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VSAT Deployment for Post-Disaster Relief and Development: Opportunities and Constraints for Inter-Organizational Coordination among International NGOs

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1. Introduction

Since the 1990s the growing frequency and complexity of humanitarian crises in developing countries have led to a surge in the number of international non-governmental organizations (NGOs) providing humanitarian relief. For these NGOs, communication plays a vital role in minimizing the damage done by disasters. The sooner humanitarian organizations are able to collect, analyze and disseminate critical information, the more effective the response becomes and the more lives are potentially saved. Therefore, NGOs increasingly rely on ICTs to share information so as to improve the efficiency of relief and development efforts. However, limited availability of infrastructure in remote areas prior to the disaster and potentially damaged infrastructure as a result of the disaster, place a significant burden on field workers to share information with headquarters or other relief agencies.

With no alternatives in place, NGOs frequently must use very expensive satellite infrastructure through VSATs (Very Short Aperture Terminals). VSAT technology is particularly useful when terrestrial infrastructure has been destroyed, and as such provides a powerful tool to mitigate damage incurred by disasters (Hancock, 1999; Marek, 1993). However, given the expensive nature of any satellite communications, VSAT is often deployed in the context of establishing new field offices; and thus is primarily deployed for development purposes, rather than for emergency response, or direct post-disaster relief.

One possible means for NGOs for lowering the cost of VSAT deployment is to cooperate on deployment; i.e. to jointly order, install and maintain VSATs. To this extent, a collaborative agreement with a VSAT vendor provides opportunity for discounts. Many vendors exist across the globe that provide VSAT connectivity to the relatively few satellite providers. Vendors provide many different types of accessibility, and may have representatives to help install and maintain VSATs in different areas and countries. Therefore, one vendor may be more or less preferable by different organizations. These, and many other factors, will determine the extent to which inter-organizational coordination among agencies will be beneficial.

In this study we analyze coordination efforts by an inter-organizational coordination body, in this study referred to under the pseudonym ReliefTechNet, that aims to support coordination of ICT equipment supply among its 21 member-NGOs. While ReliefTechNet'sVSAT supply coordination originally started for development purposes, these experiences have been leveraged for post-disaster coordination as well. Through analysis of ReliefTechNet's coordination activities for relief efforts after the 2005 Pakistani earthquake, and the 2007 Peru earthquake and South Asian floodings, as well as through analysis of interviews with IT managers at a subset of

member-NGOs and ReliefTechNet managers, this study aims to answer the following questions: How does coordination within the ReliefTechNet occur, and in what situations? What are the benefits and constraints for coordination of VSAT deployment? And, how do these differ for development and relief purposes?

By answering these questions, this research contributes to the broader literature on international inter-organizational coordination as well as the nascent literature on (inter-)organizational aspects of telecommunication deployment during humanitarian relief.

2. Inter-organizational Coordination for Humanitarian Relief & Development and the Supporting Role of ICTs

Around the world, the adoption of ICT for disaster assistance is increasing (Quarantelli, 1997). A considerable body of literature stresses the potentials of ICT for disaster relief (Quarantelli, 1997; Mendonça et al. 2001; Wentz, 2006) as well as provides actual cases of use of ICT to mitigate the effects of disaster (DITF, 1997; Basu, 2006; Currion, 2006a; Currion, 2006b). DITF (1997) provides examples where accurate and timely information generated through the use of ICT was used to reduce disaster losses. They include the 1996 Portland floods, the 1997 river floods in North Dakota, and the 1996 Mendocino National forest fire in California. Basu (2006) documents experience in ICT deployments during eight major disasters in ten countries including Afghanistan, Iraq, Liberia, Iran, Sudan, Guatemala, Indonesia, Sri Lanka, Pakistan, and Lebanon. Disaster researchers have also extensively documented the use of geographic information system (GIS) in disaster planning and management (Thomas et al., 2003). Case studies of Hurricane Andrew and the Loma Prieta and Northridge earthquakes have also shown that GIS were extensively in used with worthwhile results in those disasters (Tierney 1994; Dash 1997)

Studying inter-organizational disaster response, many researchers have looked at the use of ICTs as a coordination tool. In the literature, there is a wide range of conceptualizations for the term coordination. Coordination is the management of dependencies between activities (Malone, 1987; Malone and Crowston, 1994). Coordination takes place whenever people communicate, make decisions, and allocate resources within and between organizations (Lewis and Talalayevsky, 2004). Coordination also implies the orderly and organized direction of activities (McEntire, 1997), and as such is a requisite for relief effectiveness.

In the humanitarian relief context, a rich body of literature points to the critical role ICTs play in complex inter-organizational disaster response plans (Comfort, 1993; DITF, 1997; Comfort et al., 2001; Moss and Townsend, 2006; Wybo and Lonka, 2002). Wentz (2006) presents current knowledge and best practices in creating a collaborative, civil-military, information environment to support data collection, communications, collaboration, and information-sharing needs in disaster situations and complex emergencies. Further, Wentz (2006) describes a number of operational and technical factors that constrain coordination of the deployment of VSAT systems for humanitarian disaster relief. Operational factors include the VSAT coverage area, satellite fleet for coverage options, number of service providers available, network size; data security, etc. These relate to how the companies do business and provide the products, service, and support. Technical factors involve how the network and systems are designed and operated.

Further, studying three information coordination bodies in emergency response context, Saab et al. (2008) identified three main coordination issues. They include the needs for organizations to agree on common standards of information as well as of the tools used to share the information.

They also include the need for organization to have and be able to maintain a certain level of staff with the appropriate level of technical skills.

Borton (1996) distinguishes four types of coordination including (i) information sharing coordination, that is coordination around managing and sharing basic information; (ii) coordination through common representation, for example coordination to negotiate funding; (iii) framework coordination (requiring a shared sense of priorities); and (iv) management/directive coordination (implying an hierarchy of authority and/or a degree of leverage over the action of one body by another). Inter-organizational coordination for disaster response usually involves all of these four types of coordination.

This brief review of previous studies on inter-organization coordination for humanitarian assistance outlines the important role of ICTs for disaster response. Further, when comparing research on inter-organizational coordination for the development or deployment of IT applications with coordination for the deployment of IT infrastructure, we find that a limited amount of research focuses on the latter. To this extent, this study on inter-organizational coordination for VSAT deployment will add to this limited body of literature. Next the experiences of one inter-organizational coordination body with collaborative VSAT deployment for both development and relief purposes will be discussed.

3. Experiences of an Inter-Organizational Coordination Body in Coordinating VSAT Deployment

ReliefTechNet, an inter-organizational coordination body with 21 large-sized international member NGOs active in the humanitarian relief and development domains, focuses on technology deployment for its member NGOs to increase efficiency of their relief and development activities. As expressed by ReliefTechNet's management and members, ReliefTechNet largely focuses on initiating and executing projects in support of ICT skills building and helping organizations implement ICTs. Moreover, as one of the founders of ReliefTechNet indicates, ReliefTechNet's value primarily lies in "experience sharing", "as different agencies bring experiences and expertise in different technical and program areas." ReliefTechNet was originally founded as an organization focusing on support for NGOs active in the development rather than relief sector, as explained by one of the founders.

Among a number of core projects started by ReliefTechNet is the VSAT project, in which member organizations have come together to coordinate VSAT deployments. VSAT deployment, typically seen as the last option for obtaining access to larger communications network and the Internet, is often necessary for organizations operating in remote areas. As explained by a ReliefTechNet representative, "Dishes are expensive, satellite service is expensive, and the single most thing we could make for our members was to cut down their expenses". This could be achieved by making a collective agreement with a satellite provider that, through increased business opportunities by ReliefTechNet members, would provide attractive prices.

The VSAT project originated in 2003, when a Request For Proposal (RFP) was sent out to VSAT service providers. Throughout 2003 and 2004 negotiations with VSAT vendors took place. An evaluation team consisting of a subset of agencies of ReliefTechNet evaluated initial proposals and developed a shortlist. Subsequently the other agencies became involved and in a collaborative manner selected a vendor. ReliefTechNet needed as much commitment as possible from its member agencies, as without their commitment fewer VSATs would be installed and hence smaller discounts would be available (as discounts would apply after a particular number of

VSAT installations). In addition to establishing a master contract for ReliefTechNet, each of the member organizations had to sign individual contracts. The consensus required for these contracts and the logistics of having multiple individual contracts signed generated significant delays. Some agencies were more reluctant than others, and therefore it took roughly a year of negotiations to develop a sufficiently weak contract that all agencies were willing to sign. Finally, in 2005 a contract was signed between ReliefTechNet, its member agencies, and the preferred vendor[1].

Currently, once an agency decides it wants to use ReliefTechNet's preferred vendor for VSAT connectivity, it is a matter of the agency indicating to the ReliefTechNet VSAT project manager and the vendor's project manager the intent to purchase a VSAT, and giving them an indication of where the VSAT should be installed. Then the agency obtains quotations and is informed of the procedures that need to be followed for the installation. This entails a documented process, from quotation, contract acceptance, payment, and licensing, all the way through installation, usage and support.

During the first three years of the VSAT project, ReliefTechNet developed a pilot network of little over 20 locations. After these initial years the deployment was accelerated, partially due to the occurrence of a number of catastrophic disasters in 2006. Consequently, towards the end of 2007 ReliefTechNet already had over 100 dedicated sites. Of these sites, one member agency owns roughly 60%, followed by another agency with approximately 17% of the sites. Seven other agencies own the remaining 23% of sites, with each agency owning in between 1 and 7 sites.

Next, experiences of member organizations with VSAT deployment for development purposes through ReliefTechNet's agreement will be discussed.

3.1. VSAT Deployment for Development

3.1.1. Organizational Decision Making General

As already indicated above, the decision to implement VSAT depends on availability of other infrastructure. If nothing else is available, VSAT will be installed. As an IT manager from a ReliefTechNet member NGO indicates: "VSAT sometime is a last resort of connectivity. We only use VSAT when we have no other choice. For example […] Africa is one of the main areas where we use VSAT connectivity. Especially West Africa. [Our organization] works in rural areas, so we have offices in capital cities. In capital cities we usually don't use VSAT because they have some sort of connectivity, but the problem we have is when we go out to the communities where we do our programs. We provide hospitals, schools, educations, things like that to local communities to help children. In areas like that where we don't have any connectivity other than VSAT, then we are forced to use VSAT".

The decision to take advantage of ReliefTechNet's agreement instead of using another VSAT vendor depends on a number of factors. A first decision point of course concerns the availability of ReliefTechNet's VSAT vendor in the area. While the vendor was chosen due to its generally wide availability throughout the globe, as well as its average low costs, interviewees have indicated that there are areas in Africa where there is no availability of the particular services or technical support. In such cases, agencies are required to resort to another provider. Second, prices are important. Therefore, one interviewee indicates that ReliefTechNet's preferred vendor "is totally uncompetitive in Asia". Thus, while ReliefTechNet's VSAT vendor is on average the

[1] The name of the vendor is kept anonymous, and will be referred to as 'preferred vendor' or 'ReliefTechNet's vendor' throughout the paper.

cheapest, this is not true for all countries. Therefore, in some instances when a cheaper VSAT provider is found, this cheaper one is preferred. However, this is not necessarily the case; a number of other factors play a role, including decision making structures of agencies and technical support issues.

When an agency decides it wants to implement VSAT, first the type of technology available in a country is evaluated. If VSAT is needed, the different options for VSAT deployment are evaluated. As indicated by a number of IT managers at NGOs, particularly the identification of regional suppliers vs. local suppliers is important. Country and field offices often try to find out which one is the best, and then recommend that provider to the headquarters. This the role of country offices vs. headquarters is an important one, particularly as it relates to deciding to take advantage of ReliefTechNet's collective agreement.

The decision for an organization to take advantage of the ReliefTechNet preferred vendor contract depends on the organizational structure of the NGO. One interviewee mentions that it depends on the autonomy of field offices: if the field office has a lot of autonomy, chances are high that it will opt for a local supplier, due to technical support logistics. This interviewee refers to the preferences of field staff: "They are not usually very comfortable with the idea of having to call somewhere in Europe for support, when they can just call locally and somebody can come over to repair the problem." On the other hand, this interviewee believes that agencies where IT decision making is more centralized, might tend to use the ReliefTechNet contract more.

To this extent, a few interviewees have indicated the limited availability of vendor representation (perhaps in only 3 couintries) within sub-Saharan Africa that can do installation if the ReliefTechNet agreement is used. While ReliefTechNet has been working on this issue through providing training to ReliefTechNet agencies, training takes place in Europe that field workers often cannot attend, due to visa issues and other logistics. Conversely, bringing in the provider's technician to a number of different locations tends to become extremely expensive. Therefore, at one NGO it is indicated that if there is a representative of the preferred vendor in the country of interest that makes things much easier. To this extent, it has been mentioned that there are other VSAT providers that do have more representatives in Africa, which therefore "can make more sense", as they can do the installation and support later on.

Partially in response to the limited availability of representatives of ReliefTechNet's preferred vendor in Africa, ReliefTechNet has arranged training for its members. The training that is provided through ReliefTechNet is a one- or two-day training. It covers issues such as how to connect VSAT, how to point the dish, etc. The trainees receive the manuals that encompass the technical work. While the first training sessions have been held in Europe, provided by ReliefTechNet's preferred vendor, there are plans to have training in Africa in the future as well.

As is explained by one interviewee, through this training the larger agencies that own a lot of dishes are now becoming self sufficient, managing their networks independent of the VSAT vendor. Another interviewee explains its agency had trained a team of regional IT officers themselves. Now they are starting to put up some dishes themselves. This interviewee believes that there has not been any coordination among ReliefTechNet organizations in that regard. Another interviewee believes that in the future ReliefTechNet may have a role to play for further integration in this regard. While currently usually the service provider does the installations, the interviewee believes that it would be a step forward "if [ReliefTechNet] could have some trained personnel in different regions and countries for VSAT equipment that organizations could rely on for support or to install or to maintain".

Nevertheless, as one interviewee indicates, “installation is a small problem, support is a bigger problem”. Further, another interviewee reflects, “it seems like the main parts of the installation are easy […] Besides maintenance and lots of small problems [the need for extensive support] hasn’t been the case. I think that what the local personnel still prefer that even with little maintenance required it was still more comforting to have someone around the corner to call if something happens.”

3.1.2. External Challenges: Licensing and Customs Clearance

Besides the organizational decision making processes, implementation of VSATs may be constrained by licensing and customs procedures. Any organization that intends to install a VSAT is required to obtain a license. There are even countries where VSAT deployment is prohibited, even though that number is decreasing. The license is needed as many governments are wary of commercial deployment, making a business and benefiting from it, and therefore want to make sure what the VSAT is going to be used for. As indicated by interviewees, licenses may cost from “anywhere next to nothing” to about USD $50.000 a year. Luckily however, as indicated by one interviewee, licensing is much less of an issue than some 10 years ago, particularly in Africa. However, even though by large every country allows VSAT deployment, some governments may still restrict which type of suppliers are used; which is the case in countries such as North Sudan, Chad and Angola. In such countries one is restricted to use equipment from one or two suppliers. However, Eritrea for example still does not allow VSAT deployment.

Nevertheless, while dealing with licensing and customs challenges largely depends on willingness of local governments to cooperate, ReliefTechNet does have a role to play in this area. It is indicated that within ReliefTechNet there is a lot of collaboration with regard to obtaining licenses. If an agency wants to install a VSAT in a particular country then the first question is if another ReliefTechNet agency has already done it, and if so, what the licensing as well as customs hurdles are. Thus, ReliefTechNet plays a role in providing a platform for sharing of experiences.

The problem of licensing also brings back the issue of using a local VSAT supplier vs. ReliefTechNet’s preferred vendor. To this extent, one interviewee mentions that local providers often have better knowledge about obtaining a license because they are based there, and as such can be of greater help.

3.1.3. Coordination Challenges

As the issues outlined above point out, most of the VSAT deployment is merely an intra-organizational matter. As ReliefTechNet is growing, members are looking to expand their cooperation. A number of (potential) collaboration areas have been discussed during interviews, both issues for potential future collaboration as well as bottlenecks that may prohibit certain collaboration.

Stemming directly from the discussion about technical support, one interviewee mentions that it “would be good” to get more training at the field level; i.e. to give those people that cannot come to Europe for training the opportunity. Moreover, it is mentioned by one interviewee that currently often people attending training are managers that are not the ones doing “the real work”. It is therefore perceived as important that field workers get this opportunity for training.

Even more collaboration in this realm, but having ReliefTechNet train a number of people that can support fellow ReliefTechNet agencies, however is perceived as “a little bit of a sensitive topic”. As one interviewee explains: “You are going to be giving resources, and how happy organizations are to share their resources with other members. It would definitely be a good idea

for example, if we were in Tanzania and if [agency 1] and [agency 2] have VSATs in Tanzania it would be good if there are other organizations as well, it would be good if somebody was actually trained from these organizations and could install and support and maintain. If that resource could be shared, that would be great. I think there is complexity in the arrangement of that. It is easier said than done". In relation to this, another IT manager from a ReliefTechNet agency believes that cooperation in the area of technical support among ReliefTechNet members is "thinkable", indicating he would not mind to send their own staff to other organizations in a country of interest to help out other organizations.

Further, given the high costs involved in having VSATs installed, one could easily think that a potential area for collaboration could be the actual sharing of VSAT connections in order to save more costs. However, this has not happened under the current ReliefTechNet contract. Moreover, one organization does have experience with sharing VSAT, even though outside of the ReliefTechNet collaboration. It is indicated that such collaboration brings extensive challenges with it. When officially sharing a VSAT, an agency actually becomes an Internet Service Provider (ISP), which also means it has to act as a commercial entity, and needing to deal with issues like assessing the bandwidth, providing support, etc. There are numerous fine details.

ReliefTechNet has started to exploring collaboration related to sharing applications. Nevertheless, as one member observes: "I think [ReliefTechNet] from what I have seen so far has been more towards sharing, sharing information, working together in disaster responses and collaborating […] We actually are getting into shared services, it seems like the attitude of most of the people was, I don't know if I want to actually get into these shared services. All I want to do is share information and collaborate. This is very interesting how [ReliefTechNet] will unfold. At the moment it does not seem that it is going in that direction. I think collaborating and sharing information and working together in the field during disaster response or local chapters. So far this has been the direction."

Thus, overall it is found that for development purposes, to date limited collaboration takes place between ReliefTechNet members, even though it is increased through joint training and exploring possibilities for application sharing. However, as the following discussion shows, inter-organizational coordination for VSAT deployment for disaster relief purposes brings out a very different story. Not only does significantly more collaboration and coordination occur; the occurance of a number of large scale disasters such as the South East Asian tsunami and the Pakistani earthquake have given a significant boost to the number of VSATs deployed under the ReliefTechNet agreement.

4. VSATs for Post-Disaster Relief

This section will first discuss a number of areas of collaboration between ReliefTechNet members, including the perceived benefits and challenges of inter-organizational coordination of VSAT deployment for post-disaster relief by member agencies' IT managers. Next these and other factors influencing the deployment of VSAT during post-disaster relief situations will be further highlighted in brief case descriptions of ReliefTechNet's (lack of) inter-organizational coordination in three post-disaster situations, including the Pakistan earthquake relief (2005); the Peru earthquake relief (2007); and the South Asian flooding relief (2007). These discussions will outline the factors that have influenced ReliefTechNet's involvement in coordinating VSAT deployment.

4.1. VSAT Deployment for Relief: Perspectives from IT Managers

Similar to the use of VSAT for development purposes, during situations of disaster relief VSAT is the last technology NGOs resort to, due to its high costs. As an IT manager from a ReliefTechNet member agency explains, when agencies enter the field, "one of the first things you need to do is to get connectivity in. A lot of that connectivity is portable connectivity when the infrastructure gets knocked out." Therefore, often the first phase of disaster relief is supported with satellite telephony. If it is determined that VSAT is needed, it takes a number of weeks to ship dishes to the country, to obtain licenses etc.

Further, as an interviewee indicates, the need for equipment for disaster relief varies. "It depends on the location, sometimes the infrastructure is totally destroyed and in those instances you are looking at 36 months before it gets back on its feet. In other areas there are no terrestrial alternatives and if you are looking at somewhere like southern Chad there are no alternatives. You have to have VSAT. If you have a disaster which wipes out the communication systems then you need to have portable short term satellite systems to enable you to have the communications means that organizations need to run their business processes. It is bandwidth. A lot of the processors are bandwidth hungry."

As one interviewee indicates, once a disaster strikes, headquarters of NGOs send out a request to their country IT colleagues, to see how many VSATs are needed, and where they are needed. A list is made to see how many dishes are required. Across agencies it is determined how much is needed and what are the costs, also so that donors can commit. Then orders are placed. If it is decided to make use of ReliefTechNet's vendor agreement, the discounts apply. In addition, it sometimes happens that NGOs that already have VSAT in place are willing to have other agencies share their VSAT connection.

In order to coordinate the VSAT purchases, one interviewee indicates, "usually one of the agencies in the affected area takes on a leader role. It is a very critical role. They host meetings, they answer questions from the UN organization, from the telecom authorities, they put proposals together. It really is critical. The person from the lead agency is usually a very active person. He or she attends the headquarters' relief teleconferences. That forms the linkage between the headquarter activities and the field activities, across agencies in a disaster affected area".

Besides the cost reductions, one of the advantages of ReliefTechNet's VSAT agreement is the possibility to boost bandwidth. This means that if a member agency was already in the area prior to the disaster and already has VSAT deployed, the bandwidth can be boosted for increased communications flows. As an IT manager explains: "There is a good chance that the VSAT sites could survive within that geography. It might be configured to only support that agency […]. Full bandwidth is like 192 up and 448 down. Well we can boost that bandwidth within 24-48 hours to 512 and start to support multiple agencies. We can do that because we have this arrangement with [Vendor]. We have their preferred vendor arrangement."

In addition, the inter-organizational coordination through ReliefTechNet allows the pooling of demand for donations. For example, a number of technology companies such as Microsoft and Cisco have provided equipment donations. Monetary donations have also been provided before. As one interviewee indicates: "I think we got a lot of help in disaster situations, we use the money for equipment for training, for setting up and if need be, we can use it for licensing as well.

Even more so than for VSAT deployment for development purposes, technical support is critical for VSAT deployment after disasters, "because in the disaster area the people are much more focused on helping people than messing with technology." Therefore, if possible, one technical

support staff from the VSAT vendor will come into the field and install as many dishes as is possible. However, the VSAT vendor does not always have technical staff in proximity. Therefore, for example after the earthquake in Pakistan someone with the needed technical background was found in Afghanistan. The person was flown into Pakistan, installed about 10 dishes and trained other people, who subsequently installed the remainder of the VSAT dishes.

Finally, licensing and customs procedures are known to be the main obstacles for the quick deployment of VSAT. As one IT manager explains: “The reason that the VSATs come several weeks later is because of logistics and licensing issues. There are customs and country concerns. The quickest that we were able to provide a number of VSATs was in Pakistan and that was about 8 or 9 weeks, and we delivered I think it was 10 systems in multiple organizations, in multiple locations”. Nevertheless, for relief purposes, as opposed to VSAT deployment for development purposes, cooperation through ReliefTechNet takes place for licensing and customs clearance purposes.

Customs clearance in some places can be a significant bottleneck, while in other places it is easy to bring in VSAT equipment, “Even in disaster situations. For example in Pakistan, we had a difficult time just to get our equipment through customs. That equipment was there to help, to facilitate, for the victims. The only way that worked is that it happened that someone within the [ReliefTechNet] membership knew customs and was able to facilitate the equipment to go through for their organization and on the back of that the rest of the organizations got it in. That is one example of [ReliefTechNet] collaborating in the field”. Nevertheless, often for relief purposes dishes are shipped on humanitarian grounds, so “they go through without a headache”, and thus may go quicker than when dishes are shipped for development purposes.

One interviewee mentions that some improvements in post-disaster coordination is still desirable; for example by having a VSAT kit readily available, stocked in a warehouse so that it can be shipped right away. And that it will be shipped to the country already at a time that it is still unknown exactly where in the country the VSAT is needed. In practice currently it takes at least a month before an order is made, after which it can take a couple of months before the VSAT is on site and operational.

Nevertheless, as one interviewee indicates: “One of the things that we have discussed in the past is to even have disaster equipment in countries that would be very expensive. Even if you were to put it in the countries with high disaster ratios or possibilities. Unfortunately the only thing we can do is work with perhaps a fellow organization such as the UN and see if we can work with them. I know customs is probably a lot more lenient with the UN when it comes to responding to disasters.” Thus, it is important that good relationships with government are established. As the interviewee indicates, “if they can help us facilitate or bring in our equipment without any problems. If we can be proactive about it, that may be something that [ReliefTechNet] can do. That is obviously a very difficult task and you need resources for that. I am not sure if we can go down that route.”

Next, we provide some specific examples of how coordination came about in 3 post-disaster relief situations. There brief cases demonstrate some of the factors discussed above in context.

4.2. Earthquake in Pakistan

After the earthquake in North Pakistan on October 8, 2005, which killed 18.000 and injured 41.000[2], an immense response operation was set up. Among the international NGOs going to Pakistan were a number of ReliefTechNet member agencies that started coordinating their technology deployment the first day after the earthquake.

ReliefTechNet initiated data gathering to assess members' needs for VSATs, among other technologies. Interestingly, one member agency that prior to the disaster worked in the development domain only, and thus not had any experience with providing emergency relief, through ReliefTechNet became engaged in humanitarian relief for the first time. Because of its location in the region prior to the disaster, the agency worked with other ReliefTechNet members to provide initial VGAN systems, and then the satellite systems offered by ReliefTechNet's preferred vendor. Further, its IT personnel worked with other organizations.

Three days after the earthquake in Pakistan took place, ReliefTechNet's coordination for the licensing for VSAT imports was started. In the following days negotiations with equipment and service providers took place and pledges from Yahoo and Cisco came in. As of two weeks after the disaster, weekly ICT sharing and planning meetings took place in Islamabad among member organizations. Further, towards the end of October a spreadsheet was distributed which summarized agencies' VSAT requests; which numbers a total of 14 units. They were subsequently ordered via the ReliefTechNet agreement with the preferred vendor.

Exactly one week later the first VSAT arrived in customs. Another two weeks after that a VSAT training was held in Islamabad. Mid- November the second shipment with the majority of VSATs arrived. The equipment however got stuck in customs because of an unavailability of airway bills with the VSATs. Hence, installations were delayed. About two weeks later, in the beginning of December, six VSATs were finally released from customs, to be installed a week later, after the person in charge comes back from Afghanistan. This was about 6 weeks after the order was placed with the vendor. VSAT deployment in Pakistan also led to capacity building through training. As most ICT staff were national staff, they indicated appreciation of the training they received (Currion 2006).

Mid-December 13, 9 other VSATs are installed. Finally, towards the end of December additional VSATs for two ReliefTechNet agencies were shipped from the vendor. Further, in Pakistan other connectivity became available fairly quickly: within 6 months connectivity was available from local suppliers. To that extent, after some time two VSATs were pushed out to more remote areas. Those VSATs were deployed in those remote areas for another 6 months. Thus, after the first relief rush was over, after 6-12 months, there was an evaluation and the places where no longer connectivity was needed the dishes were removed to other locations.

4.3. Peru Earthquake

On August 15, 2007 an earthquake of 8.8 magnitude on the Rigter scale hit the coastal area of Peru. A disaster of large proportion, which left over 500 people dead and many more injured[3], many of ReliefTechNet's members went into the field to provide disaster relief. Due to heavy

[2] See e.g. http://www.cnn.com/2005/WORLD/asiapcf/10/08/quake.pakistan/index.html Last accessed 04/21/2008.

[3] See e.g. http://www.sfgate.com/cgi-bin/article.cgi?file=/c/a/2007/08/17/MN26RK7O6.DTL . Last accessed 04/20/2008.

damage to roads and communications infrastructure[4], many of the rural areas had to await assessment of the impact of the earthquake for a number of days.

ReliefTechNet organized a teleconference with its members 5 days after the disaster to assess the needs of its members in terms of ICT support. The objective of the meeting was to assess the number of ReliefTechNet agencies responding to the Peru earthquake; the technology requirements by field teams; and the licensing requirements and government restrictions. Four IT managers from member agencies participated in to the teleconference. Other participants included five ReliefTechNet managers and a manager from a crisis team at a technology company. All four IT managers from the member agencies indicated to have access to adequate communications equipment and services. A fifth member agency had already reported via email it had sufficient connectivity to the ReliefTechNet manager. ReliefTechNet offered to provide technology support including VSAT, but also indicated to be able to provide support in raising funds for technology deployment. One technology provider for example had already contacted ReliefTechNet to offer help.

This was an interesting finding, as the first news reports after the disaster hit reported on the significant damage done to the infrastructure. For example, Telecoms Sans Frontiers reported that there were no available landlines or Internet access service in the affected areas, even though it was available in Peru's capital city of Lima[5]. Nevertheless, a dedicated emergency network was being set up by the Peruvian government and Peruvian telecom companies, and Telecoms Sans Frontieres also set up emergency telecom centers[6]. People were asked to only make emergency calls[7]. Further, by early September, ITU deployed some 50 satellite terminals in support of restoring communications infrastructure[8].

4.4. South Asian Flooding 2007

In July 2007 during the monsoon season in South Asia, heavy flooding led to the devastation of the homes of hundreds of thousands of people in Nepal, India and Bangladesh. Health problems and lack of food triggered the need for (international) emergency response, and due to the limited availability of telecom infrastructure, ReliefTechNet started a coordinated effort to provide VSAT service to the ReliefTechNet member organizations engaged in the response effort.

The first email communication among ReliefTechNet members, initiated by the ReliefTechNet VSAT manager, regarded an assessment of how ReliefTechNet could help, particularly with coordinated VSAT ordering, as well as by assessing the need by member organizations for such services. During follow up communications, it was found that large parts of India, Nepal and Bangladesh are uncovered by the standard services as per the ReliefTechNet agreement, but however the common satellite provider covers the area. Therefore, the preferred vendor manager, who is the contact person for ReliefTechNet, proposed to go with the same satellite provider to set up a different type of link between Internet (the vendor's teleport) and the devastated area.

The contact point for one member agency indicates on Friday August 3rd that the organization is in good shape regarding the access to telecommunications infrastructure, and offers support from the agency's technology people in Bangladesh and Nepal to other ReliefTechNet members if needed. After this initial communication, on Monday August 6th a ReliefTechNet teleconference

[4] See e.g. http://www.presbyterian.ca/pwsd/programs/peru Last accessed 12/05/2007.
[5] See http://www.itbusinessedge.com/blogs/hdw/?p=742 Last accessed 04/20/2008.
[6] Idem.
[7] See e.g. http://www.cellular-news.com/story/25500.php Last accessed 12/05/2007
[8] See e.g. http://www.tmcnet.com/usubmit/2007/09/06/2917521.htm

was held which included 11 people. The purpose of the meeting was "to assess the scope of the response and value [ReliefTechNet] may add". The following issues were to be discussed: (1) the requirements and assessments of technology needs from the field responders and a local Chapter that is being set up by ReliefTechNet; and (2) the number of ReliefTechNet agencies responding, which for ReliefTechNet support must exceed the threshold of five. In addition to these organizational issues, the question is what type of software and network gear is required, while at the same time licensing issues have to be taken into account. Finally, government restrictions have to be figured out that determine possibilities for operation. From ReliefTechNet's side, it is offered to provide support in terms of delivery for technology equipment, including VAST, technical IT support and other equipment as identified by the field teams. As for licensing issues, it is indicated that "Government regulations may be more favorable [for] working with local vendors". In this regard, one of the benefits of coordination is indicated: "Agencies should collaborate and go to governments with one voice for licensing. We may consider petitioning for temporary 3 month licenses like we were successful in obtaining in Pakistan in the past." Radio equipment also has to be looked into.

Four agencies provide updates on their needs for telecom services. At the time (August 6th), due to bad weather and water levels not yet receding, two agencies have not yet been able to assess the situation as they cannot enter the affected areas. Another agency has IT support in Bangladesh and Nepal but not in India. The fourth agency expresses the need for communication systems to be established in the area it is targeting (Assam and Bihar), and asks what type of support ReliefTechNet could provide.

A few days later some of the possibilities for VSAT deployment are evaluated. As it was found that there is no common coverage as per ReliefTechNet's preferred vendor agreement, alternative providers are identified. Meanwhile, on August 8, an email has gone out to a satellite provider to inquire about possibilities of deployment of satellite modems.

By August 10 another teleconference is held, with three people from ReliefTechNet plus two IT managers from two member agencies. The organizational updates include that one agency as already indicated before has sufficient communications infrastructure in place but is willing to support other organizations through technical support. The other agency is also reported to have sufficient communications infrastructure in place. Meanwhile it is learnt that AsiaSat and other local equipment and service providers have a lead time of at least four to six weeks to deal with licensing and government. Nevertheless, as there are not many agencies indicating they need help, there is no formal technology supply through ReliefTechNet.

5. Relief vs. Development

The discussion above gives insight into a number of differences between inter-organizational coordination for VSAT deployment for relief vs. development purposes. While initiated for development purposes, the high number of very high impact disasters (Tsunami and Pakistan earthquake in particular), have significantly stimulated the number of VSATs installed through the ReliefTechNet agreement. As one interviewee indicates, about 16 VSATs were bought for Tsunami relief, and about 10-12 in Pakistan. Subsequently, many of the Tsunami dishes have been redeployed by the members into other locations when the temporary relief offices were shut down. As the IT manager indicates: "VSATs by definition are hard to move around, they are big, they could be more than 6 feet wide and could get even bigger. They usually go into locations which are stable and where there are more development programs".

Further, significantly more coordination among ReliefTechNet member agencies takes place for VSAT deployment for relief purposes than for development purposes. Greater coordination for development purposes would demand deeper integration and resource allocations. As one IT manager indicates: "..The way it has been right now so far with [ReliefTechNet] is, there is always people volunteering to work together. In a disaster response people work together, but when it actually comes to day to day work, I have not seen it personally, maybe it has happened but I have not seen it. … I haven't seen … sharing resources". Further, for technical support disaster situations tend to be different from development situations as one interviewee explains when talking about one disaster site in Afghanistan: "… one of them had a problem and there were no IT people on the ground, so they went across the street to the other agency and got the technical person there who happened to be there. […] They helped each other out. There is quite a bit of that going on during relief situations."

6. Discussion

This research has brought to bear a number of insights on factors influencing inter-organizational coordination of VSAT deployment during relief situations and for development purposes. These factors are related to a number of factors as summarized below.

First, while the ReliefTechNet initiative for coordinated VSAT deployment was set up initially for developmental purposes (i.e. for member organizations working in the development sector), it is found that after collectively working on getting this agreement, inter-organizational *coordination* for VSAT deployment primarily occurs for VSAT deployment during disaster relief situations. For development purposes, VSAT purchases, through making use of ReliefTechNet agreement with the preferred vendor, are based purely on an internal, intra-organizational decision.

The decision is based on technical and economic factors. Technical factors include the organization's need for using particular business applications, which have implications for the needed Quality of Service, bandwidth etc. Economic factors include primarily cost benefits. This is the price for the service per se, which has been found to be one to the most important factors, but also relates to services included in the whole package such as maintenance. In this regard, it was found to be important as to where the provider is located and if support can be easily provided. On the other hand, during relief situations greater benefits of scale come to the fore, including those regarding policy, e.g. applying for a license together instead of every organization by itself, the acquisition process including evaluation of various service providers which may easily become a time-consuming processes, and attracting donors, through which cheaper equipment can be arranged. In relief situations many member organizations have worked together to obtain these benefits.

Furthermore, this study finds that even though the initial focus on VSAT deployment by ReliefTechNet was for development purposes, the existence of an agreement has actually spurred inter-organizational coordination during relief situations. The Pakistani earthquake relief effort in 2005 was a remarkable example of inter-organizational collaboration and coordination, realizing benefits in terms of economies of scale for purchasing equipment and attracting donors, as well as lobbying for telecommunications licenses and therefore eliminating duplication of effort and resources. And, interestingly, one ReliefTechNet member-NGO that normally did not engage in humanitarian relief did get involved in the Pakistani relief effort due to its longer term presence in the area, purely as a result of its membership in ReliefTechNet.

Finally, while one might expect that the more disastrous an earthquake or flooding, the more damaged public communications infrastructure is, and hence the need for relief organizations to rebuild infrastructure, it is found that the severity of a disaster does not necessarily reflect the need for inter-organizational ICT equipment coordination. First, it was found that one cannot easily predict the extent of availability of public infrastructure after a disaster. While during some disasters infrastructure might get significantly damaged, one cannot easily predict how soon this can be recovered and networks are up and running again. Moreover, after recent disasters in the summer of 2007, it was found that ICB member organizations' presence in the region prior to the disaster had an influence on the need for coordination of ICT equipment supply. When organizations already have established presence in an affected region, they often times already have reliable organizational infrastructure in place, including VSAT, as relief organizations frequently operate in rural areas. This was particularly the case after the Peru earthquake. Even though public communications infrastructure was significantly damaged, an assessment for ICT needs by the ICB led to the conclusion that limited additional ICT support was needed, and ICB coordination was not needed.

7. Conclusions

This study aimed to analyze the extent to which inter-organizational coordination for VSAT deployment is beneficial for both development and relief purposes, and the challenges that inter-organizational coordination for VSAT deployment give rise to.

The study has found that for development purposes, the finding of a VSAT supplier and coming to consensus about terms of contract require significant inter-organizational coordination. Nevertheless, the actual subsequent implementation of VSATs remains an intra-organizational endeavor. As such, the benefits for inter-organizational coordination remain primarily limited to cost savings.

For relief purposes the coordination of VSAT deployment however does provide a number of extra benefits, including economies of scale for evaluating a variety of VSAT providers, arranging licenses, and sharing VSATs across organizations, which for development purposes is hardly done, due to the accompanying agreements regarding Quality of Service, payment etc. It is found that for relief purposes organizations are more willing to share and help each other out without having contractual agreements in place. Hence, the implementation of VSATs is much more of an inter-organizational endeavor than for VSAT deployment for development purposes.

Thus, it is found that deep inter-organizational coordination is not established through the inter-organizational coordination body. The coordination body provides value to its members as pointed out in the benefits mentioned above. Nevertheless, deep inter-organizational coordination such as through longer-term inter-organizational sharing of VSAT requires tight inter-organizational relations and complicated contractual arrangements. This type of coordination requires a significant extension of the business activities of the organization (i.e. becoming an internet service provider), and hence this is not easily achieved.

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