasters*. *Transportmetrica A: transport science*, 11(3), pp.210-242.
- Sphere Project Staff (2011). *Sphere Project: Humanitarian Charter and Minimum Standards in Humanitarian Response* [Online]. Available at <https://www.unhcr.org/50b491b09.pdf> (Accessed 20 December 2019).
- Staples, M., and Niazi, M. (2007). *Experiences using systematic review guidelines*. *Journal of Systems and Software*, 80(9), pp.1425-1437.



- Svoboda, E., and Pantuliano, S. (2015). *International and Local/Diaspora Actors in the Syria Response: A Diverging Set of Systems*. London, United Kingdom: Humanitarian Policy Group (HPG) at the Overseas Development Institute (ODI) [Online]. Available at <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9523.pdf> [Accessed 11 November 2019].
- Swithern, S. (2014). *Global Humanitarian Assistance Report 2014* [Online]. Available at <http://devinit.org/wp-content/uploads/2014/09/Global-Humanitarian-Assistance-Report2014.pdf>. (Accessed 6 October 2019).
- Szkarlat, M. and Mojska, K. (2016). *New Technologies as a Factor of International Relations*. 1<sup>st</sup> Edition. Newcastle: Cambridge Scholars Publishing.
- Tatham, P., Pettit, S., Jahre, M. and Jensen, L.M., (2010). *Coordination in humanitarian logistics through clusters*. *International Journal of Physical Distribution & Logistics Management*, 40(8/9), pp. 657-674.
- Tejada Calvo, D., 2010. *A Markov chain location-allocation meta-model for hurricane relief* [Online]. Available at <https://digitalcommons.fiu.edu/dissertations/AAI3420037/> (Accessed: 10 December 2019).
- Telford, J. and Cosgrave, J. (2007), *The international humanitarian system and the 2004 Indian Ocean earthquake and tsunamis*, *Disasters*, 31(1), pp.1-28.
- Thomas, A. S., and Kopczak, L. R. (2005). *From logistics to supply chain management: the path forward in the humanitarian sector*. *Fritz Institute*, 15(1), pp.1-15.
- Thomas, V., and López, R. (2015). *Global increase in climate-related disasters*. *Asian Development Bank Economics Working Paper Series*, 466, p. 39-40.
- Tranfield, D., Denyer, D., and Smart, P. (2003). *Towards a methodology for developing evidence-informed management knowledge by means of systematic review*. *British Journal of Management*, 14(3), pp.207-222.
- United Nations (2018). *Humanitarian Assistance and Assistance to Refugees* [Online]. Available at <http://www.un.org/ha/general.htm> (Accessed: 2 October 2019).

UNOCHA (2002). *Symposium on Best Practices in Humanitarian Information Exchange: Final Report*. Retrieved 16 October 2019, from [http://www.reliefweb.int/symposium/2002\\_symposium/Symposium%20Final%20Report.pdf](http://www.reliefweb.int/symposium/2002_symposium/Symposium%20Final%20Report.pdf)

Van Wassenhove, L. N. (2006). *Humanitarian aid logistics: supply chain management in high gear*. *Journal of the Operational research Society*, 57(5), pp.475-489.

Vega, D., and Roussat, C. (2015). *Humanitarian logistics: the role of logistics service providers*. *International Journal of Physical Distribution & Logistics Management*, 45(4), pp. 352-375.

Viegas, J. M. (2001). *Making urban road pricing acceptable and effective: searching for quality and equity in urban mobility*. *Transport Policy*, 8(4), pp.289-294.

Vitoriano, B., Rodríguez, J. T., Tirado, G., Martín-Campo, F. J., Ortuño, M. T., and Montero, J. (2015). *Intelligent decision-making models for disaster management*. *Human and Ecological Risk Assessment: An International Journal*, 21(5), pp.1341-1360.

Wakolbinger, T., Toyasaki, F., Christopher, M., and Tatham, P. (2011). *Impacts of funding systems on humanitarian operations*. In *Humanitarian logistics: meeting the challenge of preparing for and responding to disasters*. 3<sup>rd</sup> Edition. London: Kogan Page Limited.

Walton, R., Mays, R. E., and Haselkorn, M. P. (2011, May). *Defining fast: Factors affecting the experience of speed in humanitarian logistics*. In *ISCRAM* [Online]. Available at [http://idl.iscram.org/files/walton/2011/1059\\_Walton\\_etal2011.pdf](http://idl.iscram.org/files/walton/2011/1059_Walton_etal2011.pdf) (Accessed 15 September 2019).

Williamson, O. E. (1996). *The mechanisms of governance*. 1<sup>st</sup> Edition. New York: Oxford University Press.