

# NGO Collaborations: Sharing and Pooling projects

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## ABSTRACT

Humanitarian non-governmental organizations (NGOs) are increasingly facing challenges due to the growing number of actors in the humanitarian relief sector as well as the high incidence of natural disasters. A prominent means of mitigating these challenges is through the mediation of inter-organizational structures such as collaboration bodies, which attempt to find mechanisms to coordinate information technology and information management (IT/IM). The intent of this paper is to understand the coordination mechanisms undertaken by collaboration bodies focused on IT/IM. The two prominent forms of initiatives used by collaboration bodies to achieve these ends are sharing and pooling projects. Sharing projects are those projects which seek resources from members *within* the collaboration body. Conversely, pooling projects look to procure resources from *outside* the confines of the collaboration body. This study utilizes a comparative case study approach to generate a set of propositions regarding the characteristics and implications of technological infrastructure based collaborations.

## Categories and Subject Descriptors

H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces—*Collaborative computing*

## General Terms

Management, Design

## Keywords

Infrastructure, resource sharing, resource pooling, ngo, collaboration bodies.

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*Conference '10*, Month 1–2, 2010, City, State, Country.  
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## 1. INTRODUCTION

Inter-organizational collaboration between NGOs involved in providing humanitarian and disaster response presents a set of complex problems to the community. Barriers to collaboration arise from the NGOs themselves, stemming from their sheer numbers, lack of resources, and desire for autonomy. A prominent approach that has arisen to handle some of these issues, is the formation of ‘collaboration bodies’, with some of these organizations focused exclusively on Information Technology and Management issues (IT/IM). It is in these NGO collaboration bodies that we find global collaboration processes, projects and challenges that are both unique in their context and setting and similar to other IT/IS collaboration efforts more universally. Within this context, information systems collaboration is itself a goal, but it also frequently serves a supporting role in fostering collaboration in other units by promoting enhanced information sharing.

The present study highlights particular roles and functions of each collaboration project which have special significance in the way collaboration takes place. Since collaboration activities mainly facilitate access to resources, we have categorized these activities along two dimensions: pooling projects and sharing projects. This categorization describes the origin of the sought resources and its relation with the project goals. As compared to the dominant approach of considering a single international project or firm as the unit of analysis, here the scope is broader in that our unit of analysis is a collaboration body seeking to foster long-term, ongoing collaboration between organizations. In this paper, we present a comparative case study of two collaboration bodies focused on IT and IS in the humanitarian relief sector. We have chosen to highlight four projects, two for each collaboration body, with two of each project type. The four cases help to illustrate how resources are procured by coordination bodies and their role in collaboration activities among NGOs.

## 2. BACKGROUND

Humanitarian NGOs are increasingly seeking to work together, through inter-organizational structures such as coalitions, alliances, partnerships, and collaboration bodies [1, 2]. According to Bennett[3], the general characteristics of NGO collaboration

bodies include (i) independence from government; (ii) existence of a semi-permanent secretariat; and (iii) a variety of participants sharing common ideology. Within this specific context, researchers have identified a variety of information management related problems, including quality control and rapidity issues [4], unpredictable information needs [5], unwillingness to share, and issues such as below par informational sensemaking [6]. These informational issues can be overcome in part by coordinated IT/IS deployments, which have led to a number of notable successes [7-9], while at the same time posing collaboration issues at the inter-organizational level [6, 10, 11]. IT/IS collaborations, especially when set in the context of the developing world are likely to be formed in multi-level, multi-organizational contexts.

This multidimensional boundary spanning of international, inter-organizational IT/IS collaboration can be viewed through the lens multi-level, multi-organizational governance theory [12, 13]. Multi-level, multi organizational governance facilitates local collaboration on IT projects in two ways. First, collaboration is facilitated by the link between higher levels of hierarchy where a broader strategic orientation is often found and lower levels where the focus tends to be more operational. Second, such governance provides local organizations with access to resources, typically controlled through higher levels of authority [14]. Research on temporary organizations, among other things, finds that projects do indeed play a role in establishing collaborative relations among organizations [15-18]. Further, Bechky [19] also argues that in situations like emergency and disaster response teams, temporary project teams play a significant role in overall collaboration through the establishment of role structures (see also [20]; and [21]). In humanitarian and disaster response, when project teams are created across boundaries, the role and identity of the participant or member (as an IT technician, an IS manager, or a CIO) may be instrumental in allowing projects to form quickly. These projects may then lead to further collaboration. While the projects considered here are somewhat removed from the immediate answer for disaster relief context, the projects are undertaken as preparatory work to enable these types of project teams.

Due to our focus on IT/IM resources based collaborations, we rely on Resource Dependency Theory (RDT), [22, 23] which states that collaboration and collaboration activities are a result of an organization's adaption to exogenous changes in the environment in which organizations will seek the resources they lack in other organizations. Organizations will seek to formalize relationships and agreements with other organizations to ensure access to resources. Empirical evidence supports the idea that mutual resource dependence increases collaboration. Despite the preponderance of evidence that resources play a significant role in the establishment and form of collaboration, most research in this vein is on inter-firm, for-profit collaboration within complex supply chains. While there have been attempts [1, 24] at incorporating the RDT view in the non-profit context, the effect of collaboration bodies on the elements of power inequality, mutual dependence and constraint absorption [25] has yet not been explored and this paper attempts to set up some of the foundational aspects for further research of scenarios where collaboration bodies facilitate constraint absorption.

One potential avenue by which resources may facilitate collaboration is as a collaboration mechanism. There is a variety of collaboration mechanisms suggested by the extant research [26-

31] and they primarily focus on the process of collaboration rather than considering a mechanism as an element of the context of collaboration. Here we propose that collaboration mechanisms be viewed at higher level of abstraction than a particular task and instead consider the context of the collaboration project. In particular, resources play an important barrier to collaboration and various means of overcoming resource barriers may constitute an important mechanism for collaboration.

Drawing from both the literature on the role of resources in collaboration we have identified two collaboration mechanisms or kind of projects: sharing projects and pooling projects. By sharing projects we mean a collaboration mechanism in which the collaborating body facilitated some access to resources outside the project boundaries but inside the coordination body. By pooling projects we mean a collaboration mechanism used by the collaboration body to facilitate some collective access to resources outside the boundaries of the organizations.

Representatives of each NGO, who in this study are all members of a coordination body, get to work together in a specific project. The project facilitates access to two different kinds of resources: external and internal. If the kinds of resources obtained are *external*, according to our categorization, the collaborative activity is considered a pooling project. Otherwise, if the kinds of resources are *internal*, the collaborative activity is considered a sharing project.

### 3. RESEARCH DESIGN

This research is a section of a larger, multi-year, multi-level, multi-organization project, which examines the nature of collaborative activities across organizations engaged in providing humanitarian relief. The research question which captures this section of our research efforts is: *What role do sharing projects and pooling projects play in humanitarian IT/IS collaboration bodies?*

The two collaboration bodies examined here include a small, temporary group under a broader project mandate (ITEA) and a mid-size, formal, non-profit body (ReliefTechNet). The Information Technology for Emergency Alliance (ITEA) consists of seven member organizations which aimed to streamline NGO driven relief efforts over a two year timeframe. ITEA operated under a decentralized structure over the duration of the project. This paper concerns itself with the ITEA4 iteration, whose mandate concerned itself solely with Information and Communication Technologies. ReliefTechNet is a body of relief centered NGOs, which was initially concerned with donation centered issues, but later incorporated activities such as IT/IS based collaborations under its purview. ReliefTechNet is registered as a non-profit, but also relies on membership dues and grants as sources of revenue.

It is important to note that both ITEA and ReliefTechNet have a networked organizational structure [32]. As a consortium of humanitarian relief organizations, they have no inherent authority to impose their activities or agenda on its member organizations. They must seek consensus among its members to develop and implement projects. They must also rely on external donations and member organizations to fund such projects from their respective budgets as both ITEA and ReliefTechNet have limited resources or ability to provide such funding. Member organizations have a variety of motivations for proposing projects and varied capabilities with respect to funding and implementing them.

Consequently, formal and informal practices and criteria have emerged for identifying a valid consensus at the headquarters level.

Data for the two cases were collected over a period of 21 months (October 2006 through June 2008). Our comparative case study approach involved data collection from multiple data sources including semi-structured interviews, direct observation, document analysis and surveys [33]. The semi-structured interviews incorporated both pre-determined topics of inquiry but also those that arose inductively during the interview process [34]. In all, 19 telephone interviews were conducted with ReliefTechNet staff and member representatives and 12 telephone and face-to-face interviews with ITEA representatives. Lastly, the researchers attended one face-to-face meeting with members of ITEA and three with representatives of ReliefTechNet.

In terms of methodology, we utilized an analytic induction variant. A preliminary set of deductive codes was created based on the extant literature and our research questions. In addition to the deductive codes, emergent inductive codes were also included to our coding schema. Following Seidel et al.'s [35] framework, our coding process was cyclical and iterative.

## 4. CASE STUDIES

In this section we will discuss four IT/IS projects conducted through humanitarian sector collaboration bodies, two from each collaboration body. In lieu of space considerations, we present a limited number of projects as exemplars intended to represent diversity of projects rather than an exhaustive account.

### 4.1 NERC: Sharing Project

Hurricane Stan (October, 2005) gave rise to the National Emergency Response Collaborative (NERC) project. The problems encountered in the hurricane relief effort led the government of a Central American country and the local NGOs to question their information sharing practices. ITEA stakeholders, at headquarter level, found an opportunity for the development of a pilot project that would focus on the sharing/interchange of essential information among their local offices. This information management centric project was led by the offices in the region of one ITEA member, with the commitment to participate coming from the member's headquarters. The leader NGO would use its experience with an Open Source platform that was new to the other NGOs.

The major project deliverable anticipated was a web-based platform for disaster/emergency relief and prevention information sharing. The initial proposal was crafted at each NGOs' headquarters, and each regional office was instructed to participate. Each organization was expected to add its information (i.e. geographic information, emergency resources etc.) to the platform.

The system objective was to create a repository of documents and eventually become a communication tool that would facilitate collaboration among ITEA's members. Access to the platform was restricted to each ITEA agency and their field partners, so the platform was closed and access was restricted to people associated with the project. The project was scheduled over a six month period and involved all but one of the seven ITEA member organizations and the country's official emergency institution.

Since the NERC project was funded and initiated at the headquarters level, the organization and management was handled in a top-down approach. Headquarters sought access to their regional offices' knowledge, so several hierarchy boundaries were crossed during the planning of the system. However, during the development phase when activities were carried out by personnel at the local offices this was not the case.

ITEA hoped to address information management issues at the field office level. It was hoped that the web-based portal would streamline organizational information sharing issues. However, both at the headquarters level and field levels, no specific procedural or temporal adjustments were made to accommodate this initiative. A major technological problem arose due to the choice of platform, in this case, the open source platform Plone. However, the Internet Service Providers (ISPs) in the Central American country were unable to support Plone. While this specific challenge was handled by utilizing a European ISP, it added time and complexity to the eventual solution.

The NERC platform can be considered as a sharing project because resources being sought were within each institution of the collaboration body. Each NGO, by using the platform, would have access to other NGOs knowledge and information. The project established a vertical link between the headquarters and the regional offices to create a horizontal connection among them. These two elements, an intangible resource (knowledge) and the top-down planning, made the deployment of the platform harder.

Each agency at the local level decided which personnel were going to participate to the project, so individual contributions were not voluntary. These extra responsibilities were added to the already packed agenda of participants, so the project had to deal with the limited time resources of its participants. These circumstances and the lack of standards and procedures for the information sharing were the main obstacles for the project. In addition, the goals of the project were defined in terms of knowledge sharing without providing an practicable approach to measure success.

### 4.2 IT\_Emergency\_Website: Sharing Project

In 2006 the ITEA headquarters level collaboration body decided to fund a project to address two perceived needs of ICT professionals working in emergency response [36]:

1. A "knowledge base" or central repository for the sharing of technical information about various types of emergency-response appropriate hardware, software and telecommunications solutions.
2. An "emergency response center" or space dedicated to specific emergencies as they arose, where ICT professionals that were responding could share technical information about ICT activities and availability in the affected area"

Through this project, ITEA hoped to increase the efficacy and prevalence of information sharing amongst its members. The collaboration body identified the need for a portal through which the agencies could effectively share information. The project was led by one member organization, which set up the portal structure and contributed its information resources to the portal content. It was established early on in the project life cycle that organizational adoption and usage was being inhibited by systemic oversights in the project conceptualization. Specifically, organizations lacked procedures to adequately accommodate the burdens of selecting information for release as well as the man-hours needed to upload information, particularly during

emergency relief situations. Also, competing sources of information, such as ReliefWeb, were being used by members instead of the new portal. Managerial opinion on this situation contended that ReliefWeb was not a comprehensive information resource for the needs of collaboration within this specific group. Nevertheless, the accuracy and rapidity of the free ReliefWeb resource, in general made it valuable and raised the bar for domain or organization specific websites.

The IT\_Emergency\_Website had a similar goal to the NERC project, but it was intended to be implemented at a bigger scale. The NERC project was focused on ITEAs members' regional offices in a single country while the IT\_Emergency\_Website focused on providing room for emergency related IT professionals globally. As in the NERC project, the IT\_Emergency\_Website was lead by one of the members' organization, and the rest of NGOs would contribute their materials and documentations. The website was run at the headquarter level and was launched as a public space where anybody could contribute and participate. After a while, the managers found that the "openness" of the system inhibited the participation of certain NGOs and consequently access was restricted only to members of ITEA.

### 4.3 VSAT: Pooling Project

Field workers face unique challenges while engaged in relief efforts, telecommunications infrastructure is often scarce in disaster affected regions and damaged in the aftermath of the disaster event. A popular mechanism used by NGOs to circumvent this scarcity of available technological infrastructure is by the use of VSAT (Very Short Aperture Terminals), which is a satellite based technology and generally expensive to use.

One possibility for NGOs to reduce costs for VSAT deployment is to bundle forces and cooperate to deploy VSAT technology. This arrangement was achieved, in this case, by achieving an agreement with a satellite provider for a consortium of NGOs which would provide an attractive pricing scheme for all the involved organizations. Towards the end of 2007 ReliefTechNet had 110 dedicated sites (with a variable distribution between members), of which 101 sites had been fully installed. Of these 110 sites, one member agency has 67, followed by another agency with 19 sites. Seven other agencies have in between 1 and 7 sites. Out of 10 agencies involved in the VSAT project, only one agency has not implemented VSAT yet. The deployment of the VSAT project faced issues at the local level. National policies (telecommunications and the use of the electromagnetic spectrum) differ from country to country. As a result, local offices of ReliefTechNet members had to deal with official authorities during the setting up of the system.

The VSAT project was primarily a collective technology investment. The technological resource that ReliefTechNet members sought were out of the organizational boundaries of the institutions involved. Individually each of the NGOs was able to initiate negotiations with Satellite providers, but their reduced bargaining power made the attainment of a favorable deal improbable. We consider this project to be a "pooling project" where the NGOs collaborate to get access to resources out of the boundaries of the collaboration body.

It should be noticed that the VSAT project's goals can be described using assessable terms. The ReliefTechNet members wanted to hire the services of a satellite connection provider that gave the best technological services at the best cost. Although

these two dimensions can be defined in different ways, they can be easily measured.

### 4.4 Field-Level Chapters: Hybridization Process

During its first few years as a collaboration body, the member representatives of ReliefTechNet came to strongly believe that working only across the headquarters level of their organizations was semi-effective and identified the need for replicating their success at the field level. Field level agents confront emergent disasters and the associated difficulties in ICT creation, usage and deployment. It was this realization that became the impetus for creating ReliefTechNet-Chapters to address ICT issues across member organizations, in order to become more effective in inter-organizational collaboration and ultimately to better serve the communities affected by humanitarian disasters. In 2007, ReliefTechNet-Headquarters (RTN-HQ) established four pilot smaller, local-regional chapters that we call ReliefTechNet-Chapters (RTN-C) in India, Sri Lanka, East Africa and Indonesia.

RTN-HQ provided structural guidelines for Chapters with regards to formation and operation. The RTN-C's adopted largely similar goals and trust building mechanisms. Each of the Chapters adopted the agenda set forth by RTN-HQ and the Chapter advisers assigned for their initial meetings. The major theme that connected all proposed projects was the aim to provide greater connectivity at lower cost.

The Chapters were formed in each region/country with field-level members from the original 23 member NGOs. The RTN-C's were managed as a single, large project from the headquarter level, making the project very multi-national overall. New members at local level were invited to participate. The fact that most of the emergency relief organizations faced connectivity issues made membership to a RTN-Chapter appealing to a number of NGOs.

The RTN-C's faced internal intercultural challenges due to the diversity of member representatives who came from different national, ethnic and organizational cultures. Some of these challenges were attenuated by membership in a common "IT culture" that provided an initial foundation for communication and understanding, elements seen as necessary for building trust. External intercultural challenges differed across Chapters. Some RTN-C's dealt with a single national government and associated policies, while others dealt with multiple national governments and more complex policy environments.

Chapters were perceived as a useful strategy to deal with the diversity of personnel, legal and socio-political contexts, and application contexts. In the absence of the mediation provided by Chapters, these issues may have posed insurmountable barriers to collaboration. We consider the Chapter project as being involved in a hybridization process as it includes resources both inside and outside the boundaries of the collaboration body that were sought. Members wanted to gain from ReliefTechNet's experience in dealing with connectivity projects, and they also looked to establish links with other local organizations to benefit from their presence and expertise.

## 5. CASE ANALYSIS

As noted in the methods section, the cases were chosen as representative of projects that can be categorized as sharing projects or pooling projects. While these categories hold generally, the case descriptions reveal subtle differences. For

example, NERC and the IT\_Emergency\_Website are both sharing projects, but they differ slightly in both the ways resources were made available and the scale of the projects. In the NERC project each local office designed personnel in charge of “feeding” the system whereas in the IT\_Emergency\_Website participation was more open. Further, the local character of the NERC project differed from the global reach of the IT\_Emergency\_Website. Differences were also found in the pooling projects. Whereas the overall collaboration body of ITEA Chapters was formed based on access to knowledge and information, the project looks to provide future access to telecommunication infrastructure external to the organizations. This can be juxtaposed with Project VSAT, which was primarily driven by the immediate access to a specific type of resource.

In the NERC initiative, the collaboration body granted funds for system development, and the project sought to create a collective knowledge center. The goal of the project was to reach the information that each agency had collected after years of successes and failures on the field, assuming that each NGO was able to share this expertise. Therefore, the resources were available within every NGO, and it was not necessary to go beyond the boundaries of the collaboration body.

The second example, the IT\_Emergency\_Website is analogous to the NERC project, but it operated on a higher scale. The project, which received funding from the collaboration body, sought to facilitate access to the collective knowledge. In this case, the project was not focused on a single country. All the offices of ITEA members were invited to participate. Therefore the number of people involved in the project was greater than in the NERC initiative. The main benefit of a larger pool of participants is that it increases the value of the system, as a result of the network effect. On the other hand, the larger number of participants exacerbates the issues of standards and organization of the system.

Both projects, NERC and the IT\_Emergency\_Website, can be considered as sharing projects. The difference between these two cases is the reach level that each one targeted. The two projects have in common the kind of resources they pursued: knowledge. This characteristic is what makes hard to measure the success or progress of these initiatives. Since the goal of these projects was for each NGO to obtain information from the other members, measuring this exchange was a challenge. Finally, it should be noticed that, at least in the two cases studied in this paper, sharing projects added workload to the users that was not immediately compensated.

The third project, VSAT, was primarily driven by a specific type of external resource. The members looked for an economic alternative for their satellite communications, and a collaborative negotiation was the most effective way to proceed. The VSAT initiative is an apt exemplar of a pooling project. In the case of VSAT, the communication technology was the external resource. Individually, each NGO would possess limited bargaining power when dealing with providers. However, by pooling together their technology infrastructure needs into a consortium, the NGOs could obtain a better deal for all members. This feature makes it easier to assess the success of these projects. In addition, the independence of each NGOs is not compromised since the benefits of having access to the given resources do not conflict with the normal operation of the institutions. The execution of the project implies extra work for some personnel of the collaboration body, but the benefits of the project quickly impact the rest of the organizations.

The fourth project, the Field Level Chapters looked to take advantage of best practices for fostering a collaboration projects in the future. This initiative is involved in a hybridization process. A hybrid project takes advantage of internal resources to get access to external ones. The Field Level Chapters looks for internal resources that can provide future external ones, so it is a sharing project with a future goal of becoming a pooling project at the conclusion of the hybridization process.

The Field-Chapter initiative originated due to the successful experience of projects such the VSAT, so initially it sought to gather internal resources (knowledge and best procedures). In spite of this early emphasis, there is future potential for gaining access to technical resources analogous to the VSAT project. The Field Level Chapter project proposed the sharing of information that is inside the boundaries of the collaboration body. Nevertheless, the information is specific to a single theme: connectivity. Also, the project is based on knowledge gathered from prior successes, so some of the issues related to the pooling aspect of the project have been already solved.

## 6. DISCUSSION

We consider the role of technologies and formats in these collaboration efforts. Our interest here is the extent to which the issue presented a problem for the project and perhaps more importantly the priority assigned to solving said problem. Technology was an issue in Projects NERC, IT\_Emergency\_Website and VSAT. Whereas in these projects the team had to come to a decision quickly and hence a standard technology was chosen quickly to move the project forward, in NERC and the IT\_Emergency\_Website differing data standards, known to present a greater problem for collaboration due to their relationship with organizational processes [37], were an ongoing problem. In the Field-Level Chapters project, the issue of technology had yet to arise as it did not in the first instance involve technology. However, as chapters begin to undertake projects these issues may arise. The technological component of the NERC and the IT\_Emergency\_Website was a tool to achieve projects' goals while in the VSAT project the technological component was part of the goal.

Another notable finding is that the project with the most significant technology problem was the one that was most solidly based on resource pooling and had the most limited span of hierarchy. The VSAT project was achieved with few negotiations among different levels of hierarchy of the participants NGOs. NGOs' headquarters were in charge of negotiations with the providers, and regional-local offices of the collaborative body just following the recommendations given by the chosen providers.

In the VSAT project the technology issues were resolved at headquarters, and hence were not resolved by the application of power. Our observations suggest that technological solutions in the emergency relief sector, especially those that are provided by external agents, are handled by collaborative bodies without the burden of endless negotiations among hierarchical levels. There was limited debate among local, regional or headquarter offices. Negotiations took place between satellite providers and ReliefTechNet representatives.

In the same way, the technological issues in the IT\_Emergency\_Website and the NERC project were also easily solved. Both projects were able to overcome technical aspects,

but the issues rose when hands-on participation of the involved personnel was needed. These two projects had a value associated with the amount of information that they can concentrate, and data was provided in a non-planned fashion by NGOs staff. Again, lack of standards and a packed agenda complicated the development of the two projects.

Given the development of the VSAT project, there appears to be an interesting relationship between pooling projects and technologies. First, the project with the most significant technological component, from an infrastructure point, was the one that most solidly can be described as a pooling project. A corollary of this relationship is that pooling projects usually are concerned about the “hard” aspect of the information technology instead the “soft”.

The second relationship concerns the way that projects are carried out. The people that propose the idea for a pooling project usually carry it out. Conversely, sharing projects seem to involve personnel that did not participate in the crafting of the project. For example the NERC project was conceived by NGO Headquarter representatives to be carried out in a country by other members of the collaboration body. Therefore, pooling projects seem less open to the addition of participants during their development. These findings suggest the following propositions, all else being equal, concerning the characteristics of sharing and pooling projects.

*Proposition 1:* Technological Infrastructure needs are best tackled using pooling projects.

*Proposition 2:* Sharing projects are more open to new project members

*Proposition 3:* Pooling projects are less open to new project partners.

*Proposition 4:* Sharing projects may subsequently lead to pooling projects.

The above analysis suggests an important role for sharing and pooling projects in the nature and outcomes of the collaboration in the information systems domain. Access to resources appears to have positive implications for the numbers of organizations interested in participating in multi-organizational projects. While the idea that providing resources encourages participation is not new, here we see the effects juxtaposed with the kind of projects that are developed.

This research suggests that the procurement of technological infrastructure resources is a good opportunity for collaboration bodies. Usually these projects, sharing projects, are carried out in a close way and could lead to the development of pooling projects.

## 7. CONCLUSION

The objective of this paper was to understand the coordination mechanisms undertaken by humanitarian collaboration bodies focused on IT/IS. After such major disasters as the South East Asian Tsunami, Hurricane Katrina and the Pakistan Earthquake, the agencies involved in relief work at both the international, as well as the local level, identified informational problems as being critical to efficacy issues of response efforts. In addition, the desire for accountability by donors and prominent agencies, which aimed to trace money spent and services delivered, increased the focus on the informational aspects of relief work.

The response to this informational framing and other collaborative issues was to create collaboration bodies across large international NGOs focused on the topic of addressing informational problems in the humanitarian and disaster response sector. We believe that collaborative multi-organizational projects will dominate the initiatives in the humanitarian and disaster information management sector in the future.

The domain of disaster management and relief work inherently places the creation and operation of information systems in a multi-organizational context. However, the specifics of how various approaches to this coordination problem affect outcomes and the processes of participating organizations remains inadequately addressed in the literature. The non-profit sector, contrary to its for-profit counterpart, is structurally as well as procedurally more amenable to collaborative information systems. While in terms of resource procurement, non-profits compete for donor money and hence are in competition to prove their efficacy, they share largely common goals, that is, to help those regions and peoples affected by a disaster event.

The above analysis suggests an important role for sharing and pooling projects in the nature and outcomes of collaboration in the information systems domain. Access to resources appears to have positive implications for the numbers of organizations interested in participating in multi-organizational projects. This research suggests that the procurement of technological infrastructure resources is an opportunity for collaboration bodies to fulfill their mandate.

The main contribution of the paper lies on the propositions that have been developed, which establish relations between the analyzed projects and the kind of resources that were sought. These propositions constitute spaces for future research.

Future research is also needed to investigate the effectiveness of these two collaboration mechanisms. The evaluation of the effectiveness of each of these mechanisms remains complex. The reason for this complexity is that there is a lack of reliable quantitative means of measuring the degree of collaboration that a specific project was able to generate. For example, it would be misleading to use the success of a project as a measurement of the degree of collaboration since a failed project could have originated invaluable collaboration links and procedures. In addition, the measurement of communications and exchange of information among organizations is infeasible, as there are no means to discern among messages or phone calls that originated due to the collaboration mechanisms as opposed to regular communication.

While improved coordination is a noble goal itself, the real aim is to improve relief services. To date it is unclear just how much improvement in relief services result from improved coordination in the IT/IS realm. While anecdotal evidence of benefits exists, a more systematic analysis of the IT/IS coordination benefits is the next big step towards effective humanitarian informational collaboration.

## 8. ACKNOWLEDGMENTS

Our thanks to the participant organizations and their representatives. We also thank the reviewers for their valuable comments and suggestions. This research has been supported by U.S. National Science Foundation grant CMMI-0624219.

## 9. REFERENCES

- [1] Guo, C. and M. Acar, *Understanding Collaboration Among Nonprofit Organizations: Combining Resource Dependency, Institutional, and Network Perspectives*. Nonprofit and Voluntary Sector Quarterly, 2005. **34**(3): p. 340-361.
- [2] Zhao, K., et al., Zhao, K., Maitland, C., Ngamassi, L., Orendovici, R., Tapia, A., & Yen, J., in *The Second World Congress on Social Simulation (WCSS'08)*. 2008: Fairfax, VA, July 2008.
- [3] Bennett, J., *NGO coordination at field level: A handbook*. 1994.
- [4] Bruijn, H.D., *One Fight, One Team: The 9/11 Commission Report On Intelligence, Fragmentation And Information*. Public Administration, 2006. **84**(2): p. 267-287.
- [5] Longstaff, P.H., *Security, Resilience, And Communication In Unpredictable Environments Such As Terrorism, Natural Disasters, And Complex Technology*. 2005, Center For Information Policy Research, Harvard University.
- [6] Bui, T., et al., *A Framework for Designing a Global Information Network for Multinational Humanitarian Assistance/Disaster Relief*. Information Systems Frontiers, 2000. **1**(4): p. 427-442.
- [7] Comfort, L.K., *Turning conflict into cooperation : organizational designs for community response in disaster 1990*, Institute of Governmental Studies, University of California, Berkeley.
- [8] Comfort, L. and N. Kapucu, *Inter-organizational coordination in extreme events: The World Trade Center attacks, September 11, 2001*. Natural Hazards, 2006. **39**(2): p. 309-327.
- [9] Moss, M. and A. Townsend. *Disaster Forensics: Leveraging Crisis Information Systems for Social Science*. in *Proceedings of the 3rd International ISCRAM Conference 2006*. Newark, NJ, USA.
- [10] Miller, H.G., et al., *Toward interoperable first response*. IT Professional, 2005. **7**(1): p. 13-20.
- [11] Junglas, I.A. and B. Ives, *Managing IT in a Disaster: Lessons Learned from Hurricane Katrina*. MISQ Executive, 2007.
- [12] Hooghe, L. and G. Marks, *Unraveling the Central State, but How? Types of Multi-Level Governance*. The American Political Science Review, 2003. **97**(2): p. 233-243.
- [13] Bache, I. and M. Flinders, *Multi-level governance and the study of British politics and government*. Public policy and administration, 2004. **19**(1): p. 31.
- [14] Maldonado, E., C. Maitland, and A. Tapia, *Collaborative Systems Development in Disaster Relief: The Impact of Multi-Level Governance*. 2009.
- [15] Goodman, R.A. and L.P. Goodman, *Some Management Issues in Temporary Systems: A Study of Professional Development and Manpower-The Theater Case*. Administrative Science Quarterly, 1976. **21**(3): p. 494-501.
- [16] Menger, P.-M., *Artistic Labor Markets And Careers*. Annual Review of Sociology, 1999. **25**(1): p. 541-574.
- [17] Powell, W.W., *Neither Market nor Hierarchy : Network Forms of Organization*. 1990, Greenwich, EUA : Jai.
- [18] Jones, C., W.S. Hesterly, and S.P. Borgatti, *A General Theory of Network Governance: Exchange Conditions and Social Mechanisms*. The Academy of Management Review, 1997. **22**(4): p. 911-945.
- [19] Bechky, B.A., *Gaffers, Gofers, and Grips: Role-Based Coordination in Temporary Organizations*. Organization Science, 2006. **17**(1): p. 3-21.
- [20] Weick, K.E., *The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster*. Administrative Science Quarterly, 1993. **38**: p. 628-652.
- [21] Bigley, G.A. and K.H. Roberts, *The Incident Command System: High-Reliability Organizing for Complex and Volatile Task Environments*. The Academy of Management Journal, 2001. **44**(6): p. 1281-1299.
- [22] Pfeffer, J. and G.R. Salancik, *The External Control of Organizations : A Resource Dependence Perspective*. 2003, Sanford, EUA : Stanford Business Classics.
- [23] Ulrich, D. and J.B. Barney, *Perspectives in Organizations: Resource Dependence, Efficiency, and Population*. The Academy of Management Review, 1984. **9**(3): p. 471-481.
- [24] Froelich, K.A., *Diversification of revenue strategies: Evolving resource dependence in nonprofit organizations*. Nonprofit and Voluntary Sector Quarterly, 1999. **28**(3): p. 246.
- [25] Casciaro, T. and M.A.J. Piskorski, *Power Imbalance, Mutual Dependence, and Constraint Absorption: A Closer Look at Resource Dependence Theory*. Administrative Science Quarterly, 2005. **50**(2): p. 167-199.
- [26] Thompson, J., *Organizations in Action: Social Science Bases of Administrative Theory*. 1967: McGraw-Hill Companies.
- [27] Galbraith, J.R., *Designing Complex Organizations*. 1973: Addison-Wesley Longman Publishing Co., Inc. 150.
- [28] Ven, A.H.V.D., A.L. Delbecq, and R. Koenig, Jr., *Determinants of Coordination Modes within Organizations*. American Sociological Review, 1976. **41**(2): p. 322-338.
- [29] Malone, T.W. and K. Crowston, *The interdisciplinary study of coordination*. ACM Comput. Surv., 1994. **26**(1): p. 87-119.
- [30] Grandori, A., *An Organizational Assessment of Interfirm Coordination Modes*. Organization Studies, 1997. **18**(6): p. 897-925.
- [31] Tang, J., *Effect of Information Networking on Organizational Coordination: Case Study of an Electronic Travel Community*. International Journal of Management, 2007. **24**(4): p. 774.
- [32] Maitland, C.T., A., L. Ngamassi, and E. Maldonado, *A Case Study of a Technical Coordination Body Among Humanitarian NGOs: NetHope*. 2008.
- [33] Yin, R.K., *Case Study Research : Design and Methods*. 2002, Thousand Oaks, EUA : Sage.
- [34] Berg, B.L., *Qualitative research methods for the social sciences*. 1989.
- [35] Seidel, J. and U. Kelle, *Different Functions of Coding in the Analysis of Textual Data*, in *Computer-Aided Qualitative Data Analysis: Theory, Methods and Practice*., U.K. (editor), Editor. 1995, Sage: London.
- [36] (ECB), E.C.B.P. *ECB: ICT4emergencies*. Available from: <http://www.ecbproject.org/node/168>.
- [37] Maitland, C., L. Ngamassi, and A. Tapia. *Information Management and Technology Issues Addressed by Humanitarian Relief Coordination Bodies*. in *Proceedings of the 6th International ISCRAM Conference*. 2009. Göteborg, Sweden.