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Examining Intergovernmental and Interorganizational Response to Catastrophic Disasters: Toward a Network-Centered Approach

Naim Kapucu,¹ Tolga Arslan,² and Matthew Lloyd Collins³

Abstract
This research focused on the interorganizational and intergovernmental response to Hurricanes Katrina and Rita in 2005. The study used the concepts from the network and partnerships literature and used current techniques of network analysis. The study found that the use of intergovernmental and interorganizational response to coordinate complex operations in multiorganizational environments of catastrophic disasters was not successful in responding to both Hurricane Katrina and Rita in 2005. The research suggests that more investment should be made in community capacity building at the local and state levels for successful and effective partnerships in responding to catastrophic disasters. In this research, the local and state levels are shown to be faster in response and future research should focus on local, state, and federal resources coordination in response to catastrophic disasters.

¹ University of Central Florida, Orlando
² University of Georgia, Athens
³ Walden University, Naples, Florida

Corresponding Author:
Naim Kapucu, Department of Public Administration, University of Central Florida, HPA II Suite 238M, Orlando, FL 32816-1395
Email: nkapucu@mail.ucf.edu
Keywords

networks, partnerships, network analysis, disaster response, catastrophic disasters

In the 21st century, complex problems have emerged proliferating collaborative efforts using available resources to attack them, such as poverty, the AIDS pandemic, and disasters. These issues are those that are outside the scope of any one given agency and require multiorganizational and multisector interaction for successful policy solutions and implementations (International City/County Management Association [ICMA], 2006; Kettl, 2004; Sylves, 1984, 1994; Wise, 2006; Wise & Rania, 2002; Zimmerman, 1996, 2002).

Hurricanes Katrina and Rita in 2005 shook the open waters of the Gulf of Mexico for days before making landfall close to its projected path over the precariously below-sea-level city of New Orleans. The preparations for the expected 100-mile-per-hour winds, excessive rain, and flooding included a mandatory evacuation of the city for all residents. Emergency response professionals had practiced the response operations for downed telephone and power lines, keeping generators running to provide power and air conditioning to shelters and for the provision of food, water, and ice for many residents. However, emergency response professionals were not prepared for what they encountered. The levees surrounding Lake Ponchartrain, built to withstand a Category 3 hurricane, burst from the Category 4 storm and filled 85% of the city with as much as 18 feet of water in some areas. Emergency operators began receiving calls from residents trapped in their attics and on their rooftops by rising flood waters and suddenly, with hundreds of police officers unaccounted for, federal aid yet to be seen, and state aid still in the process of being organized, the city was beyond its capacity to respond (Schneider, 2005).

The White House report “The Federal Response to Hurricane Katrina Lessons Learned” reveals an important aspect about the focus of the failure in response. There are 15 lessons stated as learned or observed in the report. All of the lessons are somehow related with intergovernmental and interorganizational issues. In each of the lessons, at least one of the following terms are used: working with . . . partners, jointly plan, integration, support, in coordination with, working collaboratively, interagency, and coordinated. Four of the lessons learned include private sector, 5 of them include state and local partners, 3 of them include nonprofit and profit volunteer partners, and 11 of them include more than one federal agency (Townsend, 2006).

Preliminary evaluations of the city’s preparations and work with federal agencies such as the Federal Emergency Management Agency (FEMA) and
the Army Corps of Engineers suggest that no parties were willing to accept responsibility for the failure of disaster response operations (Grunwald & Glasser, 2005). The overwhelming nature of catastrophic disasters, like Hurricane Katrina, makes appropriate preparations imperative but the coordination efforts intimidating. The effectiveness of disaster response is precariously balanced on effective multiorganizational collaboration, and Hurricane Katrina exhibits the inextricably interconnected and highly complex intergovernmental relationships that must be in place to prepare for an effective response to a large-scale disaster.

Intergovernmental relations are those that occur between the federal government, the states, and local government in the federal system (Cameron, 2001). In other words, it is “the subject of how our many and varied American governments deal with each other and what their relative roles, responsibilities, and levels of influence are and should be” (O’Toole, 2000, p. 2). Mutual aid agreements, federal and local disaster response, and homeland security all represent the varying levels and complexity of intergovernmental relations (Kettl, 2004). The necessary coordination among public entities is the basis of intergovernmental relationships, but the defining characteristics that make them effective and worthwhile have been under discussion for quite some time (Mushkatel & Wescher, 1985; O’Toole, 2003; Peters, 1998; Peters & Pierre, 2001; Smith, 2003; Wollmann, 2003).

The study builds on and contributes to the literature of networks and governance in examining intergovernmental and interorganizational relations in response to catastrophic disasters, specifically Hurricane Katrina and Rita in 2005. First, the article reviews the literature on networks and governance. Then, it briefly discusses the recent changes in emergency management structure in the United States in response to the September 11 terrorist attack. Following the discussion of the current structural changes, the article focuses on a shift from government to governance that includes using private- and nonprofit-sector organizations in disaster response and recovery efforts. The theoretical review concludes with a brief discussion of the issues that arise when implementing networks within the emergency management setting. The National Academy of Public Administration (NAPA; 2006) acknowledges the need for increased capacity on intergovernmental research and gives first priority to emergency management and homeland security as a main focus for this research capacity. This study also contributes to building capacity on researching intergovernmental relations in emergency management and homeland security.

The research examines the following questions: (a) How did intergovernmental and interorganizational networks function in response to catastrophic
disasters in 2005? (b) How was the performance of the networked governance in response to the catastrophic disasters? (c) How can networks be utilized as a form of coordination to improve disaster response? and (d) What lessons can be learned from the response operations to improve performance of response operations? The research uses content analysis of several news reports, situation reports, and after-action reports to answer these questions. This study goes beyond thinking “network” as a metaphor. It unpacks it more as a concept and develops closer empirical examination of networks in terms of policy development and public management. The hurricanes in 2005 raise many opportunities to reexamine and refine current conceptualizations of the operation of intergovernmental and interorganizational relations in disaster response, and so do warrant a one-shot case analysis (Yin, 2003).

**Intergovernmental and Interorganizational Collaborations**

The use of integrated and interdependent collaborations as a form of intergovernmental relations allows public and private organizations to work together and create a solution to a problem larger than any one organization can handle (Conlan, 1998; Ferejohn & Weingast, 1997; Tierney, Lindell, & Perry, 2001). Partnerships and networks have both been used in collaborative efforts although they are not necessarily the integrated collaboration (Bowman, 2004; Donahue & Joyce, 2001; Kamensky, Birlin, & Abramson, 2004; Kapucu, Augustin, & Garayev, 2009; Mandell, 2001; Waugh, 2004; Waugh & Sylves, 1996; Wright, 1998).

There are three types of coordination commonly referred to: hierarchy, network, and market (Peters, 1998; Rodríguez, Langley, Béland, & Denis, 2007; Wollmann, 2003). Hierarchy, the traditional model, moves the decision from the top, most authoritative position down throughout the ranks of the organization. Networks, on the other hand, are loosely formed associations of voluntary organizations, where the network is “based on shared values, trust, solidarity, or consensus” (Wollmann, 2003, p. 595) and bargaining and negotiating are treasured qualities (Agranoff, 2004; Mandell, 2001). The third form, market coordination, allows participants to use their individual resources to achieve their separate self-interests. The market form of collaboration relies heavily on the availability of resources to individual organizations and their knowledge to use their resources. Intergovernmental relations use all three forms of coordination but this study will focus on the use of network collaboration. Networks are generally limited in scope and the organizations remain independent of one another but can become more integrated
as the relationship grows (Klitgaard & Treverton, 2004). Agranoff (2004) identified four types of networks named informational, developmental, outreach, and action that as titled described the intent and purpose of the network. These networks as applied to the network continuum provide a good base for using network characteristics to define it because as one moves from one end of the continuum to the other, the degree of interdependence and the need for collaboration varies.

Weick and Roberts (1993) describe an important concept for understanding how collaborations can work despite being created as a temporary entity on an as-needed basis. That is, when the task is accomplished the collaboration is disbanded. The collective mind concept is the intentional connection of activities while acting as part of a network. When applied to collaborations or networks, a collective mind can initially be developed and will become stronger as the group continues to work together over time (Morgan, Salas, & Glickman, 1994; Ostrom, 1990). Applied to intergovernmental and interorganizational relations in response to disasters, the creation of new groups with little familiarity of one another does not necessarily doom the outcome of the group nor limit its productivity until the group has had time to adjust. Instead, if a developed collective mind exists then collaborations of less formalized groups can successfully create new products by relying on mutual respect, coordination of action, trust, and strategic communication (Kapucu & Van Wart, 2006, 2008).

In addition to group processes such as respect, trust, and regular interaction, organizations must have the capacity to collaborate in order to be successful. An organization’s capacity to collaborate includes having the appropriate resources (e.g., financial, technological, and human) to contribute to a collective effort. Not only does an agency need to be able to support its commitment to the collaboration, it needs to be able to effectively communicate within an interagency context. Bardach (1998) identified interagency collaborative capacity (ICC) as an important framework for creating new collaborative efforts. Building interagency collaborative capacity is compared to building a house: it requires not only tools and supplies but also the knowledge to build the house correctly. Successful collaboration capacity building is a “function of the skill and purposiveness of craftsmen interacting with the quality of available materials and the craftsmen’s ability to fashion protections against potentially destructive environmental forces such as personnel turnover and the erosion of political alliances” (Bardach, 1998, p. 49). Building capacity for interagency collaboration requires that participating agency leaders remain steadfast in the process without giving in to the personal preferences. The use of collaborative efforts such as networks and
partnerships are complex and difficult to manage because they each have organizational restraints and are limited by their commitment to the effort (Weber, Lovrich, & Gaffney, 2007).

**Environmental Trends and Changes in Disaster Management**

After the terrorist attacks of 9/11, in 2002, a total of 22 federal agencies were reorganized to create the Department of Homeland Security (DHS), charged with coordinating government resources to battle terrorism and secure the United States (DHS, 2004). Determining ways to coordinate extensive federal resources among hundreds of state and local interests has been a challenge for the DHS. The creation of the DHS similarly reorganized the disaster response organization. Prior to the creation of the DHS, FEMA was a cabinet-level agency that reported directly to the president and responded under the Federal Response Plan (FRP), but after 9/11, FEMA was incorporated into the DHS and given a new operating procedure, the National Response Plan (NRP). These structural changes have forced the organization to realign its standard operating procedures with the new procedures for intergovernmental coordination when responding to disasters.

The coordination among federal, state, and local emergency management agencies in disaster response is a function of their standard operating procedures. As the federal coordinating agency, FEMA recommends that all state and local emergency management functions implement the “all-hazards” emergency management approach of disaster response (FEMA, 2003). The all-hazards model is a four-phase approach consisting of mitigation, preparedness, response, and recovery. All-hazards mitigation is the process of taking measures to prevent disasters or lessen the effects of those bound to occur. Intergovernmental interaction in mitigation takes form as implementing improved building codes at municipal, county, and state levels and coordinating land use planning at the municipal and county levels to prevent development in disaster-prone regions (Drabek, 2003; Dynes & Tierney, 1994; Kapucu et al., 2009; May & Williams, 1986; McLoughlin, 1985; Rosenthal & Kouzmin, 1997). Preparedness activities arrange responders to react during a disaster and increase their capacity to respond. Preparedness activities include creating regional or metropolitan warning systems, practicing response activities with mutual-aid partners, and training first responders at the municipal and county levels. After a disaster strikes, the response activities take form in addressing the immediate need and can include working with entities from other jurisdictions to provide rescue, food, water, housing,
or medical services. The long-term assistance to communities, or recovery, that extend beyond the initial response such as temporary housing, grants-in-aid, and job assistance are the cooperative effort of the local jurisdiction and the specialized agency (Auf der Heide, 1989; Comfort, 1988; Hardenbrook, 2005; McEntire, 2002; Waugh, 2000; Tierney, 1985). Each of these disaster management phases overlap, and emphasis is placed on the fact that all emergencies begin at the local level (Comfort, 1999).

Collaborations and Networks in Managing Catastrophic Disasters

A new approach to government referred to as governance has emerged from combining the practices of traditional government with market-driven approaches of the private sector and the resourcefulness of nonprofit organizations (Agranoff, 2004). Blending the strengths and needs of the three sectors has created a move from reliance on a highly centralized, hierarchal control mechanism to equally contributive governance mechanisms. Agranoff (2004) defines governance as “the ability to combine the necessary elements toward a result, that is, the capacity to assemble and use needed resources for a policy initiative” (p. 65).

The growing number of horizontal relationships is a result of complex issues requiring the use of management tools that fall outside of the boundaries of the traditional vertical relationship (O’Toole, 2000, 2003; Weber et al., 2007). Organizations tasked with addressing issues that have a great scope, affect a large population, or require an immense amount of resources have crossed traditional hierarchal boundaries to collaborate with other public, private, and nonprofit organizations. To a further degree, a network form of governance emphasizes “power-sharing between levels of government with no center of accumulated authority. . . . The relations are characterized by mutual interdependence on each others’ resources, not by competition for scarce resources” (Smith, 2003, p. 619). The horizontal relationships created through governance can be used to identify better ways to respond to catastrophic disasters. However, politics and power issues remain prominent among agencies seeking individual credit for collective action (Bowman, 2004; Mandell, 2001). Although intergovernmental relations can take form as a partnership or collaboration, other relationships are created through reorganization, regulation, capacity building, conflict management, and individual and group communication depending on the need of the agencies and the issue.
Communities responding to disasters are seen as coping collectively with shared pain, loss, and disruption and as temporarily suspending ongoing conflicts and disagreements in the interest of meeting urgent needs and beginning the recovery process (Comfort, 2002; Comfort & Kapucu, 2006; Wildavsky, 1971). Resilient communities are characterized by reduced failure, measured in terms of lives lost, damage, and negative social and economic impacts, and reduced time to recovery—that is, more rapid restoration of the social systems and institutions to their normal, predisaster levels of functioning (Clarke & Chenoweth, 2006; ICMA, 2006). Government organizations can contribute to resilience in a society by incorporation with other emergency response organizations.

In response to catastrophic disasters, organizations realized that the response and recovery task, if it was to be performed fast enough to prevent further disaster from occurring, lay well beyond their capabilities as individual organizations and require a collective action among public, private, and nonprofit actors (Johns, O’Reilly, & Inwood, 2006; Waugh, 2004). Coordination among networks can be guided by understanding the organizations underlying values. “If there is common logic across organizations then coordination is more likely to occur without using authority and if organizations share common policy values coordination is also likely with less disruption of organizational routines” (Peters, 1998, p. 299). Disasters create an atmosphere wherein organizations from different sectors feel the shared risk and willingly coordinate their shared responsibilities.

The implementation of intergovernmental relations in culturally and structurally diverse organizations has faced various challenges including a lack of common understanding among actors, low levels of trust, limited authority, and limited capacity to participate (NAPA, 2004). In collaborations, the challenge exists in overcoming the organizations’ structural and cultural differences and “determine its strengths and weaknesses for encouraging cooperative effort; and then to tap common interest and exchange, as appropriate and practical, to increase prospects for success” (O’Toole, 2003, p. 238). The prospects for success are highlighted by bringing on board capable partners, developing a supportive environment, and structuring to achieve results (NAPA, 2003; Schneider, 1992, 1995; Wamsley & Schroeder, 1996; Waugh & Streib, 2006).

A successful network is built on interdependency, trust, and sharing the credit for successes (Agranoff, 2004), but large federal organizations have years of disloyalty, mistrust, and selfishness to overcome before they are able to successfully participate in disaster management networks. Developing trust among agencies is done by mutual learning and action in a network. The
action that builds trust is the completion of accepted assignments, follow through, and commitment to the cause. A high level of interdependency among agencies also builds trust and strengthens the network because agencies recognize the reciprocal need to be a competent peer (Kapucu, 2006; O’Toole, 2003). If one partner does not perform its objectives in an interdependent relationship, the other is bound to fail as well. This places accountability with each agency, and its peer is likely to be its biggest motivator. In addition, individual organizations’ accepting praise for a network success breeds discontent among the network agencies and, overall, negatively affects the network. Effective horizontal relationships are essential to improving the disaster response mechanisms that currently exist (Clarke & Che NOWETH, 2006; Government Accountability Office [GAO], 2002, 2005).

Method

In this study, content analysis of news reports, government documents, and after-action reports was conducted. The main goal of the content analysis was to find the performance of intergovernmental and interorganizational response to the catastrophic disasters in 2005. The study uses data from the content analyses of related news reports from the New York Times, FEMA National Situation Reports (FEMA, 2006), Florida State Emergency Response Team (SERT) Situation Reports (www.floridadisaster.org), New Orleans City Situation Reports, Louisiana State Situation Reports, Mississippi State Situational Reports, The Federal Response to Hurricane Katrina: Lessons Learned (Townsend, 2006), Hurricane Katrina: A Nation Still Unprepared (U.S. Senate, 2006), and the U.S. House of Representatives Select Bipartisan Committee to Investigate the Preparation for and Response to Katrina: A Failure of Initiative (2006).

To evaluate the intergovernmental and interorganizational response to catastrophic hurricanes, we carefully reviewed the above-mentioned seven documents. The data collection process numbered and catalogued organizations, the date and storm was recorded, and the agency contact, sector, and source of funding were also noted. Content analysis began with the June 1, 2005, data because there were no reported storms in June or July of the 2005 hurricane season and ran through February 28, 2006. Each document was reviewed for articles that detailed the intergovernmental and interorganizational response to storm preparation, storm action, or poststorm response. Each entry was numbered by date; the organizations were listed as separate entries and given organization numbers; the contact, sector, and source of funding were identified; and the transaction was recorded. Organizations that
worked together to accomplish a task were noted and any source reporting partnership successes or failures to response to the disasters were highlighted. Then we combined all the content analyses into one master document to do the final network analyses presented in the article.

Network analysis was performed using the UCINET social network analysis program to assess the relationships among the organizations that responded to the catastrophic disasters. UCINET is a comprehensive software program for the analysis of social networks. The program contains several network analytic routines (e.g., centrality measures, dyadic cohesion measures, positional analysis algorithms, and clique), and general statistical and multivariate analysis tools such as multidimensional scaling, correspondence analysis, factor analysis, cluster analysis, and multiple regression (Borgatti, Everett, & Freeman, 2002; Gould & Fernandez, 1989; Scott, 2000).

**Intergovernmental and Interorganizational Response to Hurricane Katrina**

According to recent studies, the failure of the Hurricane Katrina response was the failure of intergovernmental and interorganizational relations (Cigler, 2007; Conlan, 2006; Mitchell, 2006; Wise, 2006). This disaster management failure incident propels the public’s desire and political need to see government services held accountable using performance measurement standards. Under the current emergency management system, prior to the NRP being activated, a state governor must request that the president declare that an emergency exists. Then, the Secretary of Homeland Security must declare the emergency to be an “incident of national significance.” In the meantime, the state and local governments are responsible for implementing their own emergency plans (DHS, 2004). On August 26, Governor Blanco declared a state of emergency, yet the mandatory evacuation was not issued until 2 days later, on August 28. President Bush had issued an emergency declaration the day before on August 27. FEMA did not coordinate its response with local governments; rather, its efforts hindered local recovery efforts.

Communication failures plagued the recovery efforts; many cell phones and landline telephones were inoperable. Amateur radio provided emergency communications and health and welfare information to the public. Before Hurricane Katrina, the Army Corps of Engineers warned that the levees surrounding the city may not withstand a Category 3 hurricane. The construction of the levees themselves increased the vulnerability of New Orleans, causing the city to sink further below sea level. Budget proposals to restore
and strengthen the levees were cut by the Bush Administration from $14 billion to $540 million over 4 years (Grunwald & Glasser, 2005).

Interorganizational and intergovernmental response to catastrophic disasters is a highly complex and difficult task because of the enormous impact of catastrophic disasters and increased number of participant organizations and increased responsibilities and required tasks to be completed. Table 1 presents distribution of the number of organizations involved in response operations to Hurricane Katrina and Rita. In total, 580 organizations participated in response and recovery activities, with the largest proportion (71% of the organizations) identified as public organizations. When it is broken down, the public organizations by jurisdictions show that the majority of the organizations, 156, are state organizations. Hundred thirty-five organizations were from county-parish level organizations, and 64 organizations were from the municipal level. Only 54 organizations, 9% of the total organizations, were from federal level public organizations. It is noteworthy that the second dominant group is private organizations, with 92 organizations. Lastly, 79% or 14% were identified as nonprofit organizations. We can conclude that in response operations, given the size and diversity of this set of disaster response organizations, the demand for coordinating response was extraordinarily high (see also Comfort & Haase, 2006, p. 333). Based on our network analyses using the UCINET software program, only 345 of the 580 organizations coordinated their activities with other responding organization.

Figure 1 depicts the number of organizations involved in disaster response operations for the period between May 28, 2005, and February 21, 2006. The figure shows the number of organizations from each sector and jurisdiction during that time.

**Table 1. Number of Organizational Responded From Different Jurisdictions and Sectors**

<table>
<thead>
<tr>
<th>Type of organization</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td></td>
</tr>
<tr>
<td>Federal</td>
<td>54 (9)</td>
</tr>
<tr>
<td>State</td>
<td>156 (27)</td>
</tr>
<tr>
<td>County</td>
<td>135 (23)</td>
</tr>
<tr>
<td>Municipality</td>
<td>64 (11)</td>
</tr>
<tr>
<td>Total</td>
<td>409 (71)</td>
</tr>
<tr>
<td>Nonprofit</td>
<td>79 (14)</td>
</tr>
<tr>
<td>Private</td>
<td>92 (16)</td>
</tr>
<tr>
<td>Total</td>
<td>580 (100)</td>
</tr>
</tbody>
</table>

Source: content analyses.
Figure 2 shows the frequency of activities for the narrower period of 30 days. These two figures indicate that state- and county-level involvement began 2 to 3 days before the landfall of Hurricane Katrina. Intense federal involvement started on August 31, 2005. It is interesting that we see a later entry of local-level organizations beginning from September 2, 2005.

Figure 3 depicts the overall network of interaction among the 345 organizations in response to Hurricane Katrina. We deleted the organizations with no ties to other responding organizations. The diagram depicts a clustering of 8 to 10 subnetworks placed in the larger network. Methodologically, an analysis of network centrality identifies those actors that are the most important in influencing the performance of the response network, as they have most ties with other responding organizations from different sectors (Comfort & Haase, 2006; Wasserman & Faust, 1994). Centrality measures reveal interesting
characteristics about the network: degree centrality, closeness centrality, and betweenness centrality (Comfort & Haase, 2006; Kapucu, 2005).

Table 2 presents the measures for degree centrality. Organizations that have more ties with others have higher degree of centrality. Analysis in Table 2 also shows that 10 of the 345 organizations have distinctive degree centrality. Nine of them are state-level public organizations, three of them are federal-level public organizations, two of them are nonprofit organizations, and one of them is a municipality-level public organization (City of New Orleans). The summary measure of centralization for the network is 14.22%, which is an indicator of a loosely coupled network.

Table 3 presents the measure for closeness centrality. The closeness centrality measure indicates how close an actor is to all other actors in the network. This centrality measure is useful in terms of estimating information sharing in the network, assuming that if the actors are close to one another, the information exchange occurs more quickly (Comfort & Haase, 2006; Scott, 2000; Wasserman & Faust, 1994). The summary statistics for closeness centrality show a very high mean for the measure of “farness,” which means that there are significant distances among actors. Network analysis reported that the graph was unconnected; therefore, no measure of centralization was calculated.

Table 4 presents the measure for betweenness centrality. Betweenness centrality is a measure of the extent to which an actor locates in the direct

Figure 3. Interorganizational networks in response to Hurricane Katrina and Rita
Table 2. Degree Centrality

<table>
<thead>
<tr>
<th></th>
<th>Degree</th>
<th>NrmDegree</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>1.821</td>
<td>0.314</td>
<td>0.002</td>
</tr>
<tr>
<td>SD</td>
<td>6.266</td>
<td>1.080</td>
<td>0.006</td>
</tr>
<tr>
<td>Sum</td>
<td>1,058.000</td>
<td>182.414</td>
<td>1.000</td>
</tr>
<tr>
<td>Variance</td>
<td>39.262</td>
<td>1.167</td>
<td>0.000</td>
</tr>
<tr>
<td>SSQ</td>
<td>24,738.000</td>
<td>735.375</td>
<td>0.022</td>
</tr>
<tr>
<td>MCSSQ</td>
<td>22,811.385</td>
<td>678.103</td>
<td>0.020</td>
</tr>
<tr>
<td>Euc Norm</td>
<td>157.283</td>
<td>27.118</td>
<td>0.149</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Maximum</td>
<td>84.000</td>
<td>14.483</td>
<td>0.079</td>
</tr>
</tbody>
</table>

Network centralization = 14.22%
Heterogeneity = 2.21%
Normalized = 2.04%

Organizations with highest degree centrality in response to Hurricane Katrina

<table>
<thead>
<tr>
<th></th>
<th>Degree</th>
<th>NrmDegree</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLSERT</td>
<td>84.000</td>
<td>14.483</td>
<td>0.079</td>
</tr>
<tr>
<td>FEMA</td>
<td>67.000</td>
<td>11.552</td>
<td>0.063</td>
</tr>
<tr>
<td>MEMA</td>
<td>51.000</td>
<td>8.793</td>
<td>0.048</td>
</tr>
<tr>
<td>Florida</td>
<td>48.000</td>
<td>8.276</td>
<td>0.045</td>
</tr>
<tr>
<td>ARC</td>
<td>41.000</td>
<td>7.069</td>
<td>0.039</td>
</tr>
<tr>
<td>EMAC</td>
<td>37.000</td>
<td>6.379</td>
<td>0.035</td>
</tr>
<tr>
<td>Alabama</td>
<td>33.000</td>
<td>5.690</td>
<td>0.031</td>
</tr>
<tr>
<td>ALEMA</td>
<td>26.000</td>
<td>4.483</td>
<td>0.025</td>
</tr>
<tr>
<td>Mississippi</td>
<td>23.000</td>
<td>3.966</td>
<td>0.022</td>
</tr>
<tr>
<td>Louisiana</td>
<td>21.000</td>
<td>3.621</td>
<td>0.020</td>
</tr>
</tbody>
</table>

Note: FLSERT = Florida State Emergency Response team; FEMA = Federal Emergency Management Agency; MEMA = Mississippi Emergency Management Agency; ARC = American Red Cross; EMAC = Emergency Management Assistance Compact; ALEMA = Alabama Emergency Management Agency.

path of communication exchange between two other actors in the network (Scott, 2000; Wasserman & Faust, 1994). Having greater betweenness centrality power for an actor means that more actors are dependent on that actor to communicate with other actors. Table 4 also shows us which actors have more betweenness power. The maximum betweenness is 8,694.527; the mean of betweenness for the network is 78.267 and the standard deviation of the network is 569.981. These numbers show that there is a great heterogeneity in the betweenness power of the actors in the network. The network centralization index is 2.57%, which indicates that the overall betweenness power is significantly low. This means that an actor in the network is not very dependent on some actors to communicate with others.
Cliqués are subsets of organizations that develop recurring patterns of interaction in the conduct of disaster operations (Scott, 2000). Cliques are important in understanding the constraints on the network. They are usually developed in an effort to facilitate action under stress caused by the catastrophic disaster; however, they may also inhibit the full exchange of information and resources with other organizations in the network by excluding others from exchange of information and sharing resources (Comfort & Haase, 2006). The boundary spanners can play an important role in linking the cliques (Kapucu, 2006). UCINET analysis identified cliques composed of five organizations. Interestingly, all cliques except two include FEMA. Moreover, in all cliques, there are at least three state-level public organizations. Table 5 shows the identified cliques by the network analyses.

The responses to Katrina by the various levels of government have highlighted the flaws and inadequacies of collective response operations. As evidenced by the cutting of funds to renovate and strengthen the levees in New Orleans, there has been a lack of support in the federal budget for emergency preparedness. The Government Performance Project of 2005 evaluated and graded all 50 states on their ability to manage money, people, information, and infrastructure. An examination of the infrastructure grades is telling, and alarming. Twenty-one states, including the southeastern states of Louisiana, Mississippi, Georgia, South and North Carolina, and Alabama, received grades of C or lower on their ability to manage infrastructure. These states are hit by hurricanes every year, yet they are evaluated as being inadequate in their daily management of roads, bridges, and buildings. The performance of these state’s management systems in disasters seems questionable. Currently,
the receipt of federal assistance is tied to NIMS; states are supposed to meet a minimal level of preparedness before receiving emergency preparedness funds. However, many local governmental organizations and agencies complain that they are not receiving the needed federal assistance. At the U.S. Conference of Mayors in 2004, 52% of 231 cities surveyed across the United States reported that they have yet to receive any money from the state-block grant program. This is a homeland security program that provides funds for first responders at the local level. Perhaps if more federal funds were made available for emergency preparedness, and levels of preparedness at the state and local levels were more closely regulated, response plans could be implemented more effectively.

Table 4. Betweenness Centrality

<table>
<thead>
<tr>
<th></th>
<th>Betweenness</th>
<th>nBetweenness</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>78.267</td>
<td>0.023</td>
</tr>
<tr>
<td>SD</td>
<td>569.981</td>
<td>0.170</td>
</tr>
<tr>
<td>Sum</td>
<td>45,473.000</td>
<td>13.541</td>
</tr>
<tr>
<td>Variance</td>
<td>324,878.875</td>
<td>0.029</td>
</tr>
<tr>
<td>SSQ</td>
<td>192,313,648.000</td>
<td>17.053</td>
</tr>
<tr>
<td>MCSSQ</td>
<td>188,754,624.000</td>
<td>16.737</td>
</tr>
<tr>
<td>Euc Norm</td>
<td>13,867.720</td>
<td>4.130</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Maximum</td>
<td>8,694.527</td>
<td>2.589</td>
</tr>
</tbody>
</table>

Network Centralization Index = 2.57%
Organizations with the highest betweenness centrality in response to Hurricane Katrina

<table>
<thead>
<tr>
<th>Organization</th>
<th>Betweenness</th>
<th>nBetweenness</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMA</td>
<td>8,694.527</td>
<td>2.589</td>
</tr>
<tr>
<td>FLSERT</td>
<td>6,014.511</td>
<td>1.791</td>
</tr>
<tr>
<td>MEMA</td>
<td>4,559.533</td>
<td>1.358</td>
</tr>
<tr>
<td>ARC</td>
<td>4,431.333</td>
<td>1.320</td>
</tr>
<tr>
<td>EMAC</td>
<td>3,312.409</td>
<td>0.986</td>
</tr>
<tr>
<td>Florida</td>
<td>2,552.102</td>
<td>0.760</td>
</tr>
<tr>
<td>Mississippi</td>
<td>2,518.083</td>
<td>0.750</td>
</tr>
<tr>
<td>Louisiana</td>
<td>2,301.840</td>
<td>0.685</td>
</tr>
<tr>
<td>TWH</td>
<td>2,046.609</td>
<td>0.609</td>
</tr>
<tr>
<td>Alabama</td>
<td>1,774.808</td>
<td>0.528</td>
</tr>
</tbody>
</table>

Note: SSQ = sum of squares; MCSSQ = mean centered sum of squares; Euc Norm = Euclidean Norm. FEMA = Federal Emergency Management Agency; FLSERT = Florida State Emergency Response team; MEMA = Mississippi Emergency Management Agency; ARC = American Red Cross; EMAC = Emergency Management Assistance Compact; TWH = U.S. Government—The White House.
Table 5. Cliques Identified Within the Disaster Response Network


Another very important lesson that must be learned is that in a disaster, there will be breakdown in communication, and both telecommunications and information technology infrastructures will be disrupted. Mayor Nagin of New Orleans and his staff did not have communication for 2 days after the storm hit. Unable to establish a communication system, Nagin sent messages through CNN reporters, and eventually was able to use an Internet telephone
account set up for personal use by a staff member (Kapucu & Van Wart, 2006; Waugh & Streib, 2006). The GAO’s report on Hurricane Katrina regarding preparedness, response, and recovery noted that communications and coordination among first responders was lacking, despite previous recommendations in GAO reports issued in 2003 and 2004 (GAO, 2005). In a disaster, the normal means of communication, cell phones, landline phones, the Internet, even radio frequencies will most likely be inoperable. Emergency plans must include alternate methods of communication and steps are to be taken so that if communication is impossible, operations still run as planned.

Florida uses a statewide radio system that allows emergency responders to communicate in a disaster regardless of the frequency they normally use. More than 200 public safety dispatch centers in each of Florida’s 67 counties are able to connect to this system (Bush, 2005). Global positioning systems (GPS) are tools that can improve coordination and preplanning in response to emergencies. For instance, in the event of a hurricane, GPS can help predict the path and strength of the storm and assist in identifying which populations need to evacuate and which do not need. Besides technology, handling communication and coordination begins with developing relationships between people. Public officials must establish relationships between municipalities and agencies before a disaster strikes. Preexisting trust is vital for effective coordination in an emergency. Among other factors, high performance in disasters depends on the coordination between and development of positive, trusting relationships between emergency agencies and responders that allow for the suspension of rules because of unexpected needs. The GAO has issued many reports related to emergency management, including a report following September 11. These reports contain several recommendations, especially concerning coordination at the top levels of government. However, it has not been determined if these previous recommendations have been implemented (GAO, 2005).

Effective emergency management must come from the bottom up; state and local governments must take responsibility. As evidenced by the network analyses results, local organizations are usually fast and responsive to disasters. The federal government also plays an important role, as Jeb Bush stated in his Testimony to the House Committee on Homeland Security: “FEMA should serve as a conduit to the tremendous resources available at the federal level” (Bush, 2005). The NRP provides a structure in which local governments must be prepared to sustain themselves for up to 72 hr before federal aid can reach the disaster area. If a local government needs assistance in preparation or response to a disaster, it has the responsibility to request
assistance from its state government (DHS, 2004). New Orleans, it seems did not prepare to respond to a recovery without immediate federal aid.

**Conclusions**

Intergovernmental and interorganizational relations are complex interactions among the multiple levels of government that require a coordinated effort but also creativity to successfully address the needs of national issues. Large, complex, and seemingly unsolvable problems, such as catastrophic disasters, are best approached from a cooperative effort combining resources and preventing duplication; however, organizing the cooperative effort is almost as difficult as the problems they are created to address. The current era of public administration requires that public managers know more than traditional organizational management methods. Public administrators must learn to solve problems within the cultural, structural, and political boundaries of networks, partnerships, and collaborations while still managing the boundaries of their own home organization. The horizontal relationship among these agencies and the unflagging need for a coordinated effort from these agencies supports the growth and implementation of networks, partnerships, and collaborations as modalities for addressing new policy issues.

Classic administrative theory describing managerial principles focused on departmentalization and specialization of administrative functions to increase effectiveness and improve overall efficiency. Compartmentalized and specialized agencies and administrative functions have served as the rule, leaving open unmet needs. The agency focus on producing a certain product has created gaps of service between the individual functions. Those gaps, or the need to fill those gaps, motivate units or agencies to align with others to provide a needed service. In addition to specialization, often agencies do not have the resources or capacity to reach the goal alone. Partnerships can create new funding sources, alleviate staffing deficiencies, and provide opportunities for good public relations in responding to catastrophic and other disasters.

This study demonstrated that local agencies are faster and more effective in responding to disasters. They also coordinate their response activities more effectively as subgroups. Therefore, we need to focus on more local-level capacity development in response to disasters. State-level partnerships, such as Emergency management Assistance Compact (EMAC), can also be a viable alternative to top-down disaster management approach. FEMA regional offices should be able to coordinate these network relations with the local and state emergency management agencies. In the U.S. emergency
management system, disasters have been managed with a command and control perspective. However, what is needed now is a dynamic and network-centered approach that has the flexibility to move resources where and when they need to be.

In this study, we focused on the broader picture of intergovernmental and interorganizational response to catastrophic disasters. Future research can focus more on specific task-related networks such as networks in donation collection and management, networks in immediate recovery, and networks in law enforcement-related activities. For future research, we will focus on the network development and leadership in recovery activities in response to Hurricane Katrina.

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Notes
1. The National Response Plan forms the basis of how the federal government coordinates with state, local, and tribal governments and the private sector during incidents.
2. Coordination problems in response to Hurricanes Katrina and Rita have been identified by other scholars as well (Waugh & Streib, 2006).

References


**Bios**

**Naim Kapucu** is Associate Professor in the Department of Public Administration at the University of Central Florida and director of the Center for Public and Nonprofit

**Tolga Arslan** is a PhD student in the Public Administration and Policy program at the University of Georgia, Athens. He recently received his MPA degree at the University of Central Florida. His research interests include comparative public administration, policy analysis, and public–private partnerships.

**Matthew Lloyd Collins** is a practitioner in the field of public administration and a faculty member in the Public Policy Department at Walden University. As a practitioner, he has served as a Community Corrections Officer, Police Officer, Project Manager, Deputy County Administrator, County Administrator, and most recently as a County Commission Policy Analyst. He earned a bachelor’s degree and a master’s degree in public administration from the Doug Wilder School of Government at Virginia Commonwealth University in 1996 and 1998, respectively. He earned his PhD in public administration from the Center for Public Administration and Policy at Virginia Tech in 2003. He has been published in the journals *Administration and Society*, *Disaster Prevention and Management*, and *Emergency Management*. He teaches courses at Walden University in public administration, public policy, and emergency management.