

Restructuring Distribution Networks in Humanitarian Logistics

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Abstract: Humanitarian logistics is a complex environment which needs a better management of the relief operations and encounters an additional challenge — the limited collaboration among humanitarian organizations. The aim of the paper is to evaluate the possibility of transferring the concept of freight villages to the humanitarian logistics environment and to examine its effect on the performance of disaster relief operations. The conducted SWOT analysis and case study (on the 2010 Haiti Earthquake) showed that humanitarian freight villages would improve the disaster relief operations in different areas: collaboration among humanitarian organizations, preparedness, benefits for small and medium sized humanitarian organizations and the performance of emergency response.

Key words: disaster relief operations; commercial freight village; humanitarian supply chain; case study; SWOT analysis

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1. Introduction

With the high number of people affected by natural and man-made disasters, humanitarian organizations need to deliver their aid in a more efficient and effective way (Van Wassenhove, 2006). One of the key issues that relief organizations can address is the distribution network configuration which has a great impact on delivery time and costs (Simchi-Levi & Kaminsky, 1999), two significant elements in humanitarian logistics (Tomasini & Van Wassenhove, 2009), whose central purpose is to rapidly provide aid to the affected population (Thomas & Kopczak, 2005).

Given the conditions under which relief aid organizations are acting (uncertain demand, short lead times, lack of resources), their supply chain is complex and managing it is very difficult (Balcik & Beamon, 2008). One of the core challenges in the humanitarian logistics environment is the limited collaboration among the actors (Thomas & Kopczak, 2005).

One solution to tackle this situation is to look into corporate logistics concepts, which are more advanced (Thomas & Kopczak, 2005). Freight villages are an example of a concept which is present in companies' distribution networks. In freight villages, companies are sharing equipment, logistics facilities and services (UNESCAP, 2009). Such kind of collaboration could help humanitarian organizations in managing the relief operations (Thomas & Kopczak, 2005).

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The purpose of the paper is to investigate the contributions and limitations of introducing in the humanitarian logistics field the concept of “freight villages”. The objectives of the paper are the following: (1) to analyze the environmental settings and constraints of humanitarian logistics, (2) to investigate the characteristics of commercial freight villages and (3) to evaluate the effect on relief operations of transferring freight villages to the humanitarian settings.

The paper proceeds as follows. The second section analyses topics such as humanitarian logistics characteristics, relief chain structure, collaboration in humanitarian logistics and humanitarian distribution networks. The third part focuses on commercial freight villages. In the fourth section, the concept of humanitarian freight villages is introduced and analyzed in detail through a SWOT analysis. By means of a case study, the fifth section evaluates if humanitarian freight villages could have improved the performance of emergency operations during the Haiti earthquake in 2010. The strengths, limitations and main findings of the paper are discussed in the last parts.

2. Literature Review

2.1 Humanitarian Logistics Characteristics

Even if humanitarian logistics is a critical part of disaster relief operations, representing 80% of them (Van Wassenhove, 2006), the topic gained interest after the Asian tsunami in 2004 (Kovács & Spens, 2007). The main aim of humanitarian operations is to alleviate the suffering of vulnerable people (Thomas & Kopczak, 2005) and the notion of profit, essential in commercial logistics, is missing (Tomasini & Van Wassenhove, 2009). The basic features of the humanitarian environment are: limited human and capital resources, high uncertainty of supply and demand, urgency and politicized environment (Tomasini & Van Wassenhove, 2009). Furthermore, relief operations are taking place in three stages: preparedness (the phase before a disaster), immediate response (operations during the first days of a disaster) and reconstruction (the post-disaster operations) (Lee & Zbinden, 2003; Kovács & Spens, 2007). The key players in the humanitarian environment are the following: aid agencies, governments, military, donors, non-governmental agencies, the affected population and the private companies (Kaatrud et al., 2003; Kovács & Spens, 2007).

2.2 Relief Chain Structure

The flow of goods in a general relief chain is shown in Figure 1. Emergency goods are either procured globally and/or locally or in-kind donations (Beamon & Balcik, 2008). To improve their response, humanitarian organizations started to pre-position critical relief goods in strategic locations (Balcik & Beamon, 2008), on different levels: global, regional or local (Balcik et al., 2010). First, supplies are usually shipped to a central warehouse which is located next to a port or an airport. Next, the relief goods are brought to an intermediary permanent warehouse, situated in a large city. From this point, the goods are going to different local warehouses, being stored and prepared for the last mile distribution to beneficiaries. The goods can also be shipped from the suppliers or from any level of the distribution network directly to the beneficiaries (Beamon & Balcik, 2008).

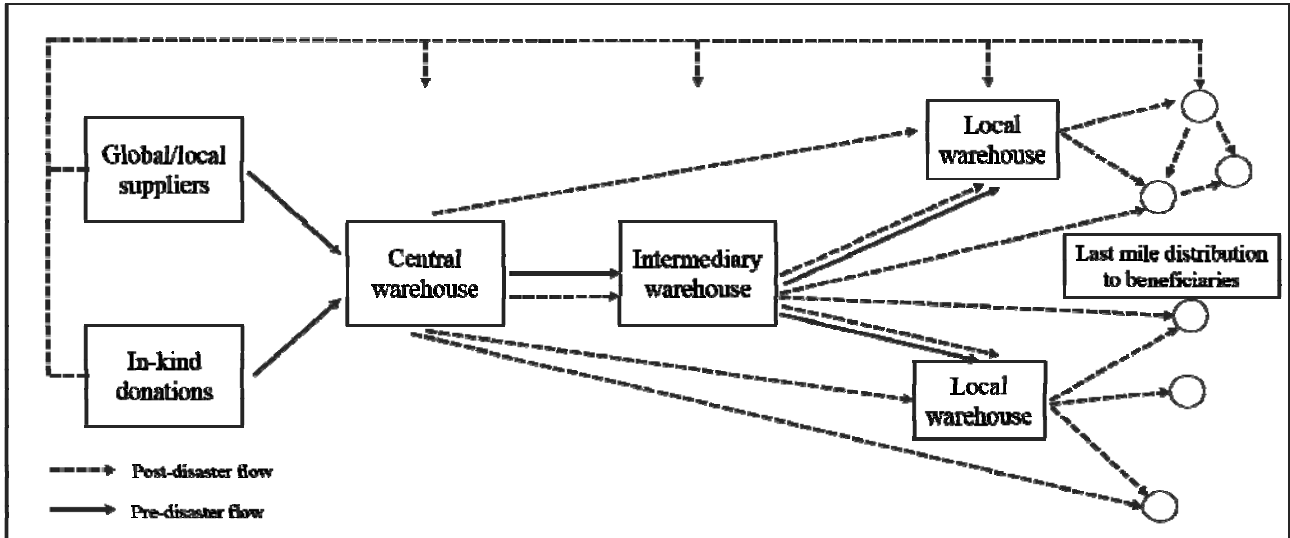


Figure 1 Relief Chain Structure, Modified From (Balcik et al., 2009)

2.3 Supply Chain Collaboration

Collaborative supply chains are defined as “two or more independent companies (which) work jointly to plan and execute supply chain operations with greater success than when acting in isolation” (Barratt, 2004). Terms such as collaboration, coordination and cooperation are used interchangeably in the humanitarian logistics field (Russell, 2005; Schulz, 2009). For the purpose of this paper, the term collaboration will refer to the jointly operations among different actors in the relief chain.

Collaboration is seen as a typical challenge for the relief chain operations (Thomas & Kopczak, 2005), being affected by various factors: (1) the large number of actors and their geographical, cultural and organizational diversity (Balcik et al., 2010; Van Wassenhove, 2006), (2) the competition for funding especially during the immediate response phase (Balcik et al., 2010; Tomasini & Van Wassenhove, 2009), (3) the cost of coordination for all the engaged actors (Minear, 2002; Balcik et al., 2010), (4) the level of unpredictability in disaster relief (Balcik et al., 2010), (5) the lack of a strong leadership to foster the collaboration among different actors (Tomasini & Van Wassenhove, 2009) and (6) the lack of resources or the oversupply (unsolicited items and information) (Balcik et al., 2010). Despite all the impediments, the donors have started to consider the inter-agency collaboration as a key performance indicator for the emergency response (Tomasini & Van Wassenhove, 2009).

One of the main collaboration methods currently used is the cluster approach (Jahre & Jensen, 2010) in which groups of relief organizations are working together to improve the humanitarian immediate response (OCHA, 2014). Furthermore, an “umbrella” organization is a facilitator of their horizontal collaboration (Balcik et al., 2010). The most present collaboration mechanisms are mentioned by Balcik et al. (2009): collaborative procurement (mainly through “umbrella” organizations during the response and reconstruction phase) and warehousing (through “umbrella” organizations and private partners in all phases of the disaster cycle) (Balcik et al., 2010).

3. Commercial Freight villages

3.1 Characteristics of Freight Villages

Some authors and organizations are using interchangeably the following terms: logistics centre, freight village, distribution centre, central warehouse, transport node, logistics depot, transport terminal, distripark etc. (Grundey & Rimienè, 2007).

For the purpose of this paper, one of the most detailed definitions, the one given by the Unescap (2009) will be used. They are defining a freight village as “an area of land that is devoted to a number of transport and logistics facilities, activities and services which are not just located in the same area but also coordinated to encourage maximum synergy and efficiency” (UNESCAP, 2009). In addition, different characteristics are considered. Firstly, a freight village is situated next to a seaport and it includes an intermodal terminal as a facilitator transfer of goods to rail and/or road. Secondly, a freight village is characterized by a central management. The managers are responsible for operational activities (e.g., maintenance of the village infrastructure) or strategic ones (e.g., growth of the village, environmental management). Lastly, in a freight village, the facilities, equipment and services are shared. The freight village members have the possibility to use their own facilities or to pay for them to other members. Additionally, there are some services and facilities that can be used by everyone in the freight village such as: customs services, conference and training rooms, truck cleaning areas. Some of the freight villages are also concerned with the well-being of the employees by building cafes, canteens or child care areas (UNESCAP, 2009). Alternative definitions for freight villages are given by given (Meidute, 2005; Weisbrod et al., 2002; Tsamboulas & Kapros, 2003).

The main services performed by the operators of a freight village are: loading/unloading, handling, storage, and consolidation/deconsolidation (Higgins & Ferguson, 2011). These are complemented by multiple value-added services such as: inventory management and control, shipment scheduling, re-packaging, freight rate negotiation, performance measurement etc. (Bolten, 1997).

3.2 Benefits and Shortcomings of Freight Villages

Most of the benefits of freight villages are related to the synergies created among the operators. Increased flexibility, lower logistics costs and higher profit margins are observed due to the sharing of logistics facilities, IT-systems and know-how (Sheffi, 2010; Jarżemskis, 2007). Moreover, small and medium-sized companies are in particular positively affected. They benefit from the economies of scale and advantages of being located within a freight village, such as intermodal equipment and better planning tools for their operations (Jarżemskis, 2007). Tacit knowledge exchange and trust among employees seem to be important advantages that proximity brings along (Sheffi, 2010). Collaboration among forwarders results in less carriers' trips with better capacity usage and the intermodal terminal shifts the long distance transports from road to rail, thus reducing the emissions and the traffic congestions (BESTUFS, 2007).

Regarding the shortcomings of freight villages, they are mostly generated when impediments for collaboration appear (Higgins & Ferguson, 2011). An exploratory study, analyzing the obstacles for horizontal collaboration within a logistics centre, found that while for unprofitable companies it is very hard to find suitable partners for cooperation, for the most profitable ones the following two factors are the impediments: (1) fair allocation of the workload in advance and (2) fair allocation of the gains (Cruijssen et al., 2007). In some of the existent freight villages, companies are just collocated, without any form of collaboration (Boile et al., 2009). The high costs of investment are seen as one of the essential shortcomings (Wisetjindawat, 2010), although there is no

conclusive evidence to evaluate if the benefits of freight villages outweigh the costs of investments (Boile et al., 2009).

4. The Concept of Humanitarian Freight Villages

4.1 Distribution Networks of Major Humanitarian Organizations

The introduction of freight villages in the humanitarian logistics environment would lead to a change in the humanitarian distribution networks.

Several examples of successful restructuring of relief distribution networks exist. For instance, after an unsatisfactory performance during Hurricane Mitch in 1998, IFRC started a plan to redesign its supply chain. By decentralizing its operations, prepositioning relief items, personnel and fleet and providing a local coordinator for the logistics activities, IFRC achieved a six times faster emergency response and a significantly better service than in previous emergency operations (Charles et al., 2011).

The goals of the distribution networks restructuring affected by the introduction of freight villages will be similar to IFRC's aims: to be closer to the affected population for improving the emergency response and to enable parallel humanitarian organizations to enter the supply chain as collaborating partners.

A visual representation of the decentralized distribution networks of four major humanitarian organizations (UNICEF, WFP, UNHCR and IFRC) is provided in Figure 2. These strategically positioned warehouses are used for the prepositioning of relief goods during the preparedness phase (UNICEF, 2013; WFP, 2014; UNHCR, 2014; IFRC, 2014). For further considerations, it is important to note that there are some locations such as Panama City or Dubai where international organizations already have their distribution centers situated and that could foster inter-organization collaboration. The second part of this section will focus on creating the framework for introducing a new concept — humanitarian freight villages.

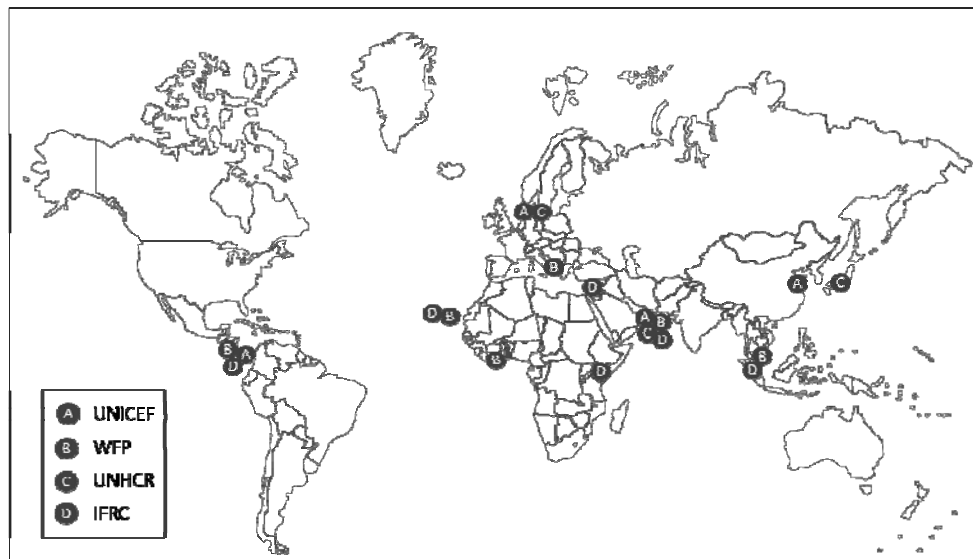


Figure 2 Regional Pre-positioning Warehouses of Major Relief Organizations

4.2 Humanitarian Freight Villages' Characteristics

For a complete overview of a humanitarian freight village, the authors looked at the definition, the tenants, the special features (facilities, management, preparedness tool, and intermodality) and the location of the villages.

These were the main points derived from the description of commercial freight villages’ characteristics, in a previous section.

It is important to mention that a humanitarian freight village will be just one type of freight village that will enable the collaboration among relief organizations. Therefore, it will be defined, similarly to a commercial freight village, as an area of land that is devoted to a number of transport and humanitarian logistics facilities, activities and services which are not just located in the same area but also coordinated to encourage maximum synergy and efficiency.

Further characteristics of this newly introduced concept — humanitarian freight villages — are introduced in Table 1.

Table 1 Characteristics of a Humanitarian Freight Village

Humanitarian freight village	
Tenants	International and local humanitarian organizations that are providing relief items to the affected population
Facilities	Warehouse and transport facilities, conference and training rooms, office buildings and additional facilities (truck cleaning, gas station, cafes); can be used by all the tenants
Management	A single humanitarian organization, responsible of the strategic decisions
Preparedness tool	Relief items pre-positioned in warehouse facilities within a humanitarian freight village
Intermodal feature	The transfer of relief goods from one transport mode to another enabled by the proximity to an airport or sea port
Location	Locations where humanitarian organizations already have their central and regional warehouses or new locations (e.g., Panama City, Dubai)

4.3 SWOT Analysis

Through a SWOT analysis, represented in Figure 3, this sub-section will further analyze the concept of humanitarian freight villages.

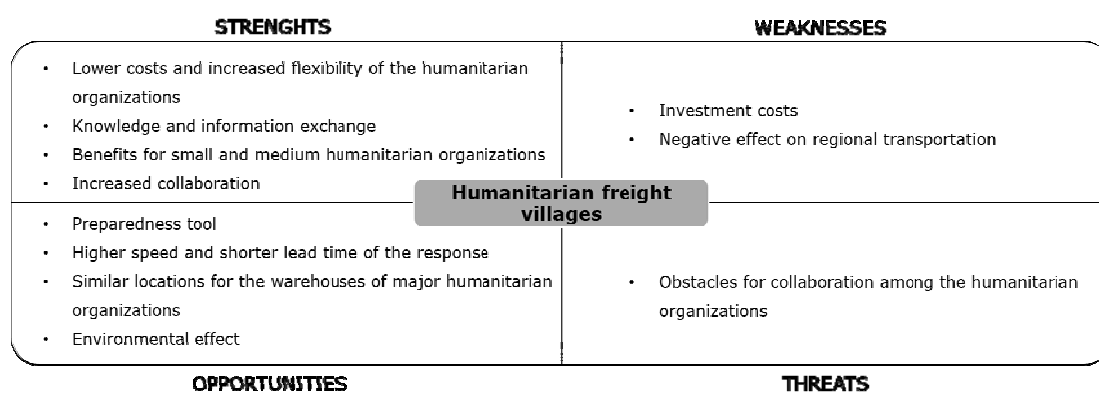


Figure 3 SWOT Analysis for Humanitarian Freight Villages

Regarding the strengths of humanitarian freight villages, most of them will be similar to the internal benefits of commercial freight villages described in a previous section. In addition, freight villages will further improve the coordination of relief activities, by excluding some of the collaboration impediments, previously presented. For instance, a humanitarian freight village will eliminate the geographical diversity factor and will decrease the cost of collaboration, which includes the salaries of the personnel and travel costs for coordination meetings (Minear, 2002). Moreover, the humanitarian freight village tenants will be managed by one leading organization, facilitating the collaboration process.

One crucial weakness of humanitarian freight villages is the high investment costs (Wisetjindawat, 2010).

However, further research is needed to conclude if the costs of humanitarian freight villages are higher than the benefits (Boile et al., 2009).

With regard to the opportunities of humanitarian freight villages, they are more related to external factors present in the humanitarian logistics environment. According to Balcik et al. (2009), most of the collaboration mechanisms in the humanitarian world are addressing the post-disaster phase (Balcik et al., 2009). However, a humanitarian freight village would be used as a preparedness tool. This will result in shorter lead times and increased speed of the emergency response (Balcik & Beamon, 2008). Similar locations of the central and regional warehouses of major humanitarian organizations (see Figure 2) will facilitate the establishment of humanitarian freight villages in particular locations, without significant changes in the upstream and downstream relief chain. Additionally, due to the sharing of transportation equipment, the number of carrier trips will be lower, with a better capacity use. This will have a positive impact on the emissions and traffic congestions (BESTUFS, 2007).

Collaboration impediments among tenants is seen as the main threat of humanitarian freight villages. This is an important point to be mentioned because it would have a negative impact on the already defined strengths of humanitarian freight villages. The competition for funding from the donors, which sometimes stops aid agencies from collaborating (Tomasini & Van Wassenhove, 2009), will still be present. Additionally, the differences in organizational and cultural structures of the relief organizations, could hinder collaboration (Van Wassenhove, 2006). Furthermore, it is not obvious how significantly the lack of technological, personnel and funding resources, seen as an obstacle in humanitarian collaboration, will be influenced by the equipment and costs sharing within a humanitarian freight village.

5. The Haiti Earthquake Case Study

5.1 Description of the Case Study

“On January 12, 2010, at 4:53 PM, a powerful 7.0-magnitude earthquake struck 15 miles southwest of Port-au-Prince, Haiti, destroying not only that capital city — home to 3 million people — but also the towns of Léogâne, Gressier, Petit-Goâve, Grand-Goâve and Jacmel, as well as countless mountain villages. The 35-second tremor devastated the administrative infrastructures of the government, several healthcare delivery facilities, and many nongovernmental relief agencies. It left more than a million people displaced, more than 300,000 injured, and an estimated 230,000 to 316,000 dead, making it one of the deadliest natural disasters in modern history. The cost of the destruction was estimated at 120% of the country’s gross domestic product” (Benjamin et al., 2011).

Because of the magnitude of the earthquake and the precarious social and living conditions prior to the disaster (Bilham, 2010), the infrastructure of Haiti was damaged on a great extent. For instance, the seaport was not operational in the first days, the airport had several damages and the telecommunication networks were hardly working (Grünwald & Renaudin, 2010). Furthermore, despite the large number of NGOs operating in Haiti before the earthquake, a major percentage of the humanitarian personnel was affected. Research data, homes and offices were destroyed, which made the assessment of the affected population needs very challenging (Kolbe & Muggah, 2010).

Most of the reports consider collaboration and weak leadership to be some of the biggest failures of the Haiti emergency response (Benjamin et al., 2011; Patrick, 2011; Grünwald & Binder, 2010). The cluster system improved the immediate relief operations, but not with the desired speed. Additionally, the lead agencies didn’t

supply sufficient emergency items (Holmes, 2010). Indeed, one of the mistakes, as outlined in the literature, was the deficient preparedness planning. Because of the low inventories of pre-positioned relief items, but also of the highly damaged infrastructure, it took 2 days for the first US airborne division to get to Haiti, even if Port-au-Prince it's just 1 hour and 20 minutes by flight from Miami. This led to a delay of several days for the affected population to receive the relief goods (Benjamin et al., 2011). Additionally, the high number of humanitarian organizations, many of whom not experienced enough, became an obstacle in providing an efficient relief response (Holmes, 2010; Patrick, 2011; Griinewald & Binder, 2010).

5.2 Effect of Humanitarian Freight Villages

While some of the problems encountered such as extensively damaged infrastructure, lack of immediate assessment of the affected population needs or weak leadership could have not been changed by the use of humanitarian freight village, others could have been positively altered.

The paper proceeds by assuming that one of the locations of humanitarian freight villages would have been Panama City, Panama.

A humanitarian freight village would have enhanced the inter-agency collaboration in terms of sharing of warehouses facilities, transportation modes, equipment and information. The positive effect would be just medium due to the existence of organizations such as UNHRD and of umbrella organizations that offer the possibility of these services. Colocation would have improved knowledge sharing and costs of collaboration to a large extent. The deficient preparedness planning could have been addressed by the use of this humanitarian freight village as a preparedness tool. A humanitarian freight village would have enabled the joint planning of multiple relief organizations. This would have resulted in higher amounts of relief items and in a better coordination in order to meet the needs of a larger part of the affected population, in a shorter time, with lower costs and higher flexibility. However, because the locations of the humanitarian freight villages would be hypothetically similar to the locations where humanitarian organizations have already warehouses, the emergency response performance would not be significantly improved, but only to a medium extent.

Furthermore, humanitarian freight villages, as the one established in Panama City or in other locations worldwide, would have brought high benefits for small and medium sized organizations, which in the case of Haiti earthquake did not perform suitably. By being co-located with major players in the relief logistics within a humanitarian freight village, small and medium NGOs could have benefited from the experience, knowledge and better equipment and training. In this way, personnel operating in the immediate response and reconstruction phase would have been more professional. This would have decreased the number of unexperienced humanitarian organizations. Obviously, for including humanitarian freight villages in the distribution networks of relief organizations, financial resources would be initially needed. The current research indicates that these costs are high, which is definitely a shortcoming of the hypothetical situation of distribution networks with humanitarian freight villages.

To conclude, humanitarian freight villages would have improved the emergency response in the 2010 Haiti earthquake, by tackling problems such as deficient preparedness, numerous unexperienced organizations and lack of collaboration.

6. Discussion

One of the strengths of this paper is the original method of tackling humanitarian logistics issues. According

to Balcik and Beamon (2008), most of the studies in humanitarian logistics are focusing on the operational relief activities through the already existing distribution networks (Balcik & Beamon, 2008). This thesis is, however, introducing a new concept which requires the restructuring of current humanitarian distribution networks. In addition, it complements the amount of studies that are addressing one essential challenge: the limited collaboration among relief organizations. Moreover, to the best of the authors' knowledge, the concept of freight villages has never been used in humanitarian logistics.

There are also some limitations of this paper. Because of the scarcity of quantitative data about the performance of commercial freight villages, a large part of the benefits and shortcomings of the humanitarian freight villages was based on theoretical and qualitative information. Besides, there was no research about the real investment costs for a freight village in order to evaluate whether the costs outweigh the benefits. Furthermore, the concept was validated in a single real-life situation, by means of the case study of the Haiti earthquake in 2010. Finally, by being a theoretical concept, humanitarian freight villages are expected to encounter alterations after the transfer to practice.

7. Conclusion

The main goal of the thesis was to investigate the contributions and limitations of introducing in the humanitarian logistics field the concept of "freight villages". The analysis demonstrated that humanitarian freight villages would improve the disaster relief operations in different areas: collaboration among humanitarian organizations, preparedness, benefits for small and medium sized humanitarian organizations and the performance of emergency response.

The concept could be enhanced by further research regarding the suitable locations and number of humanitarian freight villages. Furthermore, a quantitative evaluation of the costs of establishing such a concept in practice is required to fill the research gap in this field. It would also be interesting to study the implications of including both commercial logistics providers and humanitarian organizations as tenants within a freight village.

As a practical implication, humanitarian freight villages would address one of the most important challenges for relief organizations—the limited collaboration. In addition, they would have an impact on the management of disaster relief operations. The concept introduction in real life would positively influence the emergency response, which means the relief items would arrive faster and to a larger percentage of the affected population.

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