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Learning from the Haiti Earthquake

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# Using OR to Support Humanitarian Operations: Learning from the Haiti Earthquake

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## **Abstract**

The response to the Haiti Earthquake in 2010 has been declared the largest humanitarian operation ever carried out in a single country. Efficiently allocating scarce resources for responding to such type of massive disaster has proven to be extremely challenging. This paper identifies areas where applied operations research can have a significant impact in supporting large scale humanitarian operations. We describe the immediate response to the Haiti Earthquake focusing on five clusters: logistics, health, food, shelter and non-food items, and water, sanitation and hygiene. In each case we specify the on the ground situation, the operational objective, the key decision problems, the main bottlenecks and the outcome of the response operation. Finally, we provide recommendations on conducting research with humanitarian organizations based on over ten years of experience.

## 1 Introduction

The Haiti earthquake which occurred on January 12<sup>th</sup> 2010, at 16h53 local time, measured 7.0 magnitude on the Richter scale. The massive level of destruction caused by the seism imposed tremendous operational challenges on the humanitarian agencies and governments committed to responding. Initial reports sent via e-mail by survivors suggested a huge number of casualties and widespread damage. Electricity, phone networks and access to water were severely disrupted. The IFRC (a glossary of all acronyms used in this paper can be found in Appendix 1) highlighted the urgent need for access, search and rescue, medical facilities and supplies, clean water and sanitation, food, emergency shelter, logistics and telecommunications in order to establish “*the largest humanitarian operation ever carried out in a single country*” (IFRC 09/02/2010).

On January 13<sup>th</sup> the Humanitarian Cluster System was activated. In line with the IFRC’s stated list of urgent needs, we analyze 5 of the response clusters related to the immediate response phase of the Haiti operation. They are: logistics, health, food, shelter and non-food items, and water, sanitation and hygiene. Additionally, we analyze the search and rescue effort and the security issues which were a key component of the humanitarian response operation during the first 7 days following the earthquake. Our objective is to highlight the critical issues that impacted the response, and formulate them such as to illustrate the value that OR can bring to these operations. In this respect, we specify: 1) *the on the ground situation*; 2) *the operational objective*; 3) *the key decision problems*; 4) *the main bottlenecks*; and 5) *the outcome of the response operation*.

The paper identifies areas where applied OR can have a significant impact in supporting international humanitarian operations. However, in order to be applicable

this research must be in line with the real needs facing humanitarian decision makers. For instance, humanitarian organizations have different objectives and face more severe bottlenecks than a company operating in less volatile environments. To this end, the paper also provides recommendations on conducting research with humanitarian organizations, based on over 10 years of experience.

The structure of the paper is as follows: section 1 provides a brief overview of existing literature on disaster lifecycle management and humanitarian logistics. Section 2 describes the state of Haiti's low level of preparedness. Section 3 examines the cluster activation and response set up in the five categories highlighted previously. Section 4 provides key recommendations for carrying out research with the humanitarian sector. Section 5 outlines the main conclusions of the paper.

## **2 Brief literature discussion**

Carter (1991) identifies six phases in the cycle of a disaster: preparedness, impact, response, recovery, development and mitigation. Norman's framework (2003) includes prevention, mitigation, preparedness, response, recovery and development. Tomasini and Van Wassenhove (2009) refer to preparedness, response, mitigation and rehabilitation.

The growing body of OR literature on humanitarian logistics focuses on the disaster lifecycle stages of preparedness and response. Most models deal specifically with preparedness and response regarding victim evacuation and aid delivery. Some models for victim evacuation can be found in Sherali *et al* (1991), Pidd *et al* (1996), Barbarosoglu *et al* (2002), Han *et al* (2006), Yi and Ozdamar (2007), Chiu and Zheng (2007), Regnier (2008), Stepanov and Smith (2009), and Saadatseresht *et al* (2009). The objective of evacuation models is to efficiently plan the relocation of the human

population from dangerous to safe areas given the threat or realization of a disastrous event. Evacuation is costly and in the case of foreseen threats it must be decided on the basis of noisy signals (Regnier 2008). The OR literature on evacuation planning minimizes distance travelled, clearance time and congestion of evacuation routes.

Models for aid distribution have been developed by Long and Wood (1995), Viswanath and Peeta (2003), Ozdamar *et al* (2004), Barbarosoglu and Arda (2004), Craft *et al* (2005), Miller *et al* (2006), Jia *et al* (2007), Sheu (2007), Tzeng *et al* (2007), Yi and Kumar (2007), Campbell *et al* (2008), Balzik *et al* (2008), Lodree and Taskin (2008), Beraldi and Bruni (2009) and Lee *et al* (2009). With the objectives of minimizing time to respond or maximizing demand coverage, aid distribution models often plan the assignment of a set of aid assets or services to stochastic demand points using an available transportation network that is a function of predefined impact scenarios.

Most of these papers deal with decision making at strategic and tactical levels in terms of facility location, inventory management and transportation management. In this paper we also highlight the potential of OR to analyze operational problems. These kinds of problems are the ones faced by relief workers during the first weeks of response, henceforth referred to as the immediate response phase. Figure 1 illustrates the section of the response operation we are referring to.

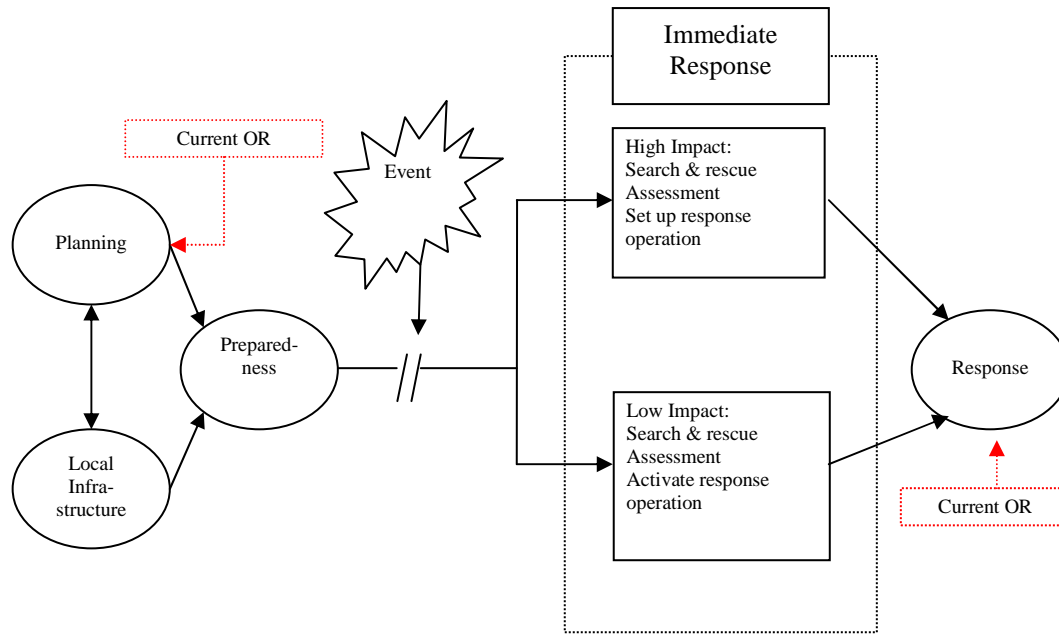


Figure1: Humanitarian response operations – planning, preparedness, and response

### 3 Preparedness: before time zero

At the time of the 2010 earthquake in Haiti, the population of the country had surpassed 9 million inhabitants. Of these, 80% were living on less than \$2 per day and the unemployment rate was running at above 70% (UN.org). Haiti was the poorest country in the western hemisphere and was still recovering from the impact of recent high intensity hurricanes including Dean and Noel in 2007, Gustav, Hanna, Ike in 2008 and Jeanne, also in 2008, which killed more than 3,000 people in the north of the Country.

Haitian local infrastructure was typified by poor quality and insufficiency. Most of the buildings in Haiti had no foundations, and had been built with heavy materials such as bricks, concrete, wood and clay roof tiles. Of the 4,160 Km of road in the country, 76% were unpaved (CIA World Fact Book). Furthermore, only 50% of the population had permanent access to clean water according to the IFRC.

As a result of these problems, there were many humanitarian organizations present working on relief and development programs at the time of the earthquake. UN agencies such as UNICEF and the WFP were present in the country. WFP supported its operations with a logistics hub in El Salvador serving the Central American region. MINUSTAH had been established in 2004 with the objective of maintaining peace. Security was handled by their 7,200 peacekeeping troops located in and around Port-au-Prince ([minustah.org](http://minustah.org)).

Based on previous experience, humanitarian organizations were prepared to cope with hurricanes and other cyclical disasters like flooding. The IFRC had a permanent delegation in Haiti. It had also located one of its regional logistics units in Panama to respond quickly, especially during the hurricane season, to disasters in Latin America and the Caribbean. Following the 2008 hurricane season, the Haitian Red Cross in collaboration with the ICRC had prepositioned 3,000 emergency family kits consisting of hygiene items, kitchen items, blankets, mosquito nets, jerry cans and buckets. They also had emergency medical supplies for 200 hospitalized surgical patients and basic drugs for 1,000 patients. Other humanitarian organizations like WVI, MSF and Oxfam, as well as many others, had ongoing operations in Haiti and had prepositioned stock to respond to cyclical disasters.

At the time of the earthquake there were three access points to Haiti: 1) by plane using the *Aéroport International Toussaint Louverture* at Port au Prince with a low capacity steady state demand of 13 flights per day before the earthquake ([wikipedia](http://wikipedia.org)); 2) by road from Dominican Republic using 2 roads. The main road connecting Santo Domingo with Port-au-Prince had an average travelling time of 8 hours and very limited refueling capacity after crossing the border into Haiti; and 3)



by sea, using, Port-au-Prince seaport, *Cap Haitien*, or the lower capacity ports of *Saint Marc* and *Gonaives*.

Haiti's infrastructural and socio-economic situation rendered the country particularly ill-prepared to cope with the impact of a major earthquake. Responding to this disaster required massive involvement of the international community. The next section examines the immediate response phase (figure 1) of this humanitarian operation. In particular, it focuses on the activation of the humanitarian cluster system and setting up the response.

#### **4 Cluster activation and response set up**

This section identifies the main operational challenges facing international humanitarian organizations in setting up the response to the Haiti earthquake. This major urban disaster resulted in specific bottlenecks and a more dependent local population than seen in a rural context. Humanitarian organizations are not as familiar with these types of disaster, as can be seen in the complications that also arose following Hurricane Katrina. With increased rates of urbanization around the globe, the frequency of urban disasters is likely to increase, bringing new challenges to disaster response in terms of the spread of diseases, security and warehousing capacity, to name some examples.

We focus on search and rescue and five of the humanitarian clusters: access and logistics; health; water, sanitation and hygiene; food aid; and shelter and non-food items, as well as security issues. The cluster approach was proposed by the UN in 2005 following an independent review of the global humanitarian system, called by the Emergency Relief Coordinator. Its purpose is to “*ensure predictability and accountability in international responses to humanitarian emergencies, by clarifying*

*the division of labour among organizations, and better defining their roles and responsibilities within the different sectors of the response”* (Adinolfi *et al* 2005, www.humanitarianreform.org). The Inter- Agency Standing Committee designated global cluster leads in the areas of humanitarian activity. Table 1 details the 12 clusters that were activated during the Haiti response and their cluster leads.

<b>Cluster</b>	<b>Lead Agency</b>
Camp coordination and camp management	IOM
Education	UNICEF
Emergency shelter and non-food items	IOM/IFRC
Food aid	WFP
Logistics	WFP
Nutrition	UNICEF
Protection	OHCHR (UNICEF for child protection and UNFPA for GBV)
WASH	UNICEF
Agriculture and food security	FAO
Early recovery	UNDP
Emergency telecommunications	WFP
Health	WHO/PAHO

Table 1: Humanitarian response clusters and lead agencies (OCHA 17/01/2010)

Cluster leads have been assigned to each of the clusters to help facilitate coordination of the response. The cluster system is generally activated in the event of major disasters that exceed local capability and require a multi-sector response and a wide range of actors. In Haiti for example, OCHA reports between 20 to 50 agencies working with the cluster system, either as a partner organization or through attendance at meetings (OCHA 16/01/2010). In fact, these numbers could be even higher, adding to the challenge of coordinating the response. Coordination of the cluster response is beyond the scope of this paper. However, in terms of the overall response operation, it does present a valuable area for future research.

#### **4.1 Search and rescue (SAR)**

Due to the impact of the earthquake, approximately 75% of the buildings in Port-au-Prince were destroyed or badly damaged (IFRC 31/01/2010). During the

critical time window of 72 hours of emergency search and rescue managed by humanitarian organizations, the *operational objective* was to rescue as many survivors as possible. The immediate response phase usually relies heavily on locals or on people already on the ground. In this specific case, so many people were killed, missing, or trying to cope with traumas in their immediate circle, that they were not in a position to provide the initial response. This added to the already significant bottlenecks facing the humanitarian response operation. With a limited number of SAR teams in the field and a lack of heavy lifting equipment some critical *decision problems* were: 1) how to optimally deploy the rescue teams in a vast geographic area including the cities of Port-au-Prince, Leogane (80-90% of buildings destroyed) Carrefour (40-50% of buildings destroyed) and Jacmel; and 2) how and where to transport rescued patients with grave traumatic injuries and urgent surgery needs to maximize their chances of survival.

The first SAR teams were composed of humanitarian staff present in the field that had survived the earthquake. International SAR teams began to arrive in Haiti on January 14<sup>th</sup>, and 26 SAR teams were on the ground and deployed by January 15<sup>th</sup>. The main *bottlenecks* facing these teams were; the lack of equipment with which to conduct the search; the limited availability of transportation equipment, or routes to transfer people for treatment, and crucially, the lack of functioning medical facilities.

SAR teams were deployed to densely populated areas, public buildings and hospitals. At the peak of the SAR operation there were 67 Urban Search and Rescue teams in Haiti consisting of 1,918 staff and 160 dogs (IFRC 27/01/2010). The search and rescue phase was declared over by the government on January 22<sup>nd</sup>. In total 211 people were rescued by international and national search and rescue teams (OCHA 08/02/2010).

## 4.2 Access and logistics

The seism rendered most of the transportation network non operational. It destroyed Port-au-Prince seaport and partially blocked the main roads to the city coming from the seaport, airport and Dominican Republic. The control tower of the airport was not functional, but its only runway, with capacity up to Boeing 757 and standing room for 18 planes (IFRC 19/01/2010), was operational with radio assisted, line-of-sight landings only. The refueling capacity was damaged (OCHA 13/01/2010). At this stage, the *operational objective* of the immediate response operation was to maximize access to the local population to deliver urgently required food and non-food items. Some of the critical *decision problems* faced by the relief operation regarding access were: 1) how to prioritize the use of ramp space at the airport; 2) how to efficiently plan the use of heavy lifting equipment to clear the roads; 3) how to minimize fuel consumption in a road network with uncertain road blockages; and 4) how to prioritize repair efforts to guarantee access by the sea in the presence of dynamic and noisy seaport capacity assessments.

However, those responsible for the operation faced serious *bottlenecks*. Use of the airport was limited to military and humanitarian flights exclusively. During the first three days of response, the number of flights increased from 13 up to 100 per day. During the fourth day of operations, the pipeline of planes waiting for landing became an issue. The number of flights landing in Port-au-Prince airport increased to a peak of 160 per day between the first 7 to 14 days of the response and began to decrease only during the fourth week of response. By February 8<sup>th</sup> the average number of flights was 74 per day (OCHA 08/02/2010).

From January 17<sup>th</sup> Santo Domingo airport in Dominican Republic became the main entry point for humanitarian relief aid destined to Haiti. The amplified volume

of traffic increased the travelling time by road between Santo Domingo and Port-au-Prince from 8 to 18 hours, while other main roads were still partially blocked. Being a very scarce resource during the first 72 hours of the immediate response, local heavy lifting equipment had the competing tasks of unblocking roads to increase access to the points of demand and removing debris to facilitate search and rescue.

Three days after the earthquake, the *Cap Haitien* seaport was operational but without fuel capacity, *Saint Marc* seaport was operational but without lifting capacity and *Gonaives* low capacity seaport was operational, with lifting capacity and fuel capacity. The *Port-au-Prince* seaport remained non operational until January 20<sup>th</sup> when the first ship containing 123 metric tons of relief items landed (OCHA 20/01/2010). On February 8<sup>th</sup>, 27 days after the earthquake and following the installation of two floating docks, the port's capacity reached 350 containers per day.

### **4.3 Health**

The buildings destroyed by the earthquake included at least 8 of the 13 existing hospitals (OCHA 16/01/2010). This generated an additional increase in demand for emergency medical treatment. The main *operational objective* of the immediate response was to minimize the time to provide emergency medical treatment to earthquake victims, prioritizing people with traumatic injuries. MSF, ICRC, *Médecins du Monde* and 21 other organizations, led by WHO, participated in the immediate response (OCHA 17/01/2010). The main *decision problems* were: 1) how to allocate scarce medical personnel and limited medical supplies to demand points in an efficient way; and 2) how to establish mobile open air hospitals provided by different humanitarian organizations in a coordinated way to maximize demand fulfillment.

*Bottlenecks* regarding emergency medical treatment were numerous. There was a lack of medical doctors to cover the unexpected demand and a lack of medical facilities due to the collapse of hospitals. Electricity, medical supplies, and warehouse space for the shipments being received from abroad were also lacking, and there were significant security issues.

Following the earthquake, the reaction of survival medical personnel already on the ground was immediate. MSF reported treating about 600 people during the first day of response. The ICRC deployed their prepositioned medical stock to operational hospitals between January 13<sup>th</sup> and January 14<sup>th</sup>. Nevertheless, the demand overwhelmed these scarce resources.

The international humanitarian response to the lack of medical doctors and facilities was also rapid. By January 17<sup>th</sup>, 7 field hospitals had been established in Port-au-Prince, 3 of them fully operational (OCHA 17/01/2010). By January 22<sup>nd</sup> there were 47 field hospitals and 11 mobile clinics in Port-au-Prince (OCHA 22/01/2010). At that time more than 55 organizations were part of the cluster and coordination became a challenge.

Starting the second week of response, an additional *operational objective* consisted of avoiding the spread of diseases like diarrhea and cholera as well as the spread of HIV. This was due to the fact that many of the 130,000 people living with HIV in the country had probably been wounded and/or were migrating to rural areas. According to MSF, psychological trauma was another source of concern affecting half of the patients in hospitals.

#### **4.4 Water, sanitation and hygiene**

The daily demand for water, including hospitals and clinics in Haiti was estimated to be above 4 million liters. This was calculated based on a requirement of between 4

and 5 liters of water per person per day, and an estimated demand of between 1 million (IFRC 09/02/2010) and 1.1 million people (OCHA 11/02/2010). Being a critical item for survival, water distribution was one of the main priorities during the first days of response. The *operational objective* was to minimize the time to distribute potable water to cover the total demand. The main *decision problems* regarding water were: 1) how to prioritize the distribution of water during the first days of response; and 2) how to set up a water distribution system to optimize demand coverage given the damage in the water distribution network. The operation also faced similar *bottlenecks* to those previously stated in relation to health and medical treatment in addition to the fact that water quality was uncertain and needed verification in real time.

The WASH cluster began distributing water in Port-au-Prince on January 16<sup>th</sup> “with 250,000 liters per day in 52 water distribution points in 17 zones with the assistance of the private sector” (OCHA 16/01/2010). The IFRC reports indicated the distribution of 500,000 liters per day starting on January 14<sup>th</sup>, two days after the earthquake (IFRC 09/02/2010). According to OCHA, around the end of the first month of operation 911,200 people had been provided with safe drinking water (5 liters per person per day) through water tanking and treatment in 300 distribution centers across *Port-au-Prince, Leogane, and Jacmel* (OCHA 11/02/2010).

#### **4.5 Food aid**

On January 13<sup>th</sup> WFP, the logistics cluster lead, estimated an initial demand of food for 2 million people. The needs consisted of 14 000 metric tons of ready to eat food and 160 metric tons of high energy biscuits for a 7 day time horizon. The multi-commodity, multi-modal network flow problem had the *operational objectives* of maximizing demand fulfillment and minimizing time of response. Some of the

*decision problems* faced by the relief operation were: 1) how to transport the required amount of food to Haiti; 2) what warehouses to use to stock food items; 3) how many final distribution points to use; and 4) where to locate the distribution points to optimize the trade-off of coverage vs. security.

With the prepositioned food items buried under debris, the closest feasible supply points were the UNHRD in Panama and the WFP satellite logistics hub in El Salvador. Given the *bottlenecks* of lack of fueling capacity in Haiti, as well as the limited capacity of the Haiti airport, aircraft had to plan at least one hour of holding fuel and extra fuel for a return trip (OCHA 15/01/2010). Plane selection, scheduling, routing and the optimal balance between fuel and cargo were complex operational problems.

On January 13<sup>th</sup> WFP airlifted 86 metric tons of high-energy biscuits (enough for half a million emergency meals) from El Salvador. WFP began delivering food on January 13<sup>th</sup> from a distribution point next to the airport; this reached 3,000 people. Security problems starting on January 14<sup>th</sup> imposed a binding *constraint*. Military escorts would be required for food distribution. On January 15<sup>th</sup> WFP distributed food to 13,000 people and given the difficulties of access adjusted its goal to assist 1 million people in 15 days.

On January 19<sup>th</sup> the total number of people fed by WFP and other members of the food cluster was 330, 000 (OCHA 17/01/2010). On February 11<sup>th</sup>, one month after the earthquake, the total number of people receiving varying levels of food coverage was above 2.3 million (OCHA/11/02/2010).

#### **4.6 Shelter and non food items**

The demand for emergency shelter in the wake of the earthquake was estimated at 700,000 people (IFRC 09/02/2010). The shelter cluster, led by IOM, was activated



with the *operational objective* of meeting the total demand with emergency shelter and access to non-food items including tarpaulins, plastic sheeting, jerry cans, water containers, and some shelter material. The second phase of the response consisted of camp management for more than 800,000 internally displaced people migrating to safer areas of the country (OCHA 14/01/2010). In this aspect of the response, the main *decision problems* were: 1) how to maximize demand coverage while minimizing time of response; 2) how to determine the optimal size of the camps; 3) where to locate the main camps; and 4) how many camps to set up.

The main *bottlenecks* in terms of shelter and non-food items faced by the relief operation during the immediate response phase were a lack of stock, lack of transportation, lack of staff for distribution, and security issues. (OCHA 16/01/2010).

On January 14<sup>th</sup> with a sufficient prepositioned stock to assist 10,000 families with non-food items, and a target group of 200,000 families, the IFRC and IOM began the distribution. During the immediate response IOM delivered 240,600 aqua tabs, 3,300 jerry cans and 1,920 hygiene kits in Port-au-Prince. Equally, the organization carried out assessments on 181 potential sites for camps finding that only one of them had permanent access to water. In conjunction with the distribution of the items mentioned above, the shelter cluster distributed over 49,000 tarps, 23,000 family size tents, 26,500 kitchen sets, 83,000 hygiene kits, 79,500 blankets and 10,300 mosquito nets during the first month (OCHA 11/02/2010). On February 11<sup>th</sup> there were 400,000 plastic sheets in stock and in the pipeline.

#### **4.7 Security**

Difficulties to access those in need increased lead times in last mile distribution. Without access to reliable information, the delays in aid delivery created anxiety amongst the Haitian people to the point that security became the main bottleneck to

aid distribution by the end of the first week. The first security incidents were registered on January 13<sup>th</sup>. Immediately, the US started planning the deployment of 2,000 marines into Haiti to support the 3,000 MINUSTAH security personnel left to respond on the ground. From January 14<sup>th</sup> MINUSTAH decided to provide escorts to those delivering relief goods. US troops and UN peacekeepers also started offering protection to aid convoys travelling from main distribution points starting with the airport. Distribution escorts were maintained during the first month of response.

Given the conditions, the systems used in setting up the humanitarian operation in response to the Haiti earthquake faced multiple problems. Not least of these was the allocation of scarce resources. Table 2 summarizes these problems.

Stage / cluster	Main operations research problems First weeks of response
<b>Search and rescue (SAR)</b>	1) How to optimally deploy the rescue teams in a vast urban area 2) How and where to transport rescued patients with grave traumatic injuries and urgent surgery needs to maximize their chances of surviving
<b>Access and logistics</b>	1) How to prioritize the use of ramp space at the airport 2) How to efficiently plan the use of heavy lifting equipment to clear the roads 3) How to minimize fuel consumption in a road network with uncertain available paths 4) How to prioritize repair efforts to guarantee access by the sea in the presence of dynamic and noisy seaport capacity assessments
<b>Health</b>	1) How to allocate scarce medical personnel and limited medical supplies to demand points in an efficient way 2) How to establish mobile open air hospitals provided by different humanitarian organizations in a coordinated way to maximize demand coverage
<b>Water, sanitation and hygiene</b>	1) How to prioritize the distribution of drinkable water during the first days of response 2) How to set up a drinking water distribution system to optimize demand coverage given the damages in the water distribution network
<b>Food Aid</b>	1) How to transport the required amount of food to Haiti 2) What warehouses to use to stock food items 3) How many final distribution points to use 4) Where to locate the distribution points to optimize the trade-off of coverage vs. security
<b>Shelter</b>	1) How to maximize demand coverage while minimizing time of response 2) How to determine the optimal size of the camps 3) Where to locate the main camps 4) How many camps to set up

Table 2: Summary of main OR problems faced during the immediate response phase after the Haiti earthquake

This paper highlights avenues where applied OR can have a significant impact in supporting international humanitarian operations. However, determining and finding solutions to the real needs facing humanitarian decision makers can also prove to be challenging. The following section provides recommendations on conducting research with humanitarian organizations, based on over 10 years of experience working with the sector.

## **5 Conducting applied research in the humanitarian context.**

As illustrated with the example of Haiti, OR applications have a unique and valuable role to play in assisting humanitarian organizations to improve their operations. However, conducting research in this context is challenging. There are many idiosyncratic and contextual issues that set humanitarian workers and operations researchers apart. Research that is groundbreaking from a theoretical point of view may not be deemed valuable by humanitarian organizations. Ultimately, there is a high degree of uncertainty inherent in the researcher/humanitarian relationship. Each party is risking time, resources and credibility to deliver valuable research outputs that will have a positive impact on operations.

INSEAD Humanitarian Research Group has been engaged in research with humanitarian organizations since 2000. Working with such diverse organizations as WFP, IFRC, Oxfam, World Vision International and MSF, the Group has been obliged to continuously reflect upon, and in some cases revise, its research approach in order to stay relevant to humanitarians without compromising methodological rigor. The following recommendations for conducting research with humanitarians have been compiled by members of the research group based on individual and collective experience.

## **5.1 Build trust by building understanding**

Humanitarian workers operate in action oriented environments. Rarely do they have time to reflect on and analyze their operations. Investigations into their operations generally come in the form of audits, and they are not in regular contact with external researchers. At all levels of their organizations, the purpose and methodology of OR is unfamiliar. In addition, the researcher is asking them to take time out of their already full schedules to divulge often confidential information for use in a study. These factors combined create a high degree of uncertainty and suspicion in the relationship that needs to be dissipated in order for the collaboration to succeed.

When first approaching humanitarian organizations to work with them, take time to *build trust*. Get to know the individuals you wish to work with and establish a central point of contact. Use the resources at hand (email, telephone, visits) to develop familiarity between you and the person you are contacting. Be patient, do not expect immediate responses but be persistent in your wish to work with them. Try to meet in person on a casual basis if possible.

Researchers should not expect immediate approval of the project from participating humanitarians. *Increase their understanding* as to the content and objectives of the project. This may include a presentation of the researcher's background, the project objectives and the proposed value to the humanitarian organization. Demonstrate that you are well prepared and that, above all, you will not waste their time.

## **5.2 Learn the language**

Humanitarians operate under the principles of humanity, neutrality and impartiality (Tomasini and Van Wassenhove 2009). Maintaining this balance is crucial to the effective implementation of disaster response operations. In many cases they operate

in regions deeply affected by extreme or prolonged conflict. In every case, they engage with multiple stakeholders from government institutions, to international donors, to local communities. Maintaining clarity and understanding across multiple stakeholders is vital. To this end, humanitarian organizations employ specific terminology.

This lexicon has significant political and practical implications. For example, from the political perspective, NGO, e.g. WVI, is not to be confused with UN, e.g. WFP, which has been established by multiple governments. From a practical point of view, humanitarians use a large number of acronyms. For example, water, sanitation and hygiene is shortened to “WASH”, internally displaced people are “IDPs” or a search and rescue team is a SAR.

In order to communicate clearly and effectively from day one, it is vital for the researcher to be familiar with the meaning and use of terms specific to the humanitarian sector. Using terms like customer (beneficiary) or shareholder (donor) immediately creates a lack of clear understanding between the parties and exacerbates the already present divide between the operations researchers and the humanitarian worker. *Learning the language* is a vital tool to create an atmosphere of trust and openness during the research process.

### **5.3 Respect existing expertise**

International humanitarian organizations generally have four levels of operations. They are: headquarters, regional, national and program (field) level. Managers from the program to headquarters level are usually expatriates with 5 to 15 years of experience at an operational level. Operations people generally include members of the local population.

Embodied in this work force is a high degree of local and tacit knowledge, heuristics to work under ambiguity and well tested rules of thumb, combined with years of field experience. Although manager and field staff alike may lack formal training in logistics or operations, this is not to be confused with lacking expertise. *Acknowledging this expertise* is very important. Listening to the real problems and using OR to develop solutions will be far more effective in the long run than using existing OR models and attempting to force-fit them to humanitarian organizations.

In order to guarantee the relevance of the research, the researcher needs to engage humanitarian experts in the project by keeping them informed as to how the work is progressing, asking for feedback and requesting advice on the applicability of the findings.

#### **5.4 Be specific and realistic about your information requirements**

Data collection is one of the most salient problems impacting humanitarian organizations today. As Pedraza Martinez *et al* (2009) assert, the problem is not a lack of data but rather the way in which it is compiled. There is little cross referencing between the different formats (excel spreadsheets, archival files or data collection systems) and the systematic use of quantitative data for decision making purposes is rare. Additionally, high levels of bureaucracy within some of these organizations have often resulted in different departments within the organization possessing detailed data on a very limited aspect of an operation. Mountains of paper work exist in offices located in remote villages with seemingly little function other than to provide material support in the event of an audit, i.e. data is often collected for accountability requirements and not for decision analysis.

As a result, demands for extensive data sets pose serious problems to humanitarian workers in terms of time required to track down and compile the

information. In a similar vein, excessive demands for data also pose problems as humanitarians may need to consult many people within the organization to obtain the information. The researcher may also confront the same problem when carrying out research interviews. Individuals working in these organizations have a high degree of specialized vertical knowledge regarding their own roles, but often lack broader knowledge of the organization as a whole i.e., organizations function in silos and supply chains are fragmented.

Mitigating this problem is a challenge. *The researcher must be specific and realistic about the information requirements.* Pinpoint the correct person to speak to regarding a given issue. Don't waste time by either asking for information that can be obtained from alternative sources (annual reports, websites) or asking for excessively detailed data that is not vital to the research. Demonstrate knowledge of the context and operational constraints. Be concise and direct with questions and specific in descriptions of the data set required. Where possible, formulate the questions such that yes/no responses are sufficient. Avoid crowding already overloaded inboxes with last minute demands. Rather, send clear requests much in advance of project deadlines and be prepared to wait a long time for a response!

## **5.5 Gain field knowledge**

Humanitarians operate in an atypical context. For many researchers, it is virtually another world. This is one factor that makes research into their operations compelling, but also deeply challenging. As previously mentioned, field workers as well as decision makers have field experience of varying durations. Firm relationships have developed between humanitarians that have crossed paths during a response or ongoing operations, and expansive networks have formed across the sector based on

shared experiences, and even shared traumas in difficult and dangerous response operations.

In an attempt to explain the difficult conditions inherent in humanitarian operations a common question posed to the researcher is “have you been to the field?” This may be followed by a reference to “dirt under the finger nails”. Having *field knowledge* increases the credibility of the operations researcher. It helps to remove the “ivory tower” image of research and helps to break down some of the barriers to understanding between the humanitarian and the researcher. At the very least, it broadens the researcher’s network of contacts and permits collection of primary data.

When arranging field trips or interviews, researchers need to recognize the difference in planning horizons and be adaptable to the humanitarian way of operating. Prior to meetings provide as much information as possible on the type of information required, and the roles/ responsibilities of the requested interviewees. It is rare to receive a meeting agenda before arriving at the organization. In this respect, it is very important to *be flexible*. Humanitarian workers have dynamic agendas which they reshuffle constantly. Be prepared to deal with last minute interviews as they occur or last minute cancellations as your interviewee is suddenly mobilized to respond to a disaster.

## **5.6 Give something in exchange and deliver relevant results**

Humanitarian organizations operate according to a mandate. As such, their workers are not motivated by profit, by product innovation, or by challenging existing understanding. The main objective is the effective delivery of programs. When entering into a collaborative research project, the main motivation is to increase the efficiency of operations. They must compare the resources that will be required to take part in the project with the value it will add to their work. The researcher has a



real responsibility in terms of setting expectations and applying the results. Every resource that is spent on research and implementation is a resource that could be used for program delivery.

In this respect, it is crucial for the researcher, particularly those who wish build a lasting relationship with a given organization, to deliver relevant results as promised. Engaging with the organizations from the design to application of the research is one way to ensure that the real value of OR in the humanitarian context is realized to the benefit of all involved.

## **6 Conclusions**

Humanitarian organizations face multiple decisions problems and bottlenecks in responding to large scale disasters such as the Haiti earthquake. OR can play a role in supporting international humanitarian operations. This paper highlights areas where OR can have a significant impact.

Current OR literature related to humanitarian operations tends to focus on planning and preparedness of the response or on the optimization of existing response systems. In the case of Haiti, these systems were non-existent or severely impacted by the disaster and required reconstruction. OR literature should also include more research on the immediate response phase. In the wake of high impact disasters, this phase involves search and rescue, assessment, and setting up the response systems.

The humanitarian operation in response to the Haiti earthquake highlights the relevance of applied OR to the field of humanitarian operations, specifically in 4 aspects: 1) on the ground; 2) operational objectives; 3) decision problems and; 4) bottlenecks. On the ground, humanitarian organizations based in Haiti had systems in place, and were prepared to respond to cyclical regional disasters such as hurricanes

or flooding. The earthquake on January 12<sup>th</sup> overwhelmed these systems, leaving the humanitarian community ill-prepared to cope with the aftermath of the disaster. The operational objectives of humanitarian response operations are to maximize coverage while minimizing time of the response. As the Haiti example illustrated, these objectives are subject to serious decision problems and bottlenecks. It is these two aspects which provide the key areas for application of OR.

In order to be relevant, OR must address the real challenges facing humanitarian organizations. Conducting research with this sector can be challenging. Humanitarian organizations are not driven by profit and do not behave as commercial companies trying to optimize their processes. They have different priorities, different planning horizons, and specific terminology. When conducting research, there are five important factors to consider. Building trust by building understanding can serve to dissipate the uncertainty surrounding academic research in humanitarian organizations. Learning the language is crucial to communicating clearly and effectively with humanitarian operatives. Acknowledging existing expertise and learning the real problems engages humanitarian experts and ensures the relevance of the project. Collecting data is one of the most significant problems facing humanitarian organizations. It is therefore important to be specific and realistic about your information requirements, and to avoid overwhelming the organizations with requests. Field research gives the researcher a clearer understanding of the context, helps to break down barriers between the researcher and the humanitarian, can broaden the researchers network of contacts and permits collection of primary data. Finally, operations researchers working with humanitarian organizations have a responsibility to manage expectations and deliver results such that time and resources invested by academics and humanitarians can contribute to improving operations.

Humanitarian logistics is a relevant research area for operations research. By collaborating with humanitarian organizations to improve disaster preparedness and disaster response operations researchers will contribute to reduce the impact of disasters like the Haiti earthquake in the future.

### Appendix 1: Glossary of Acronyms

Acronym	Meaning
CIA	Central Intelligence Agency
FAO	Food and Agriculture Organization
HIV	Human Immuno-deficiency Virus
ICRC	International Committee of the Red Cross/Crescent
IDP	Internally Displaced People
IFRC	International Federation of Red Cross/Crescent Societies
IOM	International Organization for Migration
MINUSTAH	UN Stabilization Mission in Haiti
MSF	Médecins Sans Frontières
NGO	Non-Governmental Organization
OHCHR	Office of the High Commissioner for Human Rights
OCHA	Office for the Coordination of Humanitarian Affairs
OR	Operations Research
PAHO	Pan-American Health Organization
SAR	Search and Rescue
UN	United Nations
UNDP	UN Development Program
UNHCR	UN Refugee Agency
UNHRD	UN Humanitarian Response Depot
UNICEF	UN Children's Fund
US	United States
WASH	Water, Sanitation, Hygiene
WFP	World Food Program
WHO	World Health Organization
WVI	World Vision International

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