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## What can business learn from humanitarian supply chains? The case of the Spanish red cross in Haiti

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**ABSTRACT:** This paper analyzes the response of the Spanish Red Cross to the 2010 earthquake in Haiti, looking for clues of the remarkable lean-agile performance of this organization, and how they could be applied to business operations. The paper first looks into the history and organization of the Red Cross, analyzing in more detail the deployment of the Spanish Red Cross in the 2010 earthquake in Haiti. Five clues to the performance of the Red Cross are identified: a global, multi-level organization; modularity; standardization; knowledge management; and flexible funding mechanisms. These findings are then put into the framework of humanitarian logistics. Finally, the possible extension of the findings to business operations is discussed.

**Keywords:** *Humanitarian Operations, Lean and Agile Operations*

## 1. INTRODUCTION

Humanitarian Logistics (HL) and disaster relief (DR) have gained increasing importance over the last years. A disaster is a disruption that physically affects a system as a whole and threatens its priorities and goals, and can be man-made (war) or natural (tsunami); sudden (earthquake) or slow (draught). HL is the response to such events: “the processes and systems involved in mobilizing people, resources, skills and knowledge to help vulnerable people affected by disasters” (Van Wassenhove, 2006). There is a vast potential in research that explores the interfaces between HL and commercial Logistics (Day, Melnyk, Larson, Davis & Whybark, 2012), especially concerning how such organizations respond to critical events (Gatignon, Van Wassenhove & Charles, 2010). In particular, this paper analyzes the response of the Spanish Red Cross to the 2010 earthquake in Haiti, looking for clues of the remarkable lean-agile performance of this organization, and how they could be applied to business operations.

Sadly, there is evidence that humanitarian help is under increased demand: since 1980 natural disasters show a clear upward trend, having cost 3.8 trillion dollars (World Bank, 2013). In the last years, the number of natural and man-made disasters has increased, affecting particularly those countries less prepared to face them. For instance, the World Bank reports that the yearly number of draughts, floods, earthquakes and tropical storms has doubled from 1980-1990 to 2000-2010, affecting principally South and East Asia. In a similar period (1995-2005), the magnitude of interventions realized by the United Nations Peacekeeping Forces has tripled, requiring in 2005 an average of 5,500 people in each of the 15 simultaneous missions it deployed. Similarly, statistics on the number of countries where United Nations intervention forces are stationed show a steadily rising trend (Díaz, Claes & Borla, 2007). This extraordinary increase in demand for humanitarian relief is accompanied by increased media exposure, paradoxically linked to a reduced media attention span: it is estimated that media interest in a disaster reduces sharply after one week, reducing the window of interest for capturing funds and volunteers. In consequence, the number of agencies and non-governmental organizations (NGO) that provide humanitarian relief has greatly expanded: from an estimated 30,000 NGOs worldwide, over 3,000 were present in Haiti prior to the 2010 earthquake. While many of these NGOs are very small, at least seven

have annual budgets exceeding 1,000 billion dollars (International Red Cross—including national societies, UN Development Fund, World Food Program, UN Children Fund, World Health Organization, UN High Commission for Refugees, and World Vision International – Tatham & Pettit, 2010).

In parallel to the increase in humanitarian interventions, there has been a rise in academic interest. For example, Tatham & Pettit (2010) have edited a special issue of the *International Journal of Physical Distribution & Logistics Management* on humanitarian logistics; Tomasini & Van Wassenhove (2009) inventoried case study research on humanitarian logistics, and there is at least a new journal specifically dedicated to humanitarian logistics (*Journal of Humanitarian Logistics and Supply Chain management*). There is also an increasing interest about HL in the supply chain management literature (Oloruntoba & Gray, 2006; Papadakis, 2006; Maon, Lindgreen & Vanhamme, 2009; Adivar, Athan, Oflaç & Örtten, 2010; Blecken, 2010; Wild & Zhou, 2011; Kunz, Reiner & Gold, 2014; Scholten, Scott & Fynes, 2014). The increased pressure on humanitarian interventions has produced a two-fold effect: i) the emergence of HL as an academic discipline, and ii) an accelerated learning process, resulting in lean-agile organizations analyzed in this paper.

Related to this aspect, researchers agree that commercial Logistics could learn from the experience accumulated by HL organizations. For example, HL organizations are used to work in extreme conditions, e.g. high demand uncertainty and poor infrastructure (Day et al, 2012). However, there is little empirical research on how commercial Logistics could benefit from this knowledge. This study aims at tackling this research gap. In order to investigate the applications of HL experience to commercial Logistics context, we analyze in this paper the response of the Spanish Red Cross (SRC) to the 2010 earthquake in Haiti. We are particularly interested in finding clues of the remarkable lean-agile performance of this organization, and how these principles could be applied to business operations. The paper is organized as follows: firstly, we review the structure of the International Red Cross (IRC) and analyze the deployment of the organization in Haiti. Following Van Wassenhove (2006)'s cycle of four phases of the disaster management, we focus our analysis on the phases of preparedness and response, inferring the key success factors of IRC interventions. Lastly, we discuss these findings in a lean-agile framework and the applicability of these to business organizations.

The contributions of this paper are in adding to the small body of empirical studies in the field of humanitarian logistics, in increasing the body of knowledge of lean-agility, and in offering insights into the application of humanitarian organizations logistics principles to business and commercial organizations.

## 2. LITERATURE REVIEW

### 2.1 *What business and commercial logistics can learn from HL*

Humanitarian supply chains have several characteristics that make it different from business and commercial (in the sense of trading) ones : (1) supply and demand uncertainty are much higher; (2) the shelf life is much shorter (weeks or months); (3) the supporting systems (e.g. transportation, telecommunications) may be unstable or not functional; (4) financial flows are unilateral and uncertain; (5) the set of decision-makers is larger and procedures are less clear; (6) suppliers and partners are often unknown in advance; (7) the volume of cargo transported is not stable, with spikes of demand and large periods of inactivity; (8) the social network and physical infrastructure may be damaged or not functioning at full capacity (Balcik, Beamon, Krejci, Muramatsu & Ramirez, 2010; Charles, Lauras & Van Wassenhove, 2010; Kovacs & Spens, 2007; Holguin-Veras, Jaller, Van Wassenhove, Pérez & Wachtendorf, 2012; Day et al, 2012; Wild & Zhou, 2011). The closest commercial supply chain to this type of situation would be the launch of a new, highly-demanded product with a short lifecycle (Holguin-Veras et al, 2012). Most importantly, humanitarian supply chain objectives include not only minimizing logistics costs (e.g. transportation, inventory, etc) as in commercial supply chains, but also have to consider the deprivation costs (i.e. the loss of well-being resulting from the lack of a good or service) (Holguin-Veras et al, 2012). In order to cope with those constraints, it is argued that humanitarian supply chains present a mix of lean and agile characteristics (Oloruntoba & Gray, 2006; Cozzolino, Rossi & Conforti, 2012). Thus, understanding how humanitarian supply chains are structured can provide important insights to commercial supply chains that want to be lean and agile. The structures of humanitarian supply chains can be much more efficient than commercial ones when responding to critical events (Holguin-Veras et al, 2012). Thus, commercial SCM apparently has a lot to learn from humanitarian supply chains.

Researchers recognize that the links between research in Operations Management (OM) and HL are still incipient (Iakovou, Vlachos, Keramydas & Partsch, 2014; Heaslip, 2015; Abidi, De Leew & Klumpp, 2015). A few studies have explored the HL characteristics that make them a source of insights to commercial ones. For example, Day et al (2012) claimed that HL can teach commercial logistics how to leverage knowledge and resources generated by convergence during an emergency, and how to build social capital rapidly in such circumstances – for example, when a firm is developing a supply chain to enter a new market. Furthermore, HL can provide guidance on supply chain management in the context of extreme demand and supply uncertainty (Charles et al, 2010; Day et al, 2012; Holguin-Veras et al; 2012).

Another potential HL contribution relates to emergent organizations i.e. the management of dynamic, transient supply chain structures such as those created during disasters (Day et al, 2012; Apte, Yoho, Greenfield, & Ingram, 2013). Humanitarian supply chains have to manage highly dynamic and informal networks. Especially in the post-disaster phase, thousands of supply chains may overlap and have to be coordinated, with different levels of expertise, priorities and organizational structures. The decision-making structure of humanitarian supply chains can outperform commercial ones with respect to efficiency (Holguin-Veras et al, 2012), for example by centralizing information at Regional Logistics Units (RLU) level. This centralization allows matching supply and demand and facilitates tracking items (Gatignon et al, 2010). Furthermore, Holguin-Veras et al (2012) argue that commercial supply chains could learn from humanitarian ones how to operate with damaged social networks in the case of a disaster. The damaged physical and virtual infrastructure of humanitarian supply chains requires to operate with additional constraints, for example, to deliver the products with a reduced transportation capacity. Indeed, the surge in demand during disasters often happens when the social networks and supporting systems are at their worst condition, which provides an extreme supply chain scenario (Holguin-Veras et al, 2012).

Another potential insight from HL relates to the standardization of processes (e.g. comparing bids or emitting a purchasing order) and products (e.g. IRC has a catalog of standard emergency items) that streamline SCM in large humanitarian organiza-

tions (Gatignon et al, 2010). And lastly, there is the possibility of learning how to improve traceability, by centralizing the information about relief items at regional logistics unit (RLU) level. With standard processes and systems worldwide, it is easier to follow tracking numbers for each item, create reports or monitor key performance indicators (Gatignon et al, 2010). This standardization simultaneously facilitates cost reduction and improves agility in critical situations, as explained in the next section.

## 2.2 Lean-agile paradigms

Humanitarian supply chains have to equilibrate the minimization of human suffering and quick response to disasters (agility), with the cost minimization and efficiency of resources (lean) (Holguín-Veras et al, 2012). In this section, the literature on leanness, agility and potential applications to HL is reviewed.

*Leanness* (Womack, Jones & Roos, 1990) is defined by Lamming (1996, p. 184) as “valued-adding processes unencumbered by waste”. It means developing a value stream to eliminate all waste, including buffer stocks and time, and to ensure a level schedule (Aitken, Childerhouse, Christopher & Towill, 2005). In the context of the peace-keeping operations, leanness refers to avoiding peaks and troughs in field requirements. The leanness concept resonates with the concept of efficiency of operations (Mentzer & Konrad, 1991). There is evidence to suggest that level scheduling, combined with the elimination of waste (in terms of space and in time) has successfully delivered a wide range of products to those operations where financial resources are scarce (Aitken, Christopher & Towill, 2002). Humanitarian organizations, being limited in resources, need to be lean. But, at the same time, they need to respond very rapidly to customer needs, in order to reduce deprivation costs. Thus, agility is critical as well.

*Agility* is defined as Sharifi & Zhang (1999) as the ability to cope with unexpected challenges, to survive unprecedented threats of business environment, and to take advantage of changes as opportunities. It is an organization-wide capability that embraces organizational structures, information systems, logistics processes, and mindsets (Christopher & Towill, 2000). In order to be agile, commercial agile supply chains require market sensitivity (demand driven rather than forecast driven), virtual supply chains (information based rather than inven-

tory based), and process alignment (joint product development, common systems, and shared information). A greater reliance on suppliers and alliance partners is inevitable and, hence, a new style of relationship is essential. Along with process integration comes joint strategy determination, buyer/supplier teams, transparency of information, and even open-book accounting (Christopher, 2005).

Humanitarian organizations, particularly when responding to sudden disasters, have agility as a vital prerequisite for responsiveness. For example, one of the techniques used by humanitarian organizations to achieve agility is the pre-positioning of inventories. It consists in positioning supplies near where they are likely to be required, in order to better satisfy uncertain demand (Gatignon et al, 2010). It can be implemented together with postponement of committed inventory until customer orders are received (Bowersox et al, 1996), which allows the use of more accurate data about real demand. Postponement of recipient-specific deliveries has a positive impact on the speed of response and flexibility (Oloruntoba & Gray, 2006).

Agility can benefit several humanitarian supply chain flows (i.e. material, financial, information). For example, Oloruntoba & Gray (2006) argue that humanitarian supply chains can be agile with financial flows e.g. when attracting and managing funds from donors in disasters. Whereas information flow agility means making information about a disaster needs flow rapidly in the supply chain, material flow agility implies making aid get rapidly to where it is needed, in the correct quantity and quality.

The literature supports the notion that the concepts of leanness and agility can be combined. This notion applies to HL, as well. For example, Oloruntoba & Grey (2006) propose a ‘leagility’ model for humanitarian supply chains. According to this model, humanitarian supply chains should be lean for upstream activities (e.g. sourcing, disaster preparation and planning), and agile for downstream activities (e.g. aid distribution). Agility and leanness also depend on the stage of HL life cycle. In disaster response and short-term recovery phases, the focus is on agility, because of the chaotic context and high urgency, whereas in the long-term recovery phase the focus is on leanness, because of the stable context and low urgency (Holguín-Veras et al, 2012). For that reason, large humanitarian organizations that actuate in all phases of a disaster are potential candidates to provide relevant knowledge on how to manage leanness and agility aspects of SCM.

### 3. METHODOLOGY

In order to gather data for the study, we used a case study methodology, grounded on interviews and archival research (Yin, 2014). There is a growing trend of using qualitative studies in top journals in Operations Management (Barratt et al, 2011; Ketokivi & Choi, 2014). In spite of that, the number of empirical studies in HL is “pitifully small” (Holguin-Veras et al, 2012). We used a single-case methodology, in order to gather data with sufficient depth to meaningful conclusions. Eisenhardt (1989) and Yin (2014) argue that case study research uses a theoretical or biased sampling approach, where cases are chosen for theoretical reasons rather than statistical sampling. In particular, the selected organization is one of the largest and most efficient humanitarian organizations in the world. Since the objective of the study was to collect information that could be applied in commercial supply chains, the focus on a single case is indicated, because it allows an in-depth exploration of the particularities that make this firm particularly successful. Furthermore, single case studies are recommended if they represent opportunities for unusual research access (Yin, 2014). In the present study, Haiti was the focal organization’s largest humanitarian operation ever, and thus offered an ideal opportunity to investigate the concepts proposed in the research design.

Several data sources were used in this study: mainly, structured interviews and archival sources (documents, organizational charts, and historical records). This allowed the triangulation of multiple data sources, increasing the reliability of the conclusions (Eisenhardt, 1989).

Based on the literature analysis on lean-agility and humanitarian operations, question guidelines were prepared concerning the organization of the IRC and its deployment practices in case of intervention, focusing on the experience of the earthquake in Haiti. An extensive interview took place in October 2013 with the Deputy Director of international cooperation and an emergency specialist who participated in the operation in Haiti. This data was then triangulated against archival record, in particular those in the extensive on-line library of IRC, and also published academic papers. The sources consulted are detailed in the reference section, specifying web references in a separate section. Following Glaser & Strauss (1967), data analysis was done in parallel with data collection, and adjustments were made from the addition of data sources in existing case studies (Burgelman, 1983).

Finally, with respect to the organization of results, a descriptive case write-up was prepared, following the recommendations of Yin (2014). This procedure is critical to the creation of insights, by making researchers think about ‘what the emerging issues are and how they should be captured’ (Barratt, Choi & Li, 2011, p. 331). The case write-up is described in the next section.

### 4. CASE WRITE-UP

#### 4.1 A brief history of the Red Cross: the remarkable achievement of Henri Dunant

In 1859 a young Swiss man, Henri Dunant, traveled to northern Italy trying to obtain some business documents he needed from the French Emperor Napoleon III. What he saw after his arrival at the little village of Solferino changed his life, and resulted in a remarkable humanitarian institution.

On June 24 of that year the joint armies of France battled the forces of the Austrian army engaged in a long and gruesome battle, in which close to 300,000 men were involved, resulted in thousands of casualties. The suffering was witnessed by Dunant in the aftermath of the battle. This terrible experience moved Dunant to write an account of the battle, “*Un Souvenir de Solferino*”, published in 1862, in which he describes the chaos and suffering of the wounded, and proposes the creation of a neutral organization to provide care for wounded soldiers. By the following year a committee of five members met for the first time, thus marking 2013 as the 150th anniversary of the Red Cross. A year later, 12 states signed the First Geneva Convention in a diplomatic conference organized by the Swiss Parliament. Henri Dunant’s efforts were recognized in 1901, when he became the first winner of the Nobel Prize for Peace (jointly with Frédéric Passy, co-founder of the Inter-Parliamentary Union).

The Red Cross became a truly international organization through the terrible ordeals of the 20<sup>th</sup> century: World War I and II and numerous regional conflicts (Turkish-Greek, Upper Silesia, Manchuria and Shanghai, the Chaco war, Spanish civil war). In the second half of the 20<sup>th</sup> century the organization expanded geographically to its current presence in 188 countries, and also extended its intervention scope to disaster relief and prevention, as described in this paper: the World Disaster Report of the Red Cross references over 500 disasters per year.

The Spanish Red Cross was already present in the French-Prussian war in 1870, and was very active in the Spanish Civil War of 1936–1939, honoring the principle of impartiality. The Spanish Red Cross is active in the fields of healthcare, environment, social exclusion and international cooperation, which includes the humanitarian activities analyzed in this paper. Remarkably, and in spite of the recent economic crisis and a stagnated budget, the Spanish Red Cross has been able to increase activities.

#### 4.2 SCM & Logistics organization of the IRC

The IRCRC is organized in multiple regional levels. At the highest level is the International Committee of the Red Cross (ICRC): the original institution founded in 1863 in Geneva, Switzerland, by Henry Dunant and Gustave Moynier, a three times Nobel Prize winner institution and currently a policy making body with a 25-member committee. The ICRC is an impartial, neutral and independent organization with the exclusively humanitarian mission to protect the lives and dignity of victims of war and internal violence and to provide assistance. Its main tasks are to direct and coordinate the international relief activities of the International Movement and to prevent suffering by promoting and strengthening humanitarian law and universal humanitarian principles.

At an executive level is the International Federation of Red Cross and Red Crescent Societies (IFRC), founded in 1919 and which today coordinates the activities of the 188 National Red Cross and Red Crescent Societies. Founded in 1919 in Paris, it brings together the different national societies of the Red Cross and Red Crescent in cooperation and help. Its main tasks are to provide humanitarian assistance to affected populations in emergency situations caused by natural disasters or humanitarian crises, facilitating cooperation between National Societies and contributing to the development of local capacities of these companies through development. Finally,

at the local level there are 188 National Societies recognized by the ICRC, volunteer relief agencies that cooperate with local authorities. Their tasks are to offer local and immediate support in accidents, emergency and social services and assistance to people affected by war and disasters.

Tomasini & Van Wassenhove (2009) proposed a cycle of four sequential phases of disaster management: preparedness, response, rehabilitation, and mitigation. The activities of the International Red Cross (IRC) fall under all these categories, as it engages not only in preventive activities and primary health care, but also in disaster preparedness and response. Prevention can have a significant role in reducing the aftermaths of disasters. For instance, the earthquake that struck Chile recently, in spite of being 500 times higher in intensity than the one in Haiti did a fraction of the damage due to much better prevention measures in Chile (Swiss Re, 2014). However, in this paper we focus on the first two phases (preparation for disasters and response).

This hierarchical and global organization is supported in humanitarian interventions by two specialized groups. The first one is the Field Assessment Coordination Team (FACT), which is formed by small international teams of highly trained professionals in specific areas such as logistics, health, communication and finance and who are deployed between 12 and 24 hours after the onset of the disaster and kept in the field from 2 to 4 weeks. The second type of group is the Emergency Response Unit (ERU), which corresponds to a modular system for rapid intervention in case of disaster, composed of teams of highly specialized resources. The idea of the ERU evolved from the growing complexity and demand of humanitarian operations, and was first deployed in 1994. It is noteworthy that Spain contributes to five of the seven ERU, in spite of having the lowest GDP per capita of all contributing countries (OECD, 2012). The current ERU, their functions and contributing countries are listed in Table 1 below.

**Table 1: IRC Emergency response units**

ERU	Function	Location
Logistics	Procurement of relief items, clearance, storage and distribution	Denmark, France, Spain, Switzerland, and UK
Water & sanitation	Treatment & distribution of water. 3 modules: up to 15,000 and 40,000 beneficiaries; and sanitation facilities for up to 20,000 people	Austria, Germany, Spain, Sweden, and UK
Basic health care	Immediate healthcare, mostly outpatient for up to 30,000 people	Finland, France, Germany, Japan, Norway, Spain plus staff support from Australia, Canada, Hong Kong, Iceland and Switzerland
Referral hospital	Inpatient first level referral hospital for up to 250,000 people	Finland, Germany and Norway
IT & Telecommunications	Links field & secretariat to assist operational coordination using satellite phones and high frequency & very high frequency radio systems	Austria, Denmark, Spain and USA
Relief	Distribution of relief items	Benelux, Denmark, Spain and USA
Base Camp	Provides acceptable living conditions for RC personnel	Denmark

In cases of disaster or humanitarian emergency, the Red Cross applies the following protocol:

1. The IFRC deploys the FACT teams. These perform a field evaluation and prepare a Relief Mobilization Table, with an initial estimation of required resources.
2. As a result of the evaluation, the IFRC in Geneva calls the National Societies mobilization and releases an emergency funds appeal to potential donors. The information form FACT is also used to determine the ERU required.
3. Based on the FACT report the National Societies with ERU evaluate their availability and inform the IFRC, who takes the final deployment decision.
4. Once in the field, the ERU contacts the National Society concerned, which provides services to the extent of its possibilities.

The IRC must at all moments act according to its entrenched principles: respect for the State sovereignty

(who may decide not to allow entrance to humanitarian aid); to ensure an equal distribution of the relief, and neutrality and impartiality (fundamental in cases of civil war).

#### 4.3 January 12, 2010: Earthquake in Haiti

On January 12, 2010 at 17:00 an earthquake of magnitude 7.3 hit Haiti, the poorest country in the Americas. Over 220,000 people died, 300,000 were wounded, more than 1 million people were left homeless, and all major infrastructures in the country were destroyed. The major cities, including the Capital, Port Au Prince, were seriously damaged. At least 105,000 houses were entirely destroyed; 60 percent of the Government and administrative buildings were damaged; total loss has been estimated at \$7.8 billion, more than 120 percent of Haiti's 2009 gross domestic product (Battini et al, 2014).

The Spanish Red Cross (SRC), as other national societies, already had representatives in Haiti carrying development and disaster awareness projects.

They expected, from the feedback provided by these employees, and from their years of experience, that such a big earthquake will have devastating consequences in a fragile country like Haiti.

Amid the chaos, Haiti's national Red Cross society appealed to the International Federation of Red Cross Societies (IFRC) for help (interventions are triggered by the national societies). That night in Geneva, one hour after the news of the earthquake arrives, a first meeting of the field assessment coordination team (FACT) is held, and a FACT team is deployed within 10 hours. In less than 72 hours, an emergency funds appeal was launched, containing a preliminary evaluation of damages.

The SRC was one of the national societies answering to this call. News of the earthquake arrived at Madrid at approximately 22:00 hours. The members of the humanitarian intervention teams in the SRC hurried to their quarters, where they waited for further information and instructions from the IFRC in Geneva. In Madrid, two members of the SRC humanitarian intervention team went to Barajas airport and got into the first flight leaving for Dominican Republic, the neighboring country to Haiti.

Within a day, the SRC sent to Haiti further experts and equipment, in coordination with the IFRC. Other national societies, humanitarian NGOs and international organizations were also present in the field. The SRC, acting in coordination with the IFRC, then deployed three Emergency Response Units (water, sanitation and telecommunications), which were field-operative in less than 72 hours.

## 5. DISCUSSION

The following success factors of the IRC operations in Haiti have been inferred from the case analysis and archival research:

### 5.1 Global multi-echelon organization

Governance of large, decentralized organizations is a complex issue. The IRC addresses these issues through a hierarchical organization at three levels (local, regional and central, as described in the previous section), that mimics the global and hierarchical nature of many multinational companies and which allows for centralized coordination combined with local intervention. Appeals for help and information flows bottom-up (from the national societies), while large scale support for intervention flows top-down.

It is noteworthy that in the case of Haiti the local society suffered considerable damage (including the death of some members and their families) which complicated the initial appraisal of the situation.

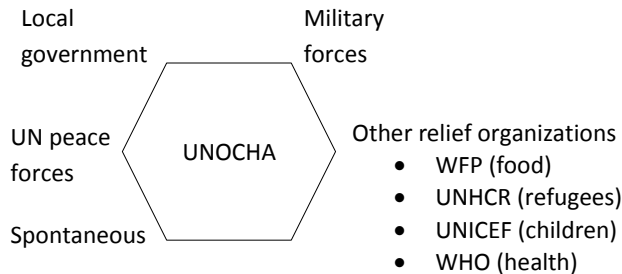
On the field, governance must frequently adopt a relational model (Zaheer & Venkatraman, 1995), but this is complicated by the large number of involved actors. Kovacs & Spens (2007) cite as the main actors in humanitarian supply chains the aid agencies, logistics providers, donors, other NGO (non-governmental organizations), local governments and the military forces. Accordingly, field coordination among the many actors deployed in disasters is systematically cited as one of the main difficulties found. In a documented case (Tatham & Pettit, 2010) a coordination meeting of the water and sanitation cluster was attended by representatives from 172 organizations. Clearly, effective coordination and decision making is impossible under such circumstances. Analyzing the lessons of nephrology relief in Haiti, Portilla, Shaffer, Okusa, Mehrhotra, Molitoris, Bunchman & Ibrahim (2010) conclude that "centralized coordination between multiple responding entities at the disaster site and around the world will facilitate disaster relief efforts". As large scale crisis, such as Haiti, receive wider exposure thanks to new communications means (internet, tweeter), the fast reaction of many uncoordinated groups create serious confusion and overload of resources in the field. For instance, unrequested donations can rapidly overwhelm limited or damaged logistic infrastructures. Interaction with local governments can be also tricky, as the IRC has to respect the principle of sovereignty; and the relation among different NGOs can be reportedly competitive (as they compete for the same donor resources). To make matters worse, a growing number of well-wishing but not professionally trained collaborators that have to be accommodated, sheltered and protected.

Clearly, humanitarian operations could profit from additional coordination of supra-organizational mechanisms. That role is increasingly taken by the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), which serves as the secretariat for inter-agency coordination with other UN units, such as the Inter-Agency Standing Committee, such as the United Nations Disaster Assessment and Coordination system, and the International Search and Rescue Advisory Group (the two latter units are rapid-response tools). Information technology can also play a role in facilitating coordination



mechanisms. Figure 1 shows some of these actors in the context of the Red Cross.

**Figure 1. Complexities of field coordination of humanitarian interventions**



### 5.2 Standardization

The IRC adopts two kinds of standardization: product and process. *Product standardization* means that the same products are purchased at a global level, no matter the geographic region where it is going to be used. It is reflected in the number of stock keeping units (SKU), which are kept low at about 4,000 (Tatham & Pettit, 2010). That figure is significantly lower than a regular retailer (about 50,000), but comparable to convenience chains such as Seven-Eleven. The reduction in SKU carries the well-known advantage of risk pooling (resulting in less stock) and better relations with suppliers (the IRC has a standardized purchasing catalog that facilitates purchasing power and coordination). Product standardization contributes to leanness by allowing economies of scale in material acquisition and stochastic economies. In parallel, economies of scope increase process productivity. Product standardization, combined with supplier certification, also contributes to reducing purchasing lead time, increasing the capacity of responding quickly to demand.

In parallel, *process standardization* means that the procedures (e.g. shipping, warehousing) are defined at a global level and do not change significantly for each geographical area. The IRC has developed extensive Standard Operations procedures (SOP) and developed the Emergency Response Units (ERU) described in Table 1. The process standardization contributes to leanness because it accelerates the learning curve in the organization, reducing the costs of operation. At the same time, it has an indirect effect over agility, because the same team may be instantly assigned to different geographical areas, reducing the time of response.

The ERU are designed to fill the gaps created by the collapse or overload of a country existing systems. They can

be dispatched within 24 hours, and be field-operational within a week. Each ERU is self-contained in specially designed color-coded containers, and includes the necessary survival equipment for a staff of 3 to 25 people. The IFRC uses multiple criteria to decide on the deployment of the ERU (for example, the magnitude of the disaster and its evolution; needs of victims; capacity of the RC in the country concerned; and the inadequacy of local resources to adequately address the disaster).

Although standardization has been traditionally seen in the OM literature as an approach to achieve cost effectiveness, it seems to be highly dependent on the organizational context (Kwon, 2008). The observation of the experience of RC illustrates how the particular context of humanitarian global operations can affect standardization strategies. More importantly, it shows how a firm can obtain both cost effectiveness and agility in a global organization context by combining product and process standardization.

### 5.3 Modularity

Modularity is the possibility of combining a limited set of components, so that multiple product configurations can be obtained (Salvador, 2007). This allows simultaneously addressing heterogeneous customer needs (Hsuan & Skjøtt-Larsen) and component standardization (Sanchez, 1999). Although there has been considerable research about modularity in the production of goods, little is known about it in the context of services (De Blok, Meijboom, Luijkx, Schols & Schroeder, 2014).

Of particular interest for this study are the definitions of *component* i.e. ‘the smallest elements in which a service offering can be meaningfully divided’, and *service package* i.e. ‘one or more components that together provide a complete service offering to the customer’ (De Blok et al, 2014, p. 176). In this context, the ERU can be considered a ‘component’, and its different combinations represent ‘service packages’, which are customized according to particular needs (e.g. a disaster situation may require sanitation services, whereas another may prioritize food supplies). Thus, the ERU emulates the typical modular design systems used in manufacturing, but applied in the context of service management.

Accordingly, the use of ERUs allows the postponement of final product configuration according to specific need detected by the FACT, which improves the capacity of response. At the same time, costs are kept low (since the ERU are standardized). Accordingly, it has many similitudes with a Build-To-Order (BTO) production system, in which the final product

is configured from different combination of basic modules (e.g. ERU), in order to satisfy a particular request (e.g. disaster-related needs). Thus, this example illustrates how BTO and postponement strategies can be applied in service operations.

### 5.3 Knowledge management

Knowledge management has received increasing attention from SCM researchers, who suggest that its effectiveness is highly dependent on supply chain partners' experiences, languages and contexts (Capó-Vicedo, Mula & Capó, 2011). In particular, there is need for empirical studies that describe the contexts that affect knowledge management in supply chains, notably the industry sector influence.

With that respect, the humanitarian operations context provides some particular features that may be useful to OM researches. For example, uncertainty concerning the moment, location and impact of disasters (due to confusion in the field) make forecasting and planning in humanitarian organizations very complex. The Red Cross has created mechanisms oriented to the systematic creation of an organizational memory that can facilitate more precise forecasting for deployment and budgeting processes. Knowledge management is handled internally, through the identification of projects and interventions that represent good practices; and externally, through the disclosure of this internal knowledge to the rest of society (as was the case of this investigation), and also through numerous publications, conferences and training courses offered to the general population.

### 5.4 Funding mechanisms

Although global supply chains increasingly rely on financial processes to coordinate the flow of goods, services and money, the implementation of financial supply chains has not been fully addressed in the SCM literature (Blackman, Holland & Westcott, 2013). Thus, it is very important to analyze supply chains that are able to provide useful insights on such coordination mechanisms. The studied company faces considerable challenges with that respect, having to coordinate several global financial flows, in conditions of extreme uncertainty of demand, supply and financial resources. Thus, it provides some interesting insights that could be used in a commercial Logistics context.

For example, the IRC has developed funding mechanisms that permit the maintenance of a basic, buffer budget, while quickly obtaining larger funds for specific actuations. The funds raised by the Red Cross originate from donations and voluntary contributions from governments (contributing to over 80% of all funds); national societies; supranational organizations (e.g. European Community) and public and private sources (companies, foundations and individuals –many of whom contribute by participating in the Red Cross lotteries). A form of non-monetary funding is the voluntary work of thousands of specialists (known as financing in kind –“*financiación en especie*”, in Spain)

The Red Cross has two types of funding mechanisms: the Annual Appeal, sent at the beginning of each year to fund programs and that is used to cover the basic operations, and the Emergency Appeals, published throughout the year in response to disasters and that represent the large majority of the funding received. It is noteworthy that at peaks the emergency funds, obtained in response to specific disaster appeals can be 3 to 4 times larger than the regular funds (Tattham & Pettit, 2010).

Therefore, with respect to financial flows, the IRC can be characterized as being simultaneously agile at the funding process (helped to a great degree by the prestige of the organization), and lean (operational costs are reduced, due to product and process standardization, support from local governments and extensive voluntary work).

### 5.5 Leanness-agility

There has been much debate during the last decade with respect to the relative merits of the so-called “lean” and “agile” paradigms in SCM. Combining leanness and agility means, for example, having volume flexibility i.e. ‘the ability to increase capacity up or down to meet demand for a single service’ (Kesavan, Staats & Gilland, 2014, p. 1884), with minimal increment in costs. Although increasingly valued in several sectors, there are few empirical studies on volume flexibility in the services context (Kevasan et al, 2014). Our case analysis shows that volume flexibility is achieved by RC through the use of voluntary workforce, which is activated in case of emergencies. Before the disaster, the professional workforce is kept at minimal levels. When a disaster strikes, the workforce increases suddenly, mainly with volunteers. Furthermore, facilities cost of op-

eration is minimal, because they are often donated by local governments. This combination of factors allows achieving minimal cost and volume flexibility simultaneously.

In addition, moving from 'lean' to 'agile' state is facilitated by maintaining a 'dormant capacity' in disaster-prone areas, through development programs. Actually, IRC is dedicated not only to disaster response, but also to long-term development activities in the affected areas. Thus, there are often trained personnel in the area, who can be instantly activated, speeding up the response process in the case of a disaster (Day et al, 2012).

'Leagility' is also achieved through the use of financial and material buffers: *Material buffers* are represented by the pre-positioning of stocks in Regional Logistics Units. They help stabilize supply and thus contribute to the level scheduling approach. *Financial buffers* are represented by the Disaster Relief Emergency Fund (DREF), centralized by the IFRC. The DREF is a fund with no specific allocation, used as a buffer to ensure the availability of financial support for immediate response to emergencies. In 2012, CHF 23 million of DREF were allocated. Funding allocations may be authorized and issued within 24 hours. Funds to launch local operations are considered loans that must be repaid with contributions received once the Emergency appeal has produced results. This financial buffer helps stabilize financial flow and reduce funding uncertainty, contributing to the leanness of operations. Another mechanism for lean-agility in deployment is through public-private partnerships (PPP). The Disaster Response Team (DRT) of DHL, developed in coordination with the UNOCHA is one of such emerging partnerships (DHL, 2014).

Being agile at the upstream side of supply chains is also a matter of concern to RC. Broadly speaking, the pre-positioning of stock, the use of ERU modules, supplier certification and standardization of products have contributed to reduce supply uncertainty. Rather than attempting to forecast a demand that is naturally hard to predict, the 'leagile' approach described in this study is characterized by increasing the speed of response by using postponement of deliveries. Moreover, it relies on 'supplier hubs'

(i.e. logistics centers near final assembly). In particular, the RC has Regional Logistics Units that are located close to disaster-prone areas (Canary Islands, Panama, Kuala Lumpur, and Dubai) and that keep pre-positioned stocks of the main emergency items.

These principles illustrate how HL knowledge can be useful for commercial Logistics that want to achieve leanness and agility simultaneously. For example, we learn from the RC experience that such firms should struggle to be lean by keeping fixed costs at a minimal level. At the same time, firms should build a diversified set of buffers of 'quickly-activating' resources (e.g. material, workforce and financial), in order to be prepared in case of surges of demand. Furthermore, they should keep a 'dormant capacity' (i.e. marginal but constant operations) close to sites where demand surges are most likely to occur. Finally, we observe from the RC experience how many of manufacturing concepts such as modularization and standardization can also be applied to service operations.

## 6. Conclusion

This study aimed at contributing to the nascent body of empirical studies in the field of humanitarian logistics. In particular, it has analyzed the utilization of logistics principles of a global humanitarian organization to business and commercial firms. More specifically, we concluded that the IRC has developed innovative solutions to the problems posed by an environment characterized by the uncertainty and scarcity of resources. On the demand side, it is responsive, thanks to the pre-positioning of strategic stocks and to the development of the ERUs, both facilitated by its global, multilevel organization. On the supply side, it is resilient, thanks to process and product standardization, global coordination and the development of flexible mechanisms for emergency funding. The governance mechanisms of the IRC are internally hierarchical, but become relational while on the field. The latter mechanisms are especially problematic, due to the complexity of field interactions, and have attracted considerable interest in recent literature. Table 2 summarizes some of the characteristics and practices that facilitate leagility in the IRC, and that can in many case resonate with private organizations.

**Table 2: SCM and logistics characteristics and practices of the IRC**

Red Cross characteristics	
Global multi-level organization	A multi-level global organization allows bottom-up flow of information and a top-down global and fast deployment of resources
Standardization	The standardization of SOP and ERU, and SKU and supplier reduction facilitate risk pooling, purchasing power and fast deployment
Knowledge management	Internal and external mechanisms of archival and diffusion of experiences facilitate preparedness in face of extremely uncertain demand
Funding mechanisms	The multi-level organization and the credibility of the institution facilitate maintaining lean levels of a basic, operating budget, and an agile access to emergency funds
Coordination and governance	Hierarchical coordination mechanisms implicit in the multi-level global organization, and emerging relational governance mechanisms through UNOCHA
Lean-agile principles	Leanness implicit in basic funding and in rationalization of logistics (SKU, ERU); agility facilitated by ERU and a global organization. PPP can contribute to both

In a global business environment characterized by increased uncertainty brought by globalization and technological change, and by market-driven reduced life-cycles, the solutions developed by the RC and other humanitarian organizations can bring many managerial insights: for example, how to develop organizations that are both resources-lean and capable of fast adaptation. This can be applied in an analogous context, e.g. during the introduction of new products, or in conditions of extreme supply or demand uncertainty. In these situations, there are many strategies that could be considered, based on the RC experience (e.g. maintain a dormant capacity with easily accessible resources, to standardize processes and products worldwide). Similarly, the important issue of material convergence, present in humanitarian supply chains, resembles the typical problem of disposal of returned products in reverse logistics. Firms struggle with trying to combine both direct and reverse logistics flows. Lastly, we have verified that the application of HL to service context presents many research opportunities. Actually,

recent studies recognize that there is a need for a re-conceptualization of HL to include services, and particularly there is a dramatic lack of studies on how services OM theories can be adapted for humanitarian OM research (Heaslip, 2015).

The application of humanitarian supply chain knowledge to this issue is a fertile ground for more empirical studies. These examples illustrate the many opportunities related to exploring such links between HL and commercial Logistics. Overall, we hope that empirical studies like this will help develop knowledge on this promising area of research.

Coda: the never ending story. In November 2013 Typhoon Haiyan hits the Philippines affecting 10 million people. In coordination with the IFR and the national RC, the Spanish Red Cross deploys its water and sanitation ERU (WATSAN) and estimates that will have to stay in the country for up to two years...

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## 7. REFERENCES

- Abidi, H., de Leeuw, S. & Klumpp, M. (2015). The value of fourth-party logistics services in the humanitarian supply chain. *Journal of Humanitarian Logistics & Supply Chain Management*, 5(1), 35-60.
- Adivar, B., Atan, T., Oflaç, B. S. & Örtten, T. (2010). Improving social welfare chain using optimal planning model. *Supply Chain Management: An International Journal*, 15(4), 290-305.
- Aitken, J., Christopher, M., & Towill, D. (2002). Understanding, implementing and exploiting agility and leanness. *International Journal of Logistics, Research and Applications*, 5(3), 59-74.
- Aitken J., Childerhouse, P., Christopher M., & Towill D. (2005). Designing and Managing Multiple Pipelines. *Journal of Business Logistic*, 26(2), 73-96.
- Apte, A, Yoho, K., Greenfield, C. & Ingram, C. (2013). Selecting Maritime Disaster Response Capabilities. *Journal of Operations and Supply Chain Management*, 6(2), 40-58.
- Balcik, B., Beamon, B. M., Krejci, C. C., Muramatsu, K. M., & Ramirez, M. (2010). Coordination in humanitarian relief chains: practices, challenges and opportunities. *International Journal of Production Economics*, 126(1), 22-34.
- Barratt, M., Choi, T. Y., & Li, M. (2011). Qualitative case studies in operations management: trends, research outcomes and future research implications. *Journal of Operations Management*, 29(4), 329-342.
- Battini, D., Peretti, U., Persona, A. & Sgarbossa, F. (2014). Application of humanitarian last mile distribution model. *Journal of Humanitarian Logistics & Supply Chain Management*, 4(1), 131-148.
- Blecken, A. (2010). Supply chain process modeling for humanitarian organizations. *International Journal of Physical Distribution & Logistics Management*, 40(8/9), 675-692.
- Blackman, I. D., Holland, C. P. & Westcott, T. (2013). Motorola's global financial supply chain strategy. *Supply Chain Management: An International Journal*, 18(2), 132-147.
- Bowersox, D. J., Closs, D. J., & Helferich, O. K. (1996). *Logistical management*. New York, NY: McGraw-Hill.
- Burgelman, R. (1983). A process model of internal corporate venturing in a major diversified firm. *Administrative Science Quarterly*, 28(2), 223-244.
- Capó-Vicedo, J., Mula, J. & Capó, J. (2011). A social network-based organizational model for improving knowledge management in supply chains. *Supply Chain Management: An International Journal*, 16(4), 284-293.
- Charles, A., Luras, M., & Van Wassenhove, L. (2010). A model to define and assess the agility of supply chains: building on humanitarian experience. *International Journal of Physical Distribution & Logistics Management*, 40(8/9), 722-741.
- Christopher M. & Towill D. (2000). Supply chain migration from lean and functional to agile and customized". *International Journal of Supply Chain Management*, 5(4), 206-213.
- Christopher, M. (2005). *Logistics and supply chain management: creating value-adding networks*. Financial Times Prentice Hall, Upper Saddle River, NJ
- Cozzolino, A., Rossi, S., & Conforti, A. (2012). Agile and lean principles in the humanitarian supply chain: the case of the United Nations World Food Programme. *Journal of Humanitarian Logistics & Supply Chain Management*,
- Day, J. M., Melnyk, S. A., Larson, P. D., Davis, E. W., & Whybark, D. C. (2012). Humanitarian and disaster relief supply chains: A matter of life and death. *Journal of Supply Chain Management*, 48(2), 21-36.
- De Blok, C., Meijboom, B., Luijckx, K., Schols, J., & Schroeder, R. (2014). Interfaces in service modularity: A typology developed in modular health care provision. *Journal of Operations Management*, 32(4), 175-189.
- Díaz, A., Claes, B., & Borla, G. (2007). Streamlining Humanitarian Relief Operations. The Case of United Nations Peace Keeping Operations. *Proceedings of the POMS Conference*, Dallas.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of management review*, 14 (4), 532-550.
- Gatignon, A., Van Wassenhove, L. N., & Charles, A. (2010). The Yogyakarta earthquake: Humanitarian relief through IFRC's decentralized supply chain. *International Journal of Production Economics*, 126(1), 102-110.
- Glaser, B., & Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies For Qualitative Research*. Wiedenfeld & Nicholson, London.
- Heaslip, G. (2015)- Humanitarian Logistics: An opportunity for service research. *Journal of Humanitarian Logistics & Supply Chain Management*, 5(1), 2-11.
- Holgúin-Veras, J., Jaller, M., Van Wassenhove, L. N., Pérez, N., & Wachtendorf, T. (2012). On the unique features of post-disaster humanitarian logistics. *Journal of Operations Management*, 30(7), 494-506.
- Hsuan, J., & Skjøtt-Larsen, T. (2004). Supply chain integration: implications for mass customization, modularization & postponement strategies. *Production Planning Control*, 15(4), 352-361.
- Iakovou, E., Vlachos, D., Keramydas, C. & Partsch, D. (2014). Dual sourcing for mitigating humanitarian supply chain disruptions. *Journal of Humanitarian Logistics and Supply Chain Management*, 4(2), 245-264.
- Kesavan, S., Staats, B. R. & Gilland, W. (2014). Volume flexibility in services: The costs & benefits of flexible labor resources. *Management Science*, 60(8), 1884-1906.
- Ketokivi, M., & Choi, T. (2014). Renaissance of case research as a scientific method. *Journal of Operations Management*, 32(5), 232-240.

- Kovacs, G. & Spens, K. (2007). Humanitarian logistics in disaster relief operations. *International Journal of Physical Distribution & Logistics Management*, 37(2), 99-114.
- Kunz, N.; Reiner, G. & Gold, S. (2014). Investing in disaster management capabilities versus pre-positioning inventory: A new approach to disaster preparedness. *International Journal of Production Economics*, 157(1), 261-272.
- Kwon, S. W. (2008). Does the standardization process matter? A study of cost effectiveness in hospital drug formularies. *Management Science*, 54(6), 1065-1079.
- Lamming, R. (1996). Squaring lean supply with supply chain management. *International Journal of Operations & Production Management*, 16(2), 183-196.
- Maon, F., Lindgreen, A., & Vanhamme, J. (2009). Developing supply chains in disaster relief operations through cross-sector socially oriented collaborations: a theoretical model. *Supply Chain Management: An International Journal*, 14(2), 149-164.
- Mentzer J., & Konrad, B. (1991). An Efficiency/Effectiveness approach to Logistics Performance Measurement. *Journal of Business Logistics*, 19(2), 33-62.
- Oloruntoba, R. & Gray, R. (2006). Humanitarian aid: an agile supply chain? *Supply Chain Management: An International Journal*, 11(2), 115-120.
- Papadakis, I. S. (2006). Financial performance of supply chains after disruptions: an event study. *Supply Chain Management: An International Journal*, 11(1), 25-33.
- Portilla, D., Shaffer, R., Okusa, M., Mehrotra, R., Molitoris, B., Bunchman, T., & Ibrahim, T. (2010). Lessons from Haiti on Disaster Relief. *Clinical Journal of the American Society of Nephrology*, 5(11), 2122-2129.
- Salvador, F. (2007). Toward a product system modularity construct: literature review and reconceptualization. *IEEE Transactions on Engineering Management*, 54(2), 219-240.
- Sanchez, R. (1999). Modular architectures in the marketing process. *Journal of Marketing*, 63(4), 92-111.
- Scholten, K., Scott, P., & Fynes, B. (2014). Mitigation processes—antecedents for building supply chain resilience. *Supply Chain Management: An International Journal*, 19(2), 211-228.
- Sharifi, H. & Zhang, Z. (1999). A methodology for achieving agility in manufacturing organisations: an introduction. *International Journal of Production Economics*, 62(1), 7-22.
- Tatham, P. & Pettit, S. (2010). Transforming humanitarian logistics: the journey to supply network management. *International Journal of Physical Distribution & Logistics Management*, 40(8/9), 609-622.
- Tomasini, R. & Van Wassenhove, L. (2009). From preparedness to partnerships: case study research on humanitarian logistics. *International Transactions in Operational Research*, 16(5), 549-559.
- Van Wassenhove L. (2006). Memorial Lecture: Humanitarian aid logistics: supply chain management in high gear. *Journal of the Operational Research Society*, 57(5), 475-489.
- Wild, N. & Zhou, L. (2011). Ethical procurement strategies for international aid non-government organisations. *Supply Chain Management: An International Journal*, 16(2), 110-127.
- Womack, J. P., Jones, D. T. & Roos, D. (1990). *The machine that changed the world*. Simon & Schuster, New York, NY.
- Yin, R. K. (2014). *Case study research: Design & methods*. Sage publications, Thousand Oaks, CA.
- Zaheer, A. & Venkatraman, N. (1995). Relational governance as an interorganizational strategy: an empirical test of the role of trust in economic exchange. *Strategic Management Journal*, 16(5), 373-392.

**Main archival documents consulted in the WEB:**

- DHL, Disaster Response Teams: [http://www.dpdhl.com/en/responsibility/corporate\\_citizenship/disaster\\_management/disaster\\_response\\_drt.html](http://www.dpdhl.com/en/responsibility/corporate_citizenship/disaster_management/disaster_response_drt.html)
- IFRC, Annual Report 2013: [https://www.ifrc.org/Global/Documents/Secretariat/201411/IFRC%20Annual%20Report%202013\\_FINAL.pdf](https://www.ifrc.org/Global/Documents/Secretariat/201411/IFRC%20Annual%20Report%202013_FINAL.pdf)
- IFRC, Disaster Management: <http://www.ifrc.org/en/what-we-do/disaster-management/responding/>
- IFRC, Disaster response and contingency planning guide: <https://www.ifrc.org/Global/Publications/disasters/disaster-response-en.pdf>
- IFRC, Disaster Risk management in Haiti RC –Midterm evaluation: [www.ifrc.org/en/publications-and-reports/evaluations/](http://www.ifrc.org/en/publications-and-reports/evaluations/)
- IFRC, Emergency response units (ERU): <https://www.ifrc.org/Global/Publications/disasters/117600-eru-brochure-en.pdf>
- IFRC, Field Assessment Coordination Team (Fact): <http://ifrc.org/fact>
- IFRC, Global logistics services: <http://www.ifrc.org/what-we-do/logistics/>
- IFRC, Haiti earthquake 4 years progress report: <https://www.ifrc.org/PageFiles/60580/Haiti%204-year%20progress%20report-EN-LR.pdf>
- IFRC, Haiti earthquake one year progress report: [http://www.ifrc.org/Global/Publications/disasters/208400-First%20anniversary%20Haiti%20EO%20operation%20report\\_16b.pdf](http://www.ifrc.org/Global/Publications/disasters/208400-First%20anniversary%20Haiti%20EO%20operation%20report_16b.pdf)
- IFRC, Haiti emergency appeal: <http://www.ifrc.org/docs/appeals/10/MDRHT008PrelimAppeal.pdf>
- IFRC, Haiti from tragedy to opportunity: <https://www.ifrc.org/Global/Publications/disasters/192600-Haiti-report-EN.pdf>
- IFRC, World Disaster Report 2013: <http://worlddisastersreport.org/en/>
- OECD Statistics 2012: <http://stats.oecd.org/>
- Swiss Re, “Chile earthquake expected to be a major insurance event”: [http://www.swissre.com/rethinking/chile\\_earthquake\\_expected\\_to\\_be\\_a\\_major\\_insurance\\_event.html](http://www.swissre.com/rethinking/chile_earthquake_expected_to_be_a_major_insurance_event.html)
- World Bank, “Building resilience. Integrating Climate & Disaster Risk into Development”, <https://www.documentcloud.org/documents/835955-wbg-2013-building-resilience.html>

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