

# Bringing Structure to the Disaster Data Typhoon: An Analysis of Decision-Makers' Information Needs in the Response to Haiyan

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## Abstract

Effective coordination and information sharing are vital for the response to sudden onset disasters, and aim at empowering the responding agencies as well as the affected communities to respond to and recover from the impact of a disaster in a well-orchestrated manner. The response to Typhoon Haiyan, however, revealed many organizational and technical obstacles that impeded the efficient retrieval and sharing of information. This paper presents findings from field research that was conducted in the Philippines in December 2013, and outlines approaches to direct future work on standardization and information sharing.

## Introduction

Typhoon Haiyan (Yolanda) has been described as one of the strongest storms ever with top wind speeds of more than 300 km/h. Haiyan made landfall in the Philippines on November 8, 2013. Over 14 million people were directly affected by the storm, more than 6,200 lost their lives (UN OCHA situation report 34, of January 28 2014).<sup>1</sup> Devastation spread across six Philippine islands and 44 provinces. In response to this disaster, the UN quickly declared a Level 3 emergency and activated the Cluster system (Jahre & Jensen, 2010). The Camp Coordination and Camp Management Cluster, for instance, brought together 566 partners including local NGOs and government organizations providing assistance to displaced persons (Haiyan Strategic Response Plan).<sup>2</sup> This onsite effort was supported by the work of volunteers that contributed remotely, from their laptops and desks. Many of those volunteers, also referred

to as “digital humanitarians”, are active within the Standby Task Force (SBTF). The SBTF currently comprises some 2,000 skilled volunteers with dedicated experience in Crisis Mapping, and is activated on a case-by-case basis at request of international agencies or local organizations in the response to a natural or complex disaster. SBTF volunteers are from 70+ different countries and have been involved in crisis mapping projects since the 2010 Haiti earthquake response (Capelo, Chang, & Verity, 2012; Crowley & Chan, 2010). After Haiyan, crowd-sourced information or satellite imagery that was analyzed, evaluated and turned into information products by remotely working volunteers has even declared as “*mainstream*” (Butler, 2013).

Yet, the typhoon’s catastrophic impact has highlighted that the increased amount of information that is available online has not been translated (yet) into better response. Clear information flows and coordination mechanisms after a large-scale sudden onset disaster such as Haiyan should facilitate sensemaking and support a plethora of decisions-makers. Owing to the diversity of skills, backgrounds, needs, interests, and contexts this however remains a challenge. This paper reports on our findings from field research on decision-makers’ information needs in aftermath of Haiyan. This fieldwork serves as basis to analyze major challenges for information sharing, and outlines implications for information management in this context. From there, we provide directions for future standardization and data structuring to support responders working on-site and remotely.

## Methods

To understand the different requirements and needs of decision-makers responding to Haiyan, a small team of researchers embarked for the Philippines on December 11,

<sup>1</sup><http://reliefweb.int/sites/reliefweb.int/files/resources/OCHAPHilippinesTyphoonHaiyanSitrepNo.34.28Jan2014.pdf>

<sup>2</sup><http://reliefweb.int/report/philippines/typhoon-haiyan-yolanda-strategic-response-plan-november-2013-november-2014>

2013, a bit more than a month after Typhoon Haiyan had made landfall. The team consisted of researchers with different backgrounds ranging from information management to logistics. Our reachback support team (Chan & Comes, 2014) provided spot analyses and document reviews. During the research in the Philippines, we conducted site observations, 39 semi-structured interviews, and engaged in meetings and conversations. Most interviewees were affiliated with the United Nations, followed by NGOs, government representatives and members of the Red Cross Red Crescent Movement (IFRC/ICRC). Approximately two thirds of interviewees were in a formal information management or coordination role, primarily in the UN system.

The semi-structured interview protocols were based on the Decision-Makers' Needs in Sudden Onset Disasters Framework (Gralla, Goentzel, & Van de Walle, 2013), which provided an overview of information needs along with qualifiers such as time when information is needed (days post disaster), or precision required. Starting from there, we derived a sample taxonomy that related information needs to a sector and area of interest and further specified the attributes of information desired. Table 1 below shows a sample list of questions related to the dimension *Context and Scope* to illustrate our approach; further dimensions that we included in an analogue way in our research were: *Capacity and Response Planning*; *Operational Situation Overview*; *Coordination and Institutional Structures*; *Internal / Management*; and *Planning / Looking forward*.

Table 1: Information Needs on Context and Scope of Haiyan

Emergency Situation	What is the impact and scope of the disaster
	Is assistance needed? Has the government appealed for international assistance?
	What geographical areas are affected?
	What has been damaged: infrastructure? Housing? Existing humanitarian efforts? Resilience?
	What was the baseline situation (before the response), and what has changed (worsened) and where?
Affected Population	How many people have been affected, and how?
	Where (geographically) are the affected people?
	What is the status of the affected people? Are they displaced, vulnerable, etc.?
	What are the characteristics of the affected: ethnicity, socio/economic, gender, etc.?
Information Availability	What information is available, both baseline (pre-emergency) data and updates on the current situation?
	What are the existing sources of information?
	How accurate is the information?
Context	What is the local socio-political context: political situation, cultural norms, etc.?
	What is the expected response of the government? Are there restrictions or sensitivities?
	What natural resources are available? What are the harvest/crop cycles? Seasonal changes?
	What is the skillset of the community, and its cohesion?
	What were the previous responses to disasters, coping mechanisms?
Publication and media	What are the public perception, awareness, and attention?
	What are the media and donor perceptions?

perception	What is the general political will for the response, including local and international?
	How do we balance capacity against expectation? with beneficiaries, donors, media?
Needs	How many people are there in need?
	What are the types of needs (e.g. food, water, health, shelter, protection...)?
	What are the lifesaving needs, and other needs?
	What are the gaps in the response?
Priorities	Which geographic areas are the most critical?
	What are the priority sectors, such as health, shelter, ...?
Information sources and gaps	Does response community agree on number of people in each type of need?
	What are the sources of our information, and the extend of assessments?

## The Challenges: Information Sharing in the Response to Haiyan

The Philippines are confronted with some of the highest disaster risks worldwide: with respect to earthquakes, storms, and flooding it is ranked among the 10 countries with highest mortality (Mosquera-Machado & Dilley, 2008). Therefore, levels of preparedness are relatively high (Brower, Magno, & Dilling, 2014). The Philippines Disaster Risk Reduction and Management Act (DRRM Act<sup>3</sup>) of 2010 has shaped the response in the Philippines; assigning the role of coordination to the National Disaster Risk Reduction and Management Council (NDRRMC). The council comprises governmental bodies at different levels, and the private sector. Another player is DRRNet, a conglomerate of 300 local NGOs and community groups. The Department of Social Welfare and Development (DSWD) acted as a part of NDRRMC as the main liaison to the Philippines government. National authorities appeared to be highly aware of needs and had accurate baseline population information. Many interviewees described these strengths, which were considered as “of extraordinary quality as compared to other disasters”. However, Common Operational Datasets (CODs) needed to be improved and completed during the response. Because of the high pressure, this happened often in parallel in government agencies and by international NGOs (Ebener, Castro, & Dimailig, 2014). According to one interviewee, a major obstacle for efficient coordination and alignment was a lack of understanding of the local context:

*People parachuted into the UN through the political system have no understanding of the organization on the ground.*

*Interview UNDAC, Tacloban, December 15, 2013*

Aims and time scales among humanitarian actors also vary. Actors with longer-term stakes organized most local efforts, whereas a high staff turn-over is characteristic for international humanitarians; while in the field, responders

3 <http://www.ifrc.org/docs/idrl/878EN.pdf>

may work in different roles and even for different organizations. In this situation, establishing relations to the local population or government agencies becomes difficult, and clear processes and structures need to provide orientation amidst a flux of changing requests, roles, responsibilities and needs.

Despite the potential of new information technologies, information sharing remains difficult in the field. Site observations and interviews consistently reveal that early information sharing still greatly relies on direct bilateral exchange via radios and satellite phones. Figure 1 highlights the divide between information products created by the digital humanitarians, and the robust communication tools present locally in the field.

Remarkably, low technology or no-technology tools such as contact information lists, paper surveys, questionnaires, printed maps, and whiteboards with updated information were frequently seen in settings that offered full support but suffered from high turnover as in many headquarters in the capital of Manila, as well as in more austere settings as in the field offices in the remote town of Guiuan. Collaborative technology-based communication platforms such as Skype chat groups, and shared Dropbox folders were among the most commonly used tools. They support logging interactions, enabling users to ‘catch up’ when connectivity improves.

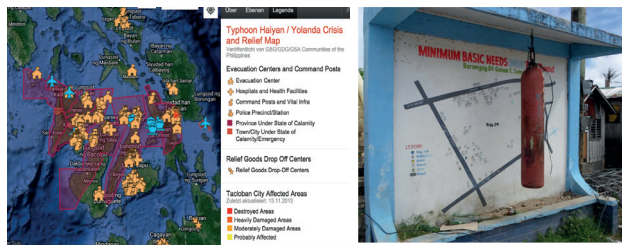


Figure 1: Global vs Local Information Sharing Mechanisms: Crisis Map<sup>4</sup> in Manila (left) vs Barangay Information on a Wall in Guiuan (right)

The plethora of organizational actors, and their procedures, combined with coordination mechanisms introduced by the UN does not only affect strategic decision-making and advocacy, but also has consequences at operational workload. To be efficient and effective, standardized protocols and procedures that guide information sharing across different interests, skills or time horizons are required.

<sup>4</sup> Typhoon Haiyan Crisis and Relief Map: Crowdsourced Map by the Google Philippine communities, last updated on November 13, 2013. Available on <http://google.org/crisismap/a/gmail.com/TyphoonYolanda>

## Information Management

In most humanitarian organizations, information management officers (IMOs) work to collect relevant data and convert these into information products such as situation reports or maps. One of the most important challenges is to create products that are **useful in dynamic and uncertain contexts within very short time**. The time pressure may favor standardized products and formats that have been used for other disasters. The aforementioned CODs, including population data, geographic data, structural data, i.e. important infrastructures such as roads, or ports, are an example of UN-OCHA standardized products. To keep track of response operations, OCHA frequently uses 3W or 4W maps, showing who does what where (and when).

The assumed advantage of the standardization is that it can result in highly efficient operations, because it is known beforehand which information needs to be collected, and how it needs to be visualized. Hence, IM activities become more predictable and potentially reliable, referring to a set of ‘standard’ products that can be updated on a regular basis, and when shared openly can create a transparent information flow despite the potential ad-hoc craziness that is typical for the early phases of disaster response. The aim of OCHA’s IM was in many cases related to setting up and maintaining such a regular and reliable product cycle to facilitate communication with the clusters space, and to enable better planning of information-related vs. operational response activities.

At the same time reacting on the numerous requests by providing standardized and well-known products does not leave room for reflection on (i) how the purpose of a specific request can *best* be served; (ii) if the request is related to products that have already been created; (iii) which format or visualization is best for the purpose. Standardization provides a structure but at the cost of flexibility, which may be a necessary in the acute phases of humanitarian interventions. If information is missing or can’t be formatted to fit the standardized form, often, new information collection efforts are initiated – to fill the unintentional gap. For example, traditional agencies will duplicate assessment efforts to fit standardize formats for their organization despite the fact that packets of this information may already be available at a local level, owned by other authorities or organizations, but often in unfamiliar formats. This is particularly relevant concerning the interface with national, local authorities and the population, but also play in the UN information management, where for example certain NGOs preferred to put their scarce time in managing their own more granular data rather than to provide data to the headquarters in Manila. Conversely, data from local actors in the field that did not meet the imposed data standards often could not easily be included in the international humanitarian system reporting mechanisms.

The duplication of efforts, and the redundancy of many information products have added to the complexity of the



information landscape. Figure 2 highlights the trade-offs that need to be made systematically and appropriately to provide flexibility where needed while maintaining reliability and efficiency.



Figure 2: Trade-off between standardized and flexible IM

### Serving Decision-Makers' Needs

Different information sharing and coordination processes reflect the dichotomy of organizational objectives. Protocols therefore should start from establishing objectives and adapt or consolidate to these aims. For all organizations, the **intra-organizational coordination between decision-makers** was found to be particularly difficult between the **field** staff and **headquarters**, due to geographical distance, specifically the different working context, bandwidth constraints at the field level – particularly in the early phases – and different information needs. Headquarters are responsible and in many ways dependent on field staff for their goals, which include advocacy, funding, PR, and strategic decision-making. This led to considerable information requests from headquarters to which the field had to comply.

Examples are the various needs assessments that emerged in the aftermath of Haiyan. While traditional assessment had been developed and procedures are put in place for standardized collection and processing (Kovács & Spens, 2011), other communities brought forth innovative forms of assessments. For example, in the initial hours after the typhoon's landfall, reports coming in via Twitter, radio, or satellite phone provided a glimpse of the impact. But many communities remained inaccessible to authorities and aid agencies for days (Heydarian, 2013). To assess the impact of Typhoon Haiyan more than 40 agencies conducted a multi-cluster initial rapid assessment (MIRA) in 9 provinces covering 92 municipalities and 283 barangays. This effort was undertaken, although according to the OCHA office in Manila, over 3,000 geocoded Twitter expressions of need were processed in the first two days by OCHA in Geneva, combined with satellite images and reports from the field. However:

*"It is not in the regular MIRA framework. It doesn't fit any statistical models - not sure how to deal with it and incorporate it, translate to response"*

Interview UN-OCHA, Manila, 12/14/2013

### Conclusions: Structuring the Information Typhoon

Information is key to better disaster response (Turoff, Chumer, Van de Walle, & Yao, 2004). Yet, as disasters and the information about them evolve ever more dynamically, we need to increase the flexibility of information collection, processing, storing and sharing protocols, provide situational awareness and support better decision making of all actors involved. Despite these challenges, information systems need to be effective, simple and easy to use.

The data collected both remotely and onsite and the available taxonomies and guidelines for data collection (IASC, 2012) contain information of large diversity, which has to be managed, interpreted, processed, filtered and transformed into action. All these heterogeneous pieces of information do not exist in isolation, but all are related to other data; they are collected in a given context and for a specific purpose.

Integrating information into a single information space aims at strengthening the responders' operational *and* strategic capabilities by improving the exchange of critical information and early monitoring of potential risks (Van de Walle & Comes, 2014). Information can bridge the gap between various disciplines, organizations, and interests and the affected communities only if retrieved and understood.

The Semantic Web describes a stack of methods and technologies to make the meaning of data more explicit. Various knowledge representation languages, such as the Web Ontology Language (OWL) or the Resource Description Framework (RDF), are used to make data available in a machine-readable and understandable way, as well as to specify ontologies that restrict the meaning of terms towards their intended representations. Taking a closer look at disaster management, it is clear that we are still far from automated interoperability; we have not yet been able to capture the tacit knowledge of the responders and translate their operational procedures or their specific domain data into a model (Noran & Bernus, 2011).

The heterogeneous nature of information as well as the difference of the data formats can cause the problem of interoperability and ultimately confusion between local and international decision makers as described for Haiyan. We suggest employing a knowledge base that is represented in a comprehensive ontology as a formal, explicit specification of a shared conceptualization describing the disaster situations as an operational domain. In this manner, the following problems can be addressed: (i) interoperability; (ii) compatibility of sharable information at the conceptual level; (iii) alignment of terminology and definitions, to comply with standards, best practices and procedures.

This ontology shall describe concepts, their properties, relationships and constraints on relationships. By combining those concepts, such as response functions and tasks with a priori background knowledge about the critical pa-

rameters (such as captured in the CODs) consistent and unambiguous models can be derived of the planned or implemented response procedures. Such a model could also serve to prune activities which are incompatible with the given task, actor or scenario. This allows to follow the relations between information components and actions, and to efficiently select the necessary information related to a certain function or area, or any other entry from the whole collection. By adding visualizations, alerts or activations, such a system can also issue warnings and supports monitoring of the response activities.

Different types of relationships are used to link information of different categories. There are several conditions that we keep in mind when implementing the information management system ontology:

- Any information should be actionable, i.e. used for decision making,
- By performing any action (such as a response function) a particular goal/effect should be achieved.
- Particular resources will be needed to successfully perform a specific function
- Each piece of information modeled is linked to other data serving as pre-conditions, triggers, being part of, used in, linked to, influencing, informing or referring to the given information.
- Advanced input/information taken within the general context is needed to start an action (such as a response function) and to successfully perform it.

Our insights add to the known challenge that there are potentially necessary but competing agendas between field and headquarters during the early response phases of a sudden onset disaster. While our early insights lead us to support the fact that coordination and information sharing should aim to ensure that *all* actors are working with the same or complementary information and baseline data and that information is as **relevant**, **accurate** and **timely** as possible, the complexity of this challenges is all the more clear and the need for solution increasingly urgent.

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