Risk management in regional humanitarian relief operations

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Executive summary

Every year disasters kill around 75000 people and affect 200 million people. The design and operation of a humanitarian relief chain play a significant role in achieving an effective and efficient immediate response. Kovacs and Spens (2007) propose a framework which draws parallels between issues in humanitarian logistics and business logistics. Three phases of the disaster relief operations can be distinguished, (1) the preparation phase, (2) immediate response phase and (3) the reconstruction phase. For each actor and phase, parallels to business logistics can be identified. Kovacs and Spens (2007) state that risk management will help regional actors in the phase of preparing for disaster and that further research is necessary to examine this link and identify the specific implications for humanitarian logistics. As an extension of the study of Kovacs and Spens (2007), this research aims to examine the parallels between commercial and humanitarian relief chains from the regional perspective in the preparation phase. This study will propose implications from supply chain risk management for the preparation of disaster relief operations from the regional perspective. With these implications the study intends to provide guidelines for a more effective preparation of disaster relief operations from the regional perspective.

Juttner, Peck and Christopher (2003) designed a comprehensive framework for systematically exploring the concept of risk management in commercial supply chains. It describes the basic constructs of the supply chain risk management with three risk sources, risk consequences, five risk drivers, and four strategies to mitigate risks for supply chains. Risk sources are environmental, organisational or supply chain-related variables which cannot be predicted with certainty and which have impact on the supply chain outcome variables. Risk consequences are the supply chain outcome variables like e.g. costs or quality, i.e. the different forms in which the variance becomes manifest. Risk drivers are the ‘calculated risks’ from the companies in order to improve competitiveness, reduce costs, and increase or maintain profitability, which can expose the companies to more risks. To mitigate risks for business supply chains, Juttner, Peck and Christopher (2003) propose four strategies, (1) avoidance, (2) control, (3) cooperation, and (4) flexibility.

A literature review revealed that the basic constructs of the framework of Juttner, Peck and Christopher (2005) were also recognised in studies about humanitarian relief operations. In addition to the literature review primary field data was gathered in order to explore the
implications from supply chain risk management for the preparation of disaster relief operations and gain insight in possible parallels between risk management and the preparation phase of humanitarian relief operations from the regional perspective. The qualitative case studies provided an in-depth perspective. Two case studies were undertaken, each of which uses a combination of expert-interviews and written material. The first case explores the regional humanitarian relief organisation of the Netherlands Antilles and Aruba. There is the local commander of the affected island in charge of the local hurricane relief. The hurricane relief is supported by the Dutch Military. The second case was undertaken in the Caribbean Disaster Emergency Response Agency (CDEMA), which is a regional inter-governmental agency serving the Caribbean Community (CARICOM) and is responsible for disaster relief management.

The results of the case studies show that the risk sources, which are described in the literature, have parallels with the regional humanitarian organisations from the case studies. The risk consequences of the regional humanitarian organisations are similar for all humanitarian organisations and without adequate and timely delivery of supplies, the risk can have consequences for health and lives. Most of the risk drivers from the business logistics are also found in the humanitarian literature. However, when we look at the case study material, only the globalisation trend was identified by the regional organisations. The four strategies to mitigate risks are all found in the case studies. Although the humanitarian relief chain is different from the business supply chain in some ways, the framework of risk management proposed by Juttner, Peck and Christopher (2003) for the business logistics can be transferred to humanitarian relief organisations including the regional organisations.

The managerial implications of the study lie in the observation that although the regional actors which have been studied for this research already used most of the risk management strategies, other regional humanitarian organisations might improve their organisation to apply the risk management strategies from the business logistics which have been proposed by Juttner, Peck and Christopher (2003). With the strategies avoidance, control, cooperation, and flexibility, the regional actors can achieve a more effective preparation of disaster relief operations and gain a more resilient organisation.

Several limitations of this study are noted. First, the regional actors from the case studies were both situated in a relatively small geographical area, which does not create a complex
environment. Other regional actors may have larger operating areas and a more complex environment. Second, the Caribbean is also known for the hurricanes which torture the region, which pushes the local community to remain alert. In regions which are less prone to natural disasters and have a more complex environment than the Caribbean, risk management might help the regional actors in the phase of preparing for natural disasters. Third, the case studies were limited to face-to-face and telephone interviews with 2 and 3 experts per case study. More experts could have given a better insight. Fourth, the research only studied if the basic constructs were present within the regional organisations. It did not research to what extent the basic constructs were implemented in the organisations. To study this, a more in-depth research is required. To create a better insight in the risk management in regional humanitarian organisations, further research is required. Further research should study more regional humanitarian organisations which are more geographically separated. With a more in-depth study of the organisations, the level of implementation of the basic constructs can better be explored.
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1. Introduction

Disasters such as hurricanes, earthquakes, floods, volcanic eruption etc. are more and more on the news. Every year there are about 500 disasters killing around 75000 people and affecting some 200 million people (Van Wassenhove, 2006). Predictions suggest the number of natural and human-made disasters will increase five-fold in the next 50 years (Thomas and Kopczak, 2005). The objective of disaster response is to rapidly provide relief (emergency food, water, medicine, shelter, and supplies) to areas affected by large-scale emergencies, so as to minimize human suffering and death (Beamon and Balcik, 2008). A disaster can be natural or man-made. Natural disasters comprise both ‘slow onset’ disasters such as famine and drought and ‘sudden onset’ such as tsunami’s, hurricanes or earthquakes (See figure 1: Explaining disasters). Man-made disasters also have ‘slow-onset’ disasters, such as a political crisis and a refugee crisis, and ‘sudden-onset’ disasters, for example a terrorist attack or a chemical leak. This research will concentrate on the natural, sudden-onset disasters.

<table>
<thead>
<tr>
<th>Natural</th>
<th>Man-made</th>
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<tbody>
<tr>
<td>Sudden-onset</td>
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<td>Poverty</td>
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Figure 1: Explaining disasters (Van Wassenhove, 2006)

The nature of most disasters demands an immediate response, hence supply chains need to be designed and deployed at once even though the knowledge of the situation is very limited (Beamon, 2004). The design and operation of a humanitarian relief chain plays a significant role in achieving an effective and efficient immediate response. Humanitarian logistics plays an important role in this relief chain and encompasses a range of activities, including procurement, transport, tracking and tracing, customs clearance, local transportation, warehousing, and last mile delivery. Although logistics is central to disaster response activities, for years, the aid sector’s regard for logistics has been viewed as a necessary expense rather than an important strategic component of their work (Beamon and Kotleba, 2006). Until fairly recently humanitarian logistics was a back-office function that was not
given the proper attention and logistics skill remained underdeveloped (Van Wassenhove, 2006). Since disaster relief is about 80% logistics it would follow that the only way to achieve a successful relief operation is through smooth, efficient and effective logistics operations and more precisely, supply chain management. Academic literature on the humanitarian logistics is limited. Most of the literature is not academic but originates in practitioner journals. Obviously, there is a need for academic research in the field (Kovacs and Spens, 2007).

While each actor involved in disaster relief logistics will need to take the contextual differences of humanitarian logistics to business logistics into account, from the difficulties to predict demand to coordinate supply, the tools and methods they need in disaster relief can be adapted from business logistics (Kovacs and Spens, 2007). If we define commercial (business) logistics as the process of managing the flow of goods, information and finances from the source to the final customers, humanitarian logistics can be quite easily defined similarly. Humanitarian logistics also requires a process for managing the flow of goods, information and finances from donors to affected persons (Ernst, 2003 cited by Kovacs and Spens, 2007). Humanitarian logistics, as well as business logistics, encompasses a range of activities including preparedness, planning, procurement, transport, warehousing, tracking and tracing and customs clearances (Thomas and Kopczak, 2005). This suggests, therefore, that the basic principles of managing the flow of goods, information and finances also remain valid for humanitarian logistics.

Kovacs and Spens (2007) proposed a framework that illustrates the links between different actors and phases of disaster relief operations. This framework also draws parallels between issues in humanitarian logistics, and business logistics. The framework in Figure 2 combines the perspectives of different actors involved in delivering humanitarian aid on disaster relief operations with three different phases of the operations. The actors involved in disaster relief can grouped in two large categories, regional actors, those that exist in the region and are intrinsically linked to it, such as host governments, the military, local enterprises and regional aid agencies, and extra-regional actors, such as the UN, larger aid agencies, extra-regional NGOs, logistics service providers, etc. Three phases of the disaster relief operations can be distinguished, (1) the times before a disaster occurs (the preparation phase), (2) instantly after a disaster (immediate response phase) and (3) the aftermath of a natural disaster (the reconstruction phase). For each actor and phase, parallels to business logistics can be
identified. Further research is necessary to examine each of these links and propose their specific implications for humanitarian logistics.

![Figure 2: framework for disaster relief logistics](image)

Figure 2: framework for disaster relief logistics

While natural disasters are difficult to prevent, some regions are more prone to them than others and particularly these high risk regions might be able to prepare for certain specific disaster. Also, measures can be taken to limit the impact of disasters. For obvious reasons, regional actors, e.g. regional governments, businesses and non-governmental organizations, should prepare such plans. However, in practice the emergency preparedness plans unfortunately often lack any insight in disaster relief logistics (Chaikin 2003). Logistic support is needed in prevention and evacuation-related measures before a disaster strikes (which might be foreseen, e.g. when volcanoes are predicted to erupt or hurricanes are approaching a region). Risk management will help regional actors in the phase of preparing for disaster. Kovacs and Spens (2007) state that further research is necessary to examine each of the links and identify their specific implications for humanitarian logistics.

As an extension of the study of Kovacs and Spens (2007), this research is aimed to examine the parallels between commercial and humanitarian relief chains from the regional perspective in the preparation phase. This study will propose implications from supply chain risk management for the preparation of disaster relief operations from the regional perspective.
With these implications the study intends to achieve a more effective preparation of disaster relief operations from the regional perspective.

The research is based on an extensive literature review, the study of archival data and interviews with key-players in disaster relief operations. We explore two case studies of regional emergency operations plans. The first case study discusses the emergency operation plan of the Netherlands Antilles and Aruba. The second case study is about the disaster management organisation Caribbean Disaster Emergency Management Agency (CDEMA), which holds sixteen participating states in the east side of the Caribbean. The aim of this research is to examine the regional perspective in the preparation phase, draw parallels with risk management and come to implications.

In this paper I start with examining the literature on business logistics and humanitarian logistics, risk management in business logistics and risk management in humanitarian relief operations. After this, the methodology is discussed and the results from the case studies are reported. This will lead to the discussion. Finally the conclusion is presented with implications and limitations.
2. Literature review

2.1 Introduction

Kovacs and Spens (2007) state that the tools and methods, which are needed in disaster relief operations, can be adapted from business logistics. Risk management will help regional actors in the preparation phase. Each actor in disaster relief logistics will need to take the differences between humanitarian logistics and business logistics into account, from the difficulties to predict demand to the high stakes involved. This chapter will give a literature review on the similarities and differences between commercial and humanitarian relief chains, risk management in business logistics and risk management in the humanitarian relief operations.

2.2 Similarities and differences between commercial and humanitarian relief chains

A supply chain is a network consisting of suppliers, manufacturers, distributors, retailers and customers. In this network there are three flows; the material flow, the information flow, and the financial flow. The material flow represents the physical product flow from the suppliers all the way to the customer and the reverse flow from the customer for product returns, servicing and recycling. The information flow represents the order transmission and order tracking which coordinate the physical flow. The financial flow represents the credit terms, payment schedules and consignment arrangements (Kleindorfer and Van Wassenhove, 2004). All three flows require careful design and close coordination.

Despite the contextual differences of the private sector and humanitarians, it is supply chain management that is at the centre of any given logistical operation (Van Wassenhove, 2006). The management task is to identify necessary operations and select their organizational location to realize the performance of the supply chain as a whole. Supply chain management must organize and manage a potentially worldwide supply and distribution network that delivers a variety of products and services in direct to customers needs in global markets (Schary and Sjott-Larsen, 2003).
The lifecycle of a disaster relief operation starts with a brief needs assessment period, which provides the foundation for developing the disaster relief supply chain (Beamon, 2004). After the supply chain has been established, supplies move to the region affected by the disaster. If operations must be sustained for a longer period of time, the supply chain progressively changes and becomes more structured. Finally, disaster relief operations should be reduced, such that the organisations either terminate the supply chain or transfer its operations to local agencies (Maon et al, 2009).

Several key similarities mark commercial and disaster relief supply chain management, such as the basic principles associated with the managing the flows of goods, information, and finances. The main supply chain management processes, which are used when structuring and analyzing commercial logistics, remain the same in humanitarian relief supply chain management (Maon et al, 2009):

- demand management;
- supply management; and
- fulfilment management

In humanitarian logistics, the demand management is assessing the demand after a disaster strikes. The demand is unpredictable regarding timing, location, and scale (Kovacs and Spens, 2007). Given the unpredictability of demand and the limited information aid agencies have in the first hours and days after a disaster, supplies are ‘pushed’ to the disaster location in a first phase. Only in a later stage of the relief operation more accurate data on the needs of disaster victims can be assembled, changing push supplies to more pull operations (Long and Wood, 1995).

Managing the supplies in humanitarian logistics can be complex, due to the many forms of supplies. There are loads of donated supplies, which can clog airports and warehouses (Murray, 2005). But also the ordered supplies arrive in unmanageable forms. The lack of standard labelling of supplies is one of the biggest problems of distributing aid at sites (Murray, 2005).

The fulfilment management during humanitarian operations is mostly challenging due to the poor infrastructure on site after a disaster. This can be the non-existence of airports and roads,
to the availability of vehicles and fuel. Transportation itself is often not the biggest problem. The biggest problem is mostly the shortage of materials handling equipment at the receiving end (Trunick, 2005).

In conclusion, the basic principles associated with the managing the flows of goods, information, and finances are quite similar in humanitarian relief chains as compared to commercial supply chain, however, the problems that occur in the management of these processes can be quite different. In disaster relief operations, supply chain management has unique characteristics related to the particular nature of disasters and the technical requirements of disaster relief operations. There are fundamental differences between commercial supply chains and humanitarian relief chains in terms of their strategic goals, customer and demand characteristics, and environmental factors. The dominating characteristics that bring additional complexity and unique challenges to relief chain design and management are (Beamon, 2004):

- Demand pattern
- Lead time
- Distribution network configuration
- Inventory control
- Information system
- Strategic goals
- Performance measurement system
- Demand characteristics

The demand pattern in the commercial supply chain is usually relatively stable, and predictable. Demands occur from fixed locations in set quantities. In the humanitarian relief chain the demand is generated from random events that are unpredictable in terms of timing, location, type, and size (Van Wassenhove, 2006). The demand requirements are estimated after they are needed, based on an assessment of the disaster.

The lead time of a commercial supply chain is determined by the chain of supplier, manufacturer, DC, and retailer. The requested lead times of the humanitarian relief chain is approximately zero, because there’s zero time between the occurrence of the demand and the
need for the demand, but the actual lead time is still determined by the chain of material flow (Beamon and Balcik, 2008).

The distribution network configuration has well-defined methods for determining the number and location of distribution centres for the commercial supply chain. Due to the nature of the unknown, such as the location, type and size of events, politics, and culture, and ‘last mile’ considerations, the distribution network configuration for the humanitarian relief chain is quite a challenge (Beamon, 2004, Beamon and Balcik, 2008).

The commercial supply chain utilizes well-defined methods for determining inventory levels based on lead time, demand and target customer service levels. The inventory control of the humanitarian relief chain is again challenging due to the high variations in lead times, demands, and demand locations (Oloruntoba and Gray, 2006).

The information systems of the commercial supply chain are generally well-defined and are using advanced technology. The information of the humanitarian relief chain is often unreliable, incomplete or non-existent. The work is mainly based on manual processes, trivial software such as Microsoft Excel and key people experience (Maon et al, 2009).

The commercial strategic goals are to produce high quality products at low cost to maximize profitability and achieve high customer satisfaction. The strategic goals of the humanitarian supply chain are to minimize the loss of lives and alleviate suffering (Beamon and Balcik, 2008, Thomas, 2003).

The commercial performance measurement systems are traditionally focused on the resource performance measures, such as maximizing profit or minimizing costs. The humanitarian primary focus is on the output performance measures, such as the time required to respond to a disaster (Beamon and Balcik, 2008, Thomas, 2003) or the ability to meet the needs after a disaster (customer satisfaction). The challenges are the immeasurability of the missions and unknowable outcomes.

The final difference is that demand in commercial supply chains is the product and in humanitarian relief chain the demand is first aid material, food, equipment, and rescue personnel (Kovacs and Spens, 2007).
2.3 Risk management in business logistics

Fone and Young (2002) see risk management as a general management function that seeks to assess and address risks in the context of the overall aims of the organisation. This section will discuss risk management in commercial supply chains, the supply chain risk management. The supply chain risk management can identify the potential sources of risk and implement appropriate actions to avoid or contain commercial supply chain vulnerability (Beamon, 2004). This study aims to use supply chain risk management to identify the potential sources of risk on humanitarian supply chains and come to strategies to mitigate risks.

Juttner, Peck and Christopher (2003) wrote an article with a good framework for systematically exploring the concept of risk management in supply chains. It describes the basic constructs of the supply chain risk management with three risk sources, risk consequences, five risk drivers, and four strategies to mitigate risks for supply chains. From this structure, the terms supply chain vulnerability and supply chain risk management can be derived: “Supply chain vulnerability is the propensity of risk sources and risk drivers to outweigh risk mitigating strategies, thus causing adverse supply chain consequences” (Juttner, Peck and Christopher, 2003). Supply chain risk management aims to identify the potential sources of risk and implement appropriate actions to avoid or contain supply chain vulnerability.

Risk sources are environmental, organisational or supply chain-related variables which cannot be predicted with certainty and which have impact on the supply chain outcome variables. Environmental risk sources comprise any uncertainties arising from the supply chain-environment interaction. These may be the result of accidents (e.g. fire), socio-political actions (e.g. fuel protests or terrorist attacks) or natural disasters (e.g. hurricanes or earthquakes). Organisational risk sources lie within the boundaries of the supply chain parties and range from labour (e.g. strikes) or production uncertainties (e.g. machine failure) to IT-system uncertainties. Supply chain-related risk sources arise from interactions between organisations within the supply chain. Whatever damage is caused by suboptimal interaction between the organisations along the chain is attributable to supply chain-related risk sources.
Risk consequences are the supply chain outcome variables like e.g. costs or quality, i.e. the different forms in which the variance becomes manifest. The adverse risk consequences can become manifest in any outcome measure, ranging from financial consequences through reputation damage to health and safety concerns.

Strategic choices have certain risk implications. Competitive pressures are often the drivers of risk and companies take ‘calculated risks’ in order to improve competitiveness, reduce costs, and increase or maintain profitability, which can expose the companies to more risks. In the last decade, there have been several factors which have increased the level of risk. These risk drivers include (1) a focus on efficiency rather than effectiveness; (2) the globalisation of supply chains; (3) focussed factories and centralised distribution; (4) the trend to outsourcing and (5) the reduction of the supplier base. All these risk drivers changes the structure of modern supply chains and impact directly on supply chain-related risk sources. Through the trends of outsourcing and globalisation, the complexity of supply chain structures increases. A supply network brings risks from all related network sources, namely uncertainties. Globalisation, centralised factories and centralised distribution cause longer paths resulting in more opportunities for disruption and a small margin for error if a disruption takes place (Kleindorfer and Van Wassenhove, 2004). Some of the risk drivers, like the reduction of the supplier base and the trend towards efficiency rather than effectiveness, lead to more integrated supply chains. This increases the likelihood of disruptions caused by suboptimal interaction between the supply chain organisations primarily through lack of ownership in highly integrated supply chain processes.

To mitigate risks for business supply chains, Juttner, Peck and Christopher (2003) propose four strategies:

- Avoidance
- Control
- Cooperation
- Flexibility

Avoidance occurs when risks associated with operating in a given product market or geographical area are considered to be unacceptable. A company could drop specific products, suppliers, or geographical markets if supply is seen to be unreliable.
Companies may seek to control contingencies from the various risk sources, rather than passively treat uncertainties as constraints within which they must operate. Examples in supply chains include vertical integration and the use of buffer inventory or maintaining excess capacity in production, storage, handling and/or transport or finally, imposing contractual requirements on suppliers.

Compared with control initiatives, cooperative responses involve joint agreements, rather than unilateral control, as a means of achieving uncertainty reduction. From a supply chain perspective, the focus on joint agreements among organisations in the supply chain is to improve supply chain visibility and understanding, to share information on exposures to specific risk sources and finally, to prepare joint business continuity plans.

Flexibility increases responsiveness while leaving the predictability of factors unchanged, unlike the strategy ‘control’, which attempt to increase the predictability of contingencies from the various risk sources. One supply chain example is postponement, where companies delay the decision to make, configure, label or ship a product to a particular destination. Postponement reduces their dependence on forecasts and increases the ability to respond to variability or even disruptions in demand. A second supply chain example is multiple sourcing, which is the traditional form of managing risk through spreading risk. Finally, a third supply chain example is localised sourcing with its short lead-times and potential for quick responses.

2.4 Risk management in humanitarian relief operations

To gain a good insight in the risk management in the humanitarian relief chains, the framework of Juttner, Peck and Christopher (2003) is used. Although the framework described the basic constructs for commercial supply chains, the risk sources, the risk consequences, the risk drivers, and the four strategies have parallels with the humanitarian supply chains. This section will describe the basic constructs which were found in the literature relating to the humanitarian relief operations. The parallels which are found in the literature are shown in figure 3. The risk sources, risk consequences, risk drivers and
strategies for the regional humanitarian relief organisations will be further examined in the case studies.

The risks sources identified above are also applicable to humanitarian supply chains. The natural disaster, which starts the humanitarian supply chain, is the environmental risk source. This environmental risk source can create complex operating conditions, which will have direct influence on the humanitarian supply chain (Van Wassenhove, 2006). The organisational risk sources are also applicable to humanitarian supply chains, because the natural disaster will strike on the local community. The risk source can affect labour, the communication, and the transportation (Sheu, 2006). Supply chain-related risk sources are also present in the humanitarian supply chain. After a disaster, there can be as many as several hundred humanitarian organisations at the scene of a disaster. These organisations have different agendas, ideologies and religious beliefs, but will have to work together (Van Wassenhove, 2006). A supply chain has to be established and supplies move to the region (Maon, 2009). The interactions between the organisations in the humanitarian supply chains are a supply chain-related risk source.

The risk consequences in the humanitarian supply chains are different from the commercial supply chains. In terms of end-result strived for, business logistics aims at increasing profits whereas humanitarian supply chains aims at reducing the suffering of vulnerable people (Kovacs and Spens, 2007). Therefore, the adverse risk consequences for the humanitarian supply chains will be different and can even mean the loss of lives (Beamon, 2004).

The five risk drivers have increased the level of risk in the last decade for the commercial supply chains (Juttner, Peck and Christopher, 2003). The humanitarian organisations are about 15 years behind their private sector counterparts (Van Wassenhove, 2006). Therefore some risk drivers are not applicable for the humanitarian relief operations. The shift of focus on efficiency rather than effectiveness is partly visible in the humanitarian relief chain. The pressure from donors asks for greater accountability and more attention is given to efficiency (Beamon, 2004; Oloruntoba and Gray, 2006; Beamon and Balcik, 2008), but the main goal remains the mission effectiveness (Beamon and Balcik, 2008). The humanitarian supply chains have a trend of globalisation and centralisation of most distribution (Van Wassenhove, 2006). There is a trend in outsourcing in the humanitarian relief chains. In the famine in Ethiopia in 2000, 89% of relief organisations outsourced their trucking activities (Coe, Roe
and Challacombe, 2004). Reduction of supplier base is not mentioned in appropriate literature about humanitarian relief operations. Balcik and Beamon (2008) state the contrary, the humanitarian organisations should have more suppliers and not depend only on local sources, but also have global sources.

The four strategies to mitigate risks are only partly applicable for the humanitarian relief operations. The first strategy of avoidance is partly usable. Avoidance of geographical markets and specific products are no option for humanitarian relief operations, because natural disasters can develop everywhere and avoiding food or medicine is no option. Avoidance of suppliers due to their risks to the supply chain is possible. If suppliers add more risk to the supply chain due to their e.g. lead time or geographical location, avoidance of these suppliers should be considered. For example, suppliers with a long lead time can delay a supply chain. Some prominent disaster relief agencies have made significant progress with this avoidance strategy and they have developed local sources (Maon et al, 2009).

The second strategy of control can be used within humanitarian supply chains. The strategy of increased stockpiling and the use of buffer inventory can be used with pre-positioned inventory (Oloruntoba and Gray, 2006). Only a few relief organizations can support the expense of operating international distribution centres. The majority of the non governmental organizations avoid the use of stockpiles considering them to be complicated and expensive (Balcik and Beamon, 2008). Maintaining excess capacity in storage, handling and/or transport can be used to remain flexible for demands. Most humanitarian organisations use pre-established contracts with suppliers to ensure supplies after a disaster (Fritz Institute, 2005).

The third strategy of cooperation can be used in humanitarian supply chains. This could be achieved by collaborating with other key players such as governments, military, business and other humanitarian organisations (Van Wassenhove, 2006).

The last strategy of flexibility can be achieved in humanitarian supply chains. Applying postponement may prove a cost-effective measure, enabling assignment of relief supplies to be as rapid as appropriate (Oloruntoba and Gray, 2006). Multiple sourcing is already widely used in the humanitarian supply chain (Sheu, 2007). The risks can be spread. With localised sourcing the humanitarian supply chain can response quickly (Van Wassenhove, 2006), but
relief agencies procuring locally must develop contingencies for acquiring supplies from other (non-local) sources (Balcik and Beamon, 2008).
### Risk Sources

<table>
<thead>
<tr>
<th>Business logistics</th>
<th>Humanitarian relief operations</th>
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<tbody>
<tr>
<td>Environmental</td>
<td>Natural disasters create complex operating conditions</td>
</tr>
<tr>
<td>Organisational</td>
<td>Natural disasters affect labour, communication, and transportation</td>
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<tr>
<td>Supply-chain related</td>
<td>Interaction between many different humanitarian organisations</td>
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### Risk Consequences

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<th>Humanitarian relief operations</th>
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<td>Financial consequences</td>
<td>Risk of losing lives</td>
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### Risk Drivers

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<tr>
<td>Focus on efficiency rather than effectiveness</td>
<td>More attention to efficiency and accountability</td>
</tr>
<tr>
<td>Globalisation of supply chains</td>
<td>Globalisation of humanitarian supply chains</td>
</tr>
<tr>
<td>Focussed factories and centralised distribution</td>
<td>Centralisation of most distribution</td>
</tr>
<tr>
<td>Trend of outsourcing</td>
<td>Outsourcing of transportation</td>
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### Reduction of Supplier Base

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### Strategies

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<tr>
<td>Avoidance</td>
<td>• Avoidance of suppliers due to risk</td>
</tr>
<tr>
<td>Control</td>
<td>• Prepositioning inventory</td>
</tr>
<tr>
<td></td>
<td>• Excess capacity in storage, handling and/or transport</td>
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<tr>
<td></td>
<td>• Contracts with suppliers</td>
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<td></td>
<td>• Warning tools</td>
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<tr>
<td>Cooperation</td>
<td>• Collaboration of key players in the humanitarian operations</td>
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<td>Flexibility</td>
<td>• Postponement</td>
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<tr>
<td></td>
<td>• Multiple sourcing</td>
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<tr>
<td></td>
<td>• Localised sourcing</td>
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Figure 3: Risk management in humanitarian supply chains

Oloruntoba (2005) writes an article about the lessons of the 2004 Tsunami in the Indian Ocean. This study suggests the use of a good tool which warns for catastrophes. This is based on the key issues leading to the catastrophe in the Indian Ocean: the failure of the Pacific tsunami early-warning system and other geophysical and hydro-meteorological monitoring agencies to communicate the occurrence of a submarine earthquake and subsequent risk of a tsunami in the Indian Ocean to regional authorities. Although the tsunami early-warning system is applicable for one region, the warning system is also transferable to other regions. Tokyo and San Francisco are examples of cities that need to carefully prepare for the possibilities of earthquakes, other cities and regions are close to an active volcano and in the
Caribbean they need to be prepared for hurricanes (Kovacs and Spens, 2007). With an early warning system the humanitarian organisations can get more control. So warning tools can be part of the control strategy.
3. Methodology

3.1 Introduction

This research is based on a literature review and on gathering primary field data in case studies. This is a suitable research strategy since the existing literature has not yet explored the possible parallels between risk management and the preparation phase of humanitarian relief operations from the regional perspective (figure 4). The case studies will be qualitative and provide an in-depth perspective. The research in this study is based on two case studies, each of which uses a combination of expert-interviews and written material. The experts of both organisations have been interviewed by phone and face-to-face in 2 rounds. Each individual interview lasted about 10 minutes. After the first contact, semi-open questions have been sent to the experts. The answers were discussed with the experts in a second interview which was mainly carried out by telephone. In some instances, a personal meeting in the Caribbean was organised. The interviews in the second round lasted approximately 30 minutes. For the NA&A-case, the Head of Operations CZMCARIB, Staff officer Operations, Head of Logistics, Supply Coordinator, Transport Coordinator, Communication Coordinator and custodian of the local operation order (Moer, 2009) were interviewed (respectively 1A, B, C, D, E, F in appendix). For the CDEMA-case, the Deputy Coordinator, Chief Researcher, Technical Manager Preparedness and Country Support and the Information, Communication and Technical Specialist were interviewed (respectively 2A, B, C, D in appendix). This procedure ensured the provision of an in-depth perspective on the organizations and their behaviour during humanitarian relief operations.
3.2 Case studies

Every year from May till late October, the hurricane season is torturing the Caribbean. Many hurricanes have created several natural disasters on the Caribbean Islands. Next to the global organisations, which can help in the area, there are several regional humanitarian organisations which come to action after a natural disaster. Throughout the years the working of these organisations has been tested by several natural disasters. The case-studies analyse the approach of two regional humanitarian organisations in the Caribbean, the humanitarian organisation of the Netherlands Antilles and Aruba and the Caribbean Disaster Emergency Management Agency (CDEMA).

3.2.1 Case description Netherlands Antilles and Aruba

The Netherlands Antilles and Aruba (NA&A) are part of the Kingdom of the Netherlands. In the NA&A are six islands. Regularly devastating hurricanes pass some of these islands: the
SSS-islands consisting of St Maarten, St Eustatius and Saba. The local commander of the affected island is in charge of the local hurricane relief. He is head of the Island Disaster Staff. The Island Disaster Staff coordinates the hurricane relief. The hurricane relief is supported by the Dutch Military. This support is one of the main tasks of the Dutch Military. The employment of the Dutch Military is coordinated by the staff of the Dutch Naval Commander Caribbean, who is seated in Willemstad, Curacao. For this hurricane relief, a specific organisation has been formed and consists of the next elements:

- The Dutch Naval Commander Caribbean and his staff
- The detachment ‘Bovenwinden’ consisting of military troops
- A navy ship with a embarked helicopter
- A support ship with 6 small boats
- A detachment of the Netherlands Military Police
- The Coastguard Netherlands Antilles and Aruba, consisting of airplanes, coastguard vessels, and small boats

The hurricane relief consist of the rescue and helping of the affected people, organising the local infrastructure, organising food, (fresh) water, and basic shelter, sanitary and power supply. Another task is to avoid and stop plundering. An active roll is played by the military in cooperation with the local authorities (fire department and police). International organisations as the Red Cross are also involved with the relief activities.

3.2.2 Case description CDEMA

The Caribbean Disaster Emergency Response Agency is a regional inter-governmental agency which serves the Caribbean Community (CARICOM) and is responsible for disaster relief management. There are currently sixteen participating states within CDEMA’s membership. The main function of CDEMA is to make an immediate and coordinated response to any disastrous event affecting any participating state, once the state requests such assistance (CDEMA, 1991). The disasters can range from earthquakes, floods to hurricanes.

The Agreement which established CDEMA (CDEMA, 1991) states the organs and the structure of CDEMA. The 16 participating states are grouped into four sub-regions, each of
which is headed by an operation unit known as a Sub-Regional Focal Point. The functions of each focal point are to maintain an updated information package about the facilities and services available in each participating state, maintain and test the basis communications, maintain independent fuel and power supplies, and maintain a serviceable and optimal working equipment package containing essential items.

Each participating state has a National Disaster Organization or a national relief organization capable of responding to disasters in the all Participating States. This is the government-designated organization which has overall responsibility for the country’s National Disaster Management Programme.
4. Results

4.1 Introduction

In this section the results of the case-studies will be described. The results are based on the basic constructs of risk management as identified in chapter two. First, the humanitarian organisation of the Netherlands Antilles & Aruba will be discussed. Second, CDEMA will be described. An overview of the results of both case studies is shown in appendix.

4.2 Netherlands Antilles & Aruba

Risk sources are the environmental, organisational or supply-chain related variables which cannot be predicted with certainty and which have impact on supply chain outcome variables. The management of the humanitarian organisation of the NA&A sees the natural disaster itself as the main source of environmental risk. The natural disaster can lead to complex operating conditions. After hurricane Luis (1995) there was no communication with the affected area for the first few days after the disaster, because all communication infrastructure was destroyed. Another risk source after this hurricane was plundering. Plunderers robbed the shops and caused anarchy on the islands. Due to the plundering, food was not distributed equally over the population. To prevent this, a part of the humanitarian organisation, which is partly military, needs to be deployed to guard the shops and cannot be deployed for humanitarian aid. Also the transportation on the islands is a risk source after a hurricane, due to the bad conditions of roads and collapsed infrastructure. The risk of plundering as well as bad infrastructure can be considered as organisational risks.

There are also supply-chain related risk sources. After each disaster, a relief chain is newly formed. Although there is a yearly exercise drill on the islands, after a disaster the situation is always different from what has been rehearsed in the exercise drill. For example, directly after the hurricane Luis in 1995, international humanitarian organisations flew in supplies to St Maarten. The regional organisation was unaware of the arrival of these supplies and had to come with a new plan to set up a supply chain for the distribution of these supplies.
The consequences of these risks can be very diverse. It can range from anarchy, in case of plundering, but it can also involve health risks for the local community. For example, after hurricane Luis in 1995, bad communication and a chaotic relief operation resulted in plundering and an excess of transportation of equipment and supplies. The first few days after the hurricane, there was no communication with the disaster area. Due to this and the chaotic operation, an overload of equipment and supplies were unnecessarily flown to the disaster area and had to be shipped back after the relief operation.

All the risk drivers that were identified in chapter 2 are not found in the humanitarian relief organisation in the NA&A. Although the organisation is also focussed on efficiency, the main focus of the organisation is on effectiveness. The trend of globalisation which is a risk driver in business logistics is not found in the organisation in the NA&A. Although the organisation still has some global suppliers, these suppliers are not critical for the supply chain. The organisation is currently reducing these global suppliers and switching more to local suppliers. Also the centralisation of the distribution is not found in the NA&A. The organisation uses several distribution centres on the main islands. The transportation of the organisation is not outsourced. They are supported by the Netherlands Ministry of Defence, which has its large transport capacity which can be used for humanitarian relief. This capacity consists of several ships, planes, helicopters and small boats (Moer, 2009). There are also no other activities outsourced. The main supplier of the humanitarian organisation NA&A is the Netherlands Ministry of Defence. They supply for example food, tents, and medicines. The other suppliers supply water and local goods. A reduction of the supplier base is not found in the organisation.

The strategy of avoidance which is used by the humanitarian organisation NA&A is mainly based on the lead times. The lead time of the Netherlands Ministry of Defence is short because of their large storage of several equipment and food. Due to the Head of Logistics, the supply of water by the Netherlands Ministry of Defence is avoided due to the weight and volume of the freshwater. The air transport capacity is not suitable for the transportation of the freshwater. The freshwater is now supplied by a local supplier, which has a short lead time. Next to this supplier, a navy ship can create and supply approximately 3000 litres of fresh water per day (Moer, 2009) and there is a small amount of fresh water stored in Curacao.
The organisation has several tools to gain more control of the humanitarian supply chain. The organisation is gaining control by pre-positioning small amounts of food, supplies and transportation which are geographically separated over the islands. There is also food and supplies stored on several navy ships which are stationed in the Caribbean. The storage on the islands and the navy ships has excess capacity. For the handling are several military platoons available. If there is a warning before a disaster strikes, a military unit, consisting of 92 persons (Moer, 2009), is already transported to the areas which are endangered by the disaster. These military forces will bring their own communication equipment, to remain in contact with the headquarters at Willemstad. The 200 coastguard personnel and military forces which are based on the NA&A can all be employed for the humanitarian operation. They are the excess capacity of the handling. The coastguard has his own transport capacity which consists of two aircrafts, one helicopter, three patrol ships, and one cargo ship. These can be used to get supplies to the affected areas. The Netherlands Ministry of Defence have excess capacity of air transport in the Netherlands, which will be used before and after the disaster strikes. The navy ships can also be used as transport capacity to get supplies to all the islands. One navy ship is also accompanied by a helicopter which can be used for the ‘last mile’ transportation. On several islands of the NA&A, there are several trucks which can also be used for the ‘last mile’ transportation.

The humanitarian organisation has also contracts with several suppliers. A local freshwater supplier can deliver large amounts of freshwater within hours at the airport or at the harbour, from where it can be transported to the affected areas. On the island St Maarten, the humanitarian organisation has a contract with a car rental company, which will deliver four-wheel drives for transporting personnel and small amounts of food and supplies. Based on the limited air capacity of the coastguard, there are contracts with local air transportation companies which will deliver several aircrafts for the transportation of supplies and personnel to the affected areas. On the command centre of the humanitarian organisation in Willemstad, there is daily communication with several meteorological stations. This keeps the organisation up-to-date with the local weather forecast and especially with the hurricane threat in the region. If possible, they can give an early warning for possible natural disasters.

Cooperation is widely used in the humanitarian operations. The humanitarian organisation is a cooperation of several players as described in chapter 3. The organisation works together with several key players to gain an efficient relief chain. The main key players are the local police,
fire-department, militias and the Red Cross which is based on the island St Maarten. There is no cooperation with other regional humanitarian organisations like CDEMA. The organisation believes that they can cope with all kinds of disasters. Further cooperation with other regional humanitarian organisations is not believed to be necessary, especially due to the close cooperation with the Netherlands Ministry of Defence, which gives the organisation enough redundancy.

The humanitarian organisation uses the strategy of flexibility with several factors. The organisation uses postponement. They postpone the decision to ship supplies to the affected area. The supplies are not pushed into the affected area, but are only transported to the affected area after the need of these supplies is confirmed. The military forces, which are already geographical separated in the affected areas, have their own military communication equipment and not rely on the local communication infrastructure. They will communicate the local requirements with the command centre. Based on this information, the required supplies will be transported to the areas. In the past, the supplies were pushed in the affected areas. This leaded to chaos on the affected areas and the organisation postpones the decision to ship supplies and now mainly uses the ‘pull’ strategy, where military forces in the affected area communicate the demand for supplies and equipment with the humanitarian relief organisation. The organisation uses multiple sourcing, but this is mainly indirect. The Netherlands Ministry of Defence is the main supplier for the humanitarian organisation. They use multiple sourcing and they can use supplies from all NATO-countries.

As stated before, the humanitarian organisation also uses localised sourcing for the freshwater supplies. Because the humanitarian organisation is controlled by the coastguard and the Ministry of Defence, the organisation has the power to seize supplies of the local retailers and companies. The seizure can be seen as a form of localised sourcing.

4.3 CDEMA

The management of CDEMA considers the natural disaster as the main risk source for the organisation. This environmental risk source will create complex operating conditions on the affected island. The natural disaster can also affect labour, communication and transportation on the affected island. Due to the geographical separation of the participating states, it is unlikely that all 16 states will be affected. Due to this, a part of the capacity of the CDEMA
will remain unaffected. The risk of not enough labour, bad communication and inadequate transportation is considered the organisational risk source. After a disaster, the government of the affected participating state can ask CDEMA for assistance. They will start with coordinating assistance from the other participating states and start a humanitarian supply chain. They will also appeal international organisations and other countries to assist the organisation. Due to the extent of the disaster, the situation after a disaster will always be different. The new supply chain has to adapt to the situation. The creating of the new supply chain can cause problems, which are considered as the supply-chain related risk source.

The risk consequences can range from health risks to risk of life. After hurricane Ivan in 2004, several health institutions remained inoperable for many days, because the institutions were inaccessible due to damage to the infrastructure or due to the lack of the right equipment. Many people suffered longer due to the inoperable institutions.

Most of the risk drivers were, like in the NA&A-case, not found in the CDEMA. CDEMA is also mainly focussed on effectiveness, although they also try to focus on efficiency. Every participating state has a national disaster organisation. All these organisations have their own distribution centre and there is no trend of centralisation. No activities of CDEMA are outsourced. The participating states use their own transportation of all personnel, equipment and supplies, but after a disaster all transportation is coordinated by CDEMA. There is also no trend of reduction of the supplier base. CDEMA is expanding their supplier base to remain resilient.

There is a trend of globalisation within the organisation. Most supplies come from national and regional organisations, but international organisations, like NGOs, can provide specific resources or expertise. CDEMA already cooperate with NGOs and after a disaster CDEMA coordinates this assistance.

All participating states have their suppliers and have their own avoidance strategy. Suppliers are avoided based on their lead times and geographical setting.

CDEMA uses the strategy of control. All 16 states have their own national organizations, which have their own suppliers, pre-positioned inventory, and own capacity in storage, handling and transportation. This creates an overlap which ensures the right aid for the
community. The four Sub-Regional Focal Points have a database of relevant resources, facilities, and services of their sub-region and this gives the organization good control of the supply chain. All participating states have their own contracts with suppliers. Most states have contracts with local suppliers which oblige them to have excess supplies during the hurricane season in their own warehouses, to make sure that enough supplies can be delivered after a disaster. CDEMA established arrangements with regional airlines and shipping lines in order to ensure access to their facilities on a priority basis after a disaster. The secretariat of CDEMA, which is based in Barbados, monitors the Caribbean meteorological stations which will warn the organization and participating states for coming disasters.

CDEMA has pursued a policy of cooperation with national, regional and international organisations which have overlapping interest. They cooperate with all sixteen national disaster organisations, NGOs like the Red Cross, private sector and specialised technical agencies. After a disaster the organisation makes an appeal to all organisations to assist in the humanitarian relief organisation.

The fourth strategy of flexibility is also used in the organisation. Postponement is frequently used. One of the best lessons from other humanitarian relief operations is the need of an immediate assessment of the affected area. This assessment has to be made within 12-24 hours after the disaster. Due to much effort, the organisation has now a reliable damage assessment system and procedures to facilitate rapid and effective evaluation of a disaster. An emergency operations system capable of handling emergency telecommunications and facilitating coordination of emergency responses are rapidly established. This emergency system relies on HF-radio and satellite communication, because the primary communication with telephone and internet is probably out of commission. The immediate assessment enables the organisation to postpone the decision to transport supplies to the affected area until there is a reliable assessment of the need for supplies in the area. To remain flexible, all organisations which assist in the humanitarian relief operation have to coordinate the correct supplies and the transportation with CDEMA. In the past, organisations helped the affected areas with supplies, but these uncoordinated supplies had to be processed and a new supply chain had to be formed. This uncoordinated assistance delayed the operation and consumed capacity of the organisation.
CDEMA uses localised sourcing within the organization. All sixteen states have their own sources, which are mainly local. Due to the limited resources in the region, some suppliers are from outside of the region. All participating states have their own regional and/or national suppliers for their inventory. CDEMA is also maintaining relations with international relief organisations, like the Red Cross, in order to facilitate accessing of their resources. With these overlapping resources, CDEMA use multiple sourcing.
5. **Discussion**

5.1 **Introduction**

In chapter 2, the literature describing the humanitarian operations and risk management has been discussed. This study is focussing on the regional humanitarian operations and where risk management can assist the regional humanitarian organisations. Therefore, the case-studies focus on whether and how the regional humanitarian organisations can use risk management in their preparation phase. Based on the constructs of the risk management, the results from the case-studies will be discussed and compared with the literature about humanitarian operations and risk management.

5.2 **Discussion**

The *risk sources*, which are described in the literature, have parallels with the regional humanitarian organisations from the case studies. The environmental risk source is a large risk, because the natural disaster creates complex operating conditions. The organisational risk source in humanitarian relief operations is similar to the situation as described in the literature about commercial supply chains. The risk source is present in both organisations, because a disaster can affect labour, communications, and transportation. In the NA&A is also the risk of plundering, which will lead to anarchy on the islands. Although the regional organisations hold regular exercise drills, each relief chain is newly formed after a disaster and the interaction between the different humanitarian organisations remains a supply chain-related risk source.

The *risk consequences* of the regional humanitarian organisations are similar for all humanitarian organisations and without adequate and timely delivery of supplies, the risk can have consequences for health and lives. An extra risk consequence is the plundering on the NA&A. This leads to anarchy, which will affect the transportation of the last mile on the affected island. The anarchy can delay the humanitarian supply chain.
Most of the risk drivers from the business logistics are also found in the humanitarian literature. However, when we look at the case study material, only the globalisation trend was identified by the regional organisations. No other risk drivers were identified by the regional organisations. Maybe the evolvement of the regional humanitarian organisations are years behind the large international organisations or the risk drivers are absent because this is inherent to these organisations. The shift of focus on efficiency rather than effectiveness, which is seen at the business logistics and with international NGO’s, did not occur within the regional organisations. The main reason is probably because the regional organisation is run by the government, which has no pressure from donors. There is some globalisation found in the organisation of NA&A, but there is no trend of more globalisation. The organisation searches for more regional players in the supply chain. The trend within this organisation is to reduce the globalisation. A trend of more globalisation is found within CDEMA. They cooperate with NGOs and after a disaster, NGOs can deliver specific supplies to the affected states. This cooperation with these international humanitarian organisations is established as an extent of the national and regional supply network and is mainly used for multiple sourcing and establishing a resilient supply chain. These international suppliers can not be considered as a replacement and therefore this globalisation can not be seen as a risk driver as mentioned in chapter 2. The trend of centralisation, outsourcing, and reduction of suppliers are not found in the regional organisations, probably because the regional organisations are years behind the international organisations.

The strategy of avoidance is used in the regional organisations. Most suppliers are chosen based on their geographical position and lead time and other suppliers are avoided. Avoiding certain markets or products is not possible for humanitarian organisations based on their main goal. Their main goal is to reduce the suffering of the community. Avoiding in these organisations will result in avoiding people in need or withhold them certain required products.

The regional humanitarian organisations both use the strategy control as described in the literature about humanitarian organisations. They preposition their inventory and spread these inventories strategically over their operating areas. Both have especially non-consumable inventories and trust on supplies from out of their operating areas. Both had excess capacity in storage, handling and/or transport. One had this due to their high level of collaboration and the other based on their military back-up. They both had contracts with suppliers which
provide consumable, non-consumable supplies and services. The warning tools are very good in the Caribbean and both organisations rely on warning tools outside their own organisation. The warning tools are checked regularly and will provide the organisations with an early warning if possible.

The cooperation of the regional actors is mostly on a high level. The NA&A do not cooperate with other regional humanitarian organisations and rely on their collaboration with the Red Cross, regional police, militias and their backup from the Netherlands Military. Especially the Netherlands Military is a large player. Although the military assistance to the humanitarian organisation is mainly based on the assets and personnel which are based in the Caribbean, the military assistance can be enlarged with management, material and personnel which are based in the Netherlands. The CDEMA does cooperate with their 16 members and national, regional and international organisations.

The regional actors already use the strategy of flexibility. Both organisations already use postponement in combination with some critical pre-positioned inventories. They both rely on their communications and only send supplies to the affected areas after these supplies are requested. Both organisations use a combination of localised sourcing and multiple sourcing to remain as flexible as possible. CDEMA consists of 16 participating countries, with all their own government-designated organizations. These organizations all have their own contracts and suppliers. Although this may not be efficient, it makes the organization resilient.

The basic constructs of risk management for business logistics which are proposed by Juttner, Peck and Christopher (2003) were also found in the literature about humanitarian relief operations and the regional organisations from the case studies. Although the risk drivers from the business logistics were not found in the regional organisations, the framework of the business logistics with the basic constructs can be used in the regional humanitarian relief operations. Due to the limited in-depth interviews by telephone, this research does not study till what extent the basic constructs were implemented.
6. Conclusion and further research

In this research, the objective was to examine the parallels between commercial and humanitarian relief chains in the preparation phase from the regional perspective and come to implications from supply chain risk management for the preparation for disaster relief operations from the regional perspective. In previous research Kovacs and Spencer (2007) stated that risk management can help regional organisations in the preparation phase of humanitarian relief operations.

Although the humanitarian relief chain is different from the business supply chain in some ways, the framework of risk management proposed by Juttner, Peck and Christopher (2003) for the business logistics can be transferred to humanitarian organisations including the regional organisations. The framework consists of four basic constructs: (1) the risk sources, (2) the risk consequences, (3) the risk drivers, and (4) the strategies to mitigate risks. The regional humanitarian organisations, which were studied during this research, do have the same risk sources. The risk consequences are different and can range up to risk of life. The risk drivers were mostly not found in the regional organisations, probably because the organisations are years behind of the global humanitarian organisations. Only the risk driver globalisation was found, but this was not a risk driver in the regional organisation. Due to the lack of these risk drivers, the supply chain is not exposed to more risks like the business logistics. The regional organisations already used the risk management strategies avoidance, cooperation, control and flexibility.

The managerial implications of the study lie in the observation that although the regional actors which have been studied for this research already used most of the risk management strategies, other regional humanitarian organisations might improve their organisation to apply the risk management strategies from the business logistics which have been proposed by Juttner, Peck and Christopher (2003). With the strategies avoidance, control, cooperation, and flexibility, the regional actors can achieve a more effective preparation of disaster relief operations and gain a more resilient organisation.

Several limitations of this study are noted. First, the regional actors from the case studies were both situated in a relatively small geographical area, which does not create a complex
environment. Other regional actors may have larger operating areas and a more complex environment. Second, the Caribbean is also known for the hurricanes which torture the region, which pushes the local community to remain alert. In regions which are less prone to natural disasters and have a more complex environment than the Caribbean, risk management might help the regional actors in the phase of preparing for natural disasters. Third, the case study of CDEMA was limited to written material and telephone interviews with 4 experts. More experts could have given a better insight. Fourth, the research only studied if the basic constructs were present within the regional organisations. It did not research to what extent the basic constructs were implemented in the organisations. To study this, a more in-depth research is required. To create a better insight in the risk management in regional humanitarian organisations, further research is required. Further research should study more regional humanitarian organisations which are more geographically separated. With a more in-depth study of the organisations, the level of implementation of the basic constructs can better be explored.