

**Intergovernmental Relations in Response to the 1999
Marmara Earthquake in Turkey: A Network Analysis**

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This research examines the intergovernmental coordination to reduce vulnerability of local communities to disasters. Turkey's exposure to seismic risk is very high and achieving intergovernmental coordination in response operations is a challenge. The formal bureaucratic structure of the disaster management inhibits timely collective action in complex disaster environments. The paper examines one of the most destructive regional disasters of the last century, the 1999 Marmara earthquake. The research uses data from content analyses of news reports, interviews with public and nonprofit managers, and direct field observations. This analysis was carried out using UCINET 6.0 social network analysis software program. The results of the network analysis have shown that there is a problem of communication and coordination among public agencies in response to the disaster. Moreover, the integration of organizations from different jurisdictions and other sectors was problematic in the response operations. The results of the study reveal the leverage points for improving intergovernmental collective action from the perspective of complex adaptive systems theory.

Introduction

Turkey is located in the historically earthquake prone Anatolian Peninsula. People who have lived in this region since 2000 B.C. have been subject to seismic risk. Turkey's location in the Eastern Mediterranean sector of the Alpine-Himalayan earthquake belt exposes 92% of the population and 95 % of the land to seismic risk (Saglik Bakanligi 2004). Destructive earthquakes occurred 131 times and represented 60 percent of all natural disasters between 1902 and 1999 (Ergunay 1999). Five recent earthquakes between 1992 and 1999 killed more than 20,000 people (Gulkan 2002).

Disaster environments involve complex, dynamic, and uncertain conditions. Sudden and destructive disasters create chaos and disorder for both people and organizations in the local communities. The "symmetry breaking" (Kiel, 1994 p. 39) effects of disasters break up linearly designed and centralized administrative activities. The result is a significant decline in the performance of a disaster system in organizing a timely and coordinated response operation.

This paper uses network analysis to analyze the coordination and communication of public organizations in response to the 1999 Marmara Earthquake. The study addresses the following research questions: How can the Turkish disaster system facilitate intergovernmental coordination during the response operations? Did the formal disaster management system in response to the 1999 Marmara earthquake integrate organizations from different jurisdictions and sectors? What are the leverage points for a dynamic organizational structure that can facilitate interorganizational coordination? The study uses complex adaptive systems theory and its application to Turkish disaster management system. The complex adaptive systems theory provides important insights for creating a dynamic organizational structure that can collectively respond to the rapid changes in dynamic disaster environments.

Complex Adaptive Systems and Intergovernmental Coordination in Emergencies

The problems of disaster events are ill-structured and highly complex (Dunn 2004). The complexity in disaster environments

significantly decreases the effectiveness of the traditional control oriented bureaucracies (Rosenthal, Boin, and Comfort 2001; Mileti 1999). Bureaucratic organizations are expected to operate in a routinized, efficient, reliable, and predictable way (Comfort 1999). Max Weber described bureaucracy as an example of command and control mechanisms. According to Weber (in Morgan 1998), the bureaucratic form routinizes the process of administration exactly as the machine routinizes production. He has defined bureaucracy as a form of organization that emphasizes precision, speed, clarity, regularity, reliability and efficiency. Like Taylor and other classic organizational theorists, Weber has emphasized the creation of a fixed division of tasks, hierarchical supervision, precisely defined lines of command and communication, and detailed rules and regulations for organizational effectiveness. While bureaucratic organizations are able to achieve their expected goals under stable conditions, they prove to be ineffective in dynamic environments (Comfort and Kapucu 2004; Stacey 2000; Axelrod and Cohen 1999; Marion 1999; Senge 1994), especially in emergencies (Comfort 1999; Mileti 1999; Wildavsky 1988; Merton 1940).

Change and complexity have marked today's organizational environments. Most organizations are susceptible to continuing change occurring simultaneously at local, national, and international levels (Comfort 1994). Reviewing the literature, Garnett (1992) asserts that emphasis on hierarchy, linear plans and procedures developed in advance, often fails to implement government strategies and policies effectively. Disasters create uncertainty, rapid change, and unique conditions. The assumptions and rules that public organizations hold for their regular activities and work environments do not apply to emergencies (Mileti 1999). According to Nadler et al (Nadler et al. 1995), the traditional organizations that focus on control are increasingly less effective, since they cannot receive sufficient energy and respond to change, complexity, and uncertainty. Uncertainty results from the interdependent relations of multiple actors in a complex environment and makes the prediction of the future a much more difficult task for organizations (Uri 1995; Comfort 1999; Bolman and Deal 1997). Reducing the vulnerability of local communities to unexpected and destructive natural events requires changing the

traditional rule-bounded and inflexible organizational structures (Wildavsky 1988). The dynamic environments of disasters necessitate a dynamic organizational structure for responding to rapidly changing conditions (Mileti 1999).

Complex adaptive systems provides an important theoretical framework for both intra-organizational and inter-organizational coordination, collaboration, and adaptation. The theory of complex adaptive systems (CAS) was built on the accumulation of knowledge in chaos and complexity theories. The major developments in CAS started in the physical sciences (Prigogine 1997) and developed especially in ecology, biology, and systems theory (Kauffman 1993 and 1995; Holland in Lewin 1999). More recently, it has been applied to social and human systems (Kiel 1994; Comfort 1999; Uri 1995, Axelrod and Cohen 1999; Marion 1999; Stacey 2000).

Biologist Stuart Kauffman (1993) has examined biological systems that are composed of units which interact with one another and form complex networks of interdependency. In these systems, units form networks, networks form attractors (group of networks), and a network of attractors forms a system (Marion 1999). Similarly, Holland (in Lewin 1999), argues that a complex adaptive system has many levels of organization. Different agents at any one level serve as the building blocks for agents at a higher level. In complex adaptive systems different units or networks learn from each other and adapt to each other's behavior through interactions and information flow (Axelrod and Cohen 1999).

Complex systems evolve of their own accord to the edge of chaos (Kauffman 1993). They operate on a continuum ranging from chaos to order. However, complex systems are neither stable, nor chaotic, but in between. Kauffman (1993) calls this transition stage the edge of chaos. Systems that operate at the edge of chaos have the ability to self-organize. Self-organized systems respond resiliently to external stress by returning in a characteristic way to its critical state. The major reason for the resiliency lies at the heart of the relationship between structure and flexibility. At the edge of chaos, coupling of interacting subsystems is neither tight nor weak (Kauffman 1993). The coupling of interdependent networks or subsystems is marked by sufficient structure to hold and exchange information, but sufficient

flexibility to adapt to changing conditions (Kauffman 1993, Comfort 1999). This important characteristic facilitates self-organization, a rearrangement within the system that allows it to generate a global structure (Comfort 1994).

Information and its exchange is key in a complex system in which actors continuously interact with each other. Computers and other information technologies enable individuals and organizations with different levels of intentions, capabilities, and responsibilities to create mechanisms of communication, information storage, retrieval, dissemination, and exchange (Simon 1997; Comfort 1999; Alavi and Tiwana 2003). Information technology can thus play an important role in supporting individual and organizational learning as well as individual and organizational collaborative interaction (Alavi and Tiwana 2003). Two-way information processes among participating organizations create a shared understanding of emergency requirements and support effective collective action. Comfort (1999) argues that adaptation of organizations and jurisdictions to one another can be achieved through sufficient communications. Quick and accurate information acquisition, processing, and dissemination decreases the uncertainty at each level of government, thereby increasing the interorganizational problem solving capacity and the effectiveness of overall response systems (Comfort and Kapucu 2004; Comfort and Sungu 2001).

The coordination and collaboration of organizations, as well as reallocation of needed resources require Turkey to employ a dynamic organizational structure that can collectively respond to the rapid changes in disaster environments. The formal bureaucratic structure inhibits coordination and collaboration. A dynamic organizational structure that can self-adapt to rapidly changing conditions is necessary. A flexible organizational structure and sufficient information flow facilitate coordination between organizations and jurisdictions as well as increasing organizational self-adaptation to changing conditions.

Methodology

This is a small-n exploratory case study. The data were collected from five sets of sources: on-site observations; semi-structured

interviews with public and nonprofit managers who participated in response operations; review of official reports, related laws and regulations; post-disaster critiques by participating organizations, analyses by researchers, national and international professional organizations; and daily news reports of *Cumhuriyet* between August 7-September 17 1999.

Data from the content analysis of *Cumhuriyet* daily newspaper for 21 days after the earthquake and 23 semi structured interviews with managers of public and nonprofit organizations between October 5 and December 20, 2002 are used to identify the organizations and jurisdictions as well their roles in the response operations. The data from the same content analysis is also used to determine the interactions among organizations. Interactions were defined as the joint acts between two or more organizations. After the initial coding, an interaction matrix was created for the Marmara response and recovery operations. We used a binary nominal level of measurement for the matrices that included only the names of interacting organizations, the direction of interactions, and the frequency of interactions. An interaction between two organizations was coded as 1. If an interaction did not exist between two organizations, it was coded as 0. If the same organizations interacted again, we increased the previously assigned value by the number of new interaction/s. Later we imported the matrices from Microsoft Office- Excel 2002 to UCINET 6.0 software to conduct the network analysis for finding the measures of centrality and cliques for each response system.

Using network analysis for analyzing the interactions was important to see the influential actors, their roles, existing subgroups, and informal organizational structure for the response operations. Although only domestic public and nonprofit organizations with interactions were included in the network analysis, all public, nonprofit, and private organizations mentioned in the news reports were identified regardless of any interaction.

This study came with its own limitations. The content analyses were based on a prestigious daily Turkish newspaper, yet the news coverage for the Marmara earthquake could not possibly cover all interactions that took place among the actors. Moreover, other

events that took place in the world and in Turkey could impact the coverage of the response and recovery operations. Since the network analysis was based on this data, it also reflects the limitations of the content analyses. However, we used interviews, official reports and documents, the reports of international and domestic organizations, post-disaster critiques by participating organizations, and previously conducted on-site observations to corroborate the results of network analysis, and minimize the threats to validity.

The 1999 Marmara Earthquake

The Marmara earthquake occurred in the Izmit Bay and adjacent region with a magnitude of 7.4 on the Richter scale in August 1999 in Turkey. This earthquake that lasted 45 seconds was one of the strongest earthquakes that has ever occurred in western Turkey and the largest event on record that devastated a modern, industrialized area since the 1906 San Francisco and 1923 Tokyo earthquakes. According to the General Directorate of Disaster Affairs (Afet Isleri Genel Mudurlugu 2000), the rupture of the North Anatolian Fault (62-75 miles long), extending from the town of Karamursel to the town of Golkaya caused this disaster. This earthquake, with two or more shocks, broke at least four adjacent fault segments. The first main shock with an epicenter located in the town of Golcuk, at the province of Kocaeli, at the eastern end of the Marmara Sea, formed surface faulting for 25 miles between Golcuk and Sapanca Lake. By this shock, it was estimated that the 12-19 mile part running parallel to the southern coastline of the Izmit Bay was also ruptured. The second main shock with an epicenter located between Sapanca Lake and the town of Akyazi ruptured for 31 miles from Sapanca Lake to Golyaka.

The earthquake occurred at 3:02 am (local time), when most people were resting at their homes. The earthquake killed 17, 480 people and injured 43, 953 people according to the official figures (Basbakanlik Kriz Yonetim Merkezi 2000).¹

The Marmara earthquake caused heavy damages in the most industrialized region of Turkey that included approximately two-thirds of the population. The earthquake caused heavy damage in

the Kocaeli, Sakarya, Yalova, Istanbul and Bolu provinces. Izmit (the province center), Golcuk, Korfez, Derince districts of Kocaeli province, Adapazari (the province center), Akyazi, and Sapanca districts of Sakarya province, Avcilar district of Istanbul Province, and Duzce² and Golyaka districts of Bolu province were among the heavily stricken places. The Marmara Earthquake damaged 244,382 properties and left approximately 500,000 people homeless (Basbakanlik Kriz Merkezi 2000).

The earthquake occurred at the heart of Turkish industry and commerce. The stricken provinces produced 35.51 % the national Gross Domestic Product and had 52.8 % percent of the manufacturing industry, 48.3 percent of all businesses and 47.4 percent of the employment in Turkey (Devlet Planlama Teşkilati 1999). The State Planning Agency estimated that the Marmara Earthquake caused \$8.6 to \$13.1 billion in economic losses (Devlet Planlama Teskilati, 1999). Considering the socioeconomic costs, Gulkan (2002) asserted that the cost of the earthquake was over \$20 billion (more than 7 percent of Turkey's Gross domestic product at the time).

The Turkish Disaster Response System

Turkey has a formal disaster response system to coordinate major public organizations at central and local levels.³ Disaster Law Number 7269 and Regulation Number 88/12777, that are concerned with the principles of emergency aid organization and planning, are intended to create a planning process to coordinate all resources of public organizations ahead of time for the fastest and most effective disaster response operations (Afet Isleri Genel Mudurlugu 1998).

Provinces and districts are supposed to coordinate organizations and resources in districts and provinces through rescue and aid committees before earthquakes, in accordance with the Disaster Law and Regulation Number 88/12777. Therefore, provincial/district rescue and aid committees must prepare for disasters in advance. When crisis management is declared by a prime minister, rescue and aid committees function as the local crisis management

centers. According to the national emergency plan, province and district rescue and aid committees must plan the response operations principally with the provincial and district resources. The local military garrisons or military forces prepare their own plans in coordination with the provincial and district plans. The provinces and districts can ask for help from neighboring provincial and district organizations, local and regional military forces, private organizations or individuals, if the local resources are inadequate for timely satisfaction of the stricken community needs. When this is the case, incoming organizations are supposed to work under the coordination of local rescue and aid committees.

The national disaster plan requires the central public organizations to prepare supplementary plans to aid stricken provinces and districts. The central crisis management, known as the Prime Ministry Crisis Management Center (PMCM), is supposed to provide nationwide coordination of organizations and resources in case of a crisis. PMCM is authorized to take necessary measures and assign duties to public organizations. PMCM involves the members as shown in Table 1.

Table 1: Organizations in Prime Ministry Crisis Management Center

Chair: Prime Ministry or A State Ministry

Agriculture and Forestry Ministry
 Energy and Natural Resources Ministry
 Environment Ministry
 Finance Ministry
 Foreign Affairs Ministry
 Health Ministry
 Industry and Trade Ministry
 Interior Ministry
 Labor and Social Security Ministry
 National Defense Ministry
 National Education Ministry
 National Security Council
 Public Works and Settlement Ministry
 Red Crescent Society
 Secretary of National Security
 Transportation Ministry

Source: Adapted from Basbakanlik Kriz Merkezi (2000)

Disaster Law No 7269 and Regulation 12777 assume a formal organizational structure and coordination pattern that is not effective and is different from the informal response system in practice. The policy maker places a stricken province and/or district at the center of response and recovery operations with certain but implicit assumptions that are generally not valid in case of a major earthquake. According to some of these implicit assumptions: provinces and districts have sufficient capacities to respond to disasters; a major disaster will not significantly impact the local human resources; the interjurisdictional and interorganizational communication channels will remain open or will be quickly restored; the reallocation of national resources for timely response will be achieved through the collaboration between the local rescue and aid committee/s and the central government; and incoming central, provincial, district and military organizations, as well as the Red Crescent Society will be coordinated effectively by the local Rescue and Aid Committees (Corbacioglu 2004).

The Marmara earthquake provides contradictory evidence that does not corroborate the assumptions of the national disaster organization and planning, as explained in the next section. The district or province centered approach pays insufficient attention to the multi jurisdictional and multi sectoral state of emergency response operations. As the analysis of data from the content analyses will show, the intergovernmental response from different levels of government is a fact, not an exception in major disasters.

The Nature of Intergovernmental Coordination and Communication

As opposed to the assumptions of the disaster law and regulations previously stated, the local communities had not sufficiently mitigated and prepared for seismic risk before the Marmara earthquake (Corbacioglu 2004). The formal organizational structure and emergency plans existed on paper in the pre-emergency period but were ineffective in the emergency.⁴ The earthquake traumatized the provincial and district human resources.⁵ The local communities had to rely on outside help. Moreover, the coordination of response

operations shifted from the local communities to the central government while almost all communications with the region were immediately lost for a considerable time.⁶

Communications were inhibited during the first three days. There was no communication between local communities and the central government on the first day and limited communication on the second day (Comfort and Sungu 2001; *Milliyet* August 19, 1999). The communication and information flow between local organizations were not much different. Limited information flow between medical emergency centers, rescue teams, police, military, volunteers and nonprofit organizations significantly inhibited timely and informed collective action. Authorities could not get the site-specific information, which would have enabled them to rush the right type of aid to the right locations (Gulkan 2000). The direct information flow between the national ministries and the disaster area could not be reestablished until the second day, when there were still doubts about the magnitude of the earthquake (Comfort and Sungu 2001).

When interviewees were asked about the extent of intergovernmental coordination, out of 23 respondents, 13 or 56% stated that the extent of intergovernmental coordination for timely action was limited, while 8 or 35% rated the level of coordination as none. Only 2 or 8 percent of the respondents thought that the extent of coordination was to some or good extent (4% to good extent and 4% to some extent).

The state and local authorities have taken important steps for improving intergovernmental coordination and communications after the earthquake.⁷ Cabinet Decision Numbers 583/1999 and 600/2000 founded the Turkey Emergency Management General Directorate (TEMGD) to coordinate public organizations for emergencies that threaten national security. The Prime Ministry also founded the National Earthquake Council in 2000 to provide reliable expert opinion for the scientific issues discussed especially after the earthquakes and to decide on the priority of studies to be conducted for minimizing seismic risk. Another important development was to increase the number of professional rescue personnel and emergency centers at the General Directorate of Civil Defense (GDGD) through Cabinet Decision 586/1999. Through this decision, the number of

regional search and rescue centers increased from three to eleven. Moreover, perceiving the difficulty of implementing such provincial emergency plans in major disasters, the Interior Ministry divided provinces into 11 groups after the 1999 Marmara Earthquake. The Ministry asked provinces in each group to collectively respond to a disaster site. However, this order has been insufficient to achieve inter-provincial collaboration because of the failure to develop any significant, advance technical and organizational infrastructure for inter-provincial action. Without sufficient organizational and technical inter-provincial capacities and collective preparedness, knowing who to help does not make any major difference for a timely and collective seismic response.

The seismic response to the Marmara earthquake showed the ineffectiveness of the Turkish disaster management system in integrating public organizations and jurisdictions for timely collective action. The following section will provide information on the evolution of the Marmara response and recovery operations.

Evolution of the Seismic Response and Recovery Network

The content analysis and the interviews with the managers of the public and nonprofit organizations identified 366 organizations that responded to the 1999 Marmara Earthquake as shown in Table 2. Subtracting the identified international organizations, 73, from this number leaves 293 domestic organizations that engaged in the response and recovery operations. Notable is the role of the state and provincial organizations among all domestic public organizations. They represent 80 % of all domestic public organizations that responded to the Marmara Earthquake. Also significant is the number of international (73 or 20%) and domestic private organizations (78 or 21%).

The Marmara Earthquake was a regional disaster that involved many local crisis management centers in the disaster region. Figure 1 presents the interorganizational network based on the data from the content analysis of news reports from *Cumhuriyet* newspaper. The same data is also used for the following analyses of centrality and cliques.

Table 2: Organizations in the Marmara Operations

Public Organizations	N	%
Public-International	52	14.2
Public-State	88	24.0
Public-Province	56	15.3
Public-District	16	4.4
Public-Municipal	19	5.2
Total Public-Domestic	179	48.9
<i>Total Public Organizations</i>	231	63.1
Nonprofit Organizations	N	%
Nonprofit-Domestic	36	9.8
Nonprofit-International	13	3.6
<i>Total Nonprofit Organizations</i>	49	13.4
Private Organizations	N	%
Private Domestic	78	21.3
Private International	8	2.2
<i>Total Private Organizations</i>	86	23.5
Total Organizations	366	100.0

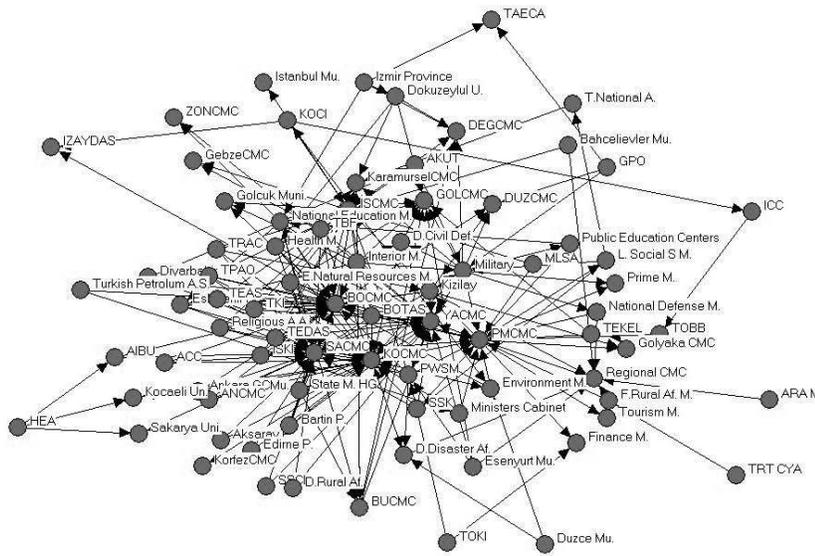
Sources: *Cumhuriyet* news reports, August 17 - September 7, 1999 and Interviews Conducted with the public and nonprofit organizations (October 5- December 20 2002).

Figure 1 shows the domestic public and nonprofit organizations that interacted with each other during the response and recovery operations. The interactions were joint activities by two or more organizations. All interactions for the 21 days were coded from the news reports. The pending organizations, nodes with degree 1, were deleted from the output for analytical purposes.

As seen in Figure 1, organizations have different positions depending on how connected they are to each other. Just by looking at the figure, we can see that Kocaeli (KOCMC), Sakarya Crisis Management Center (SACMC), Bolu Crisis Management Center

(BOCMC), Yalova Crisis Management Center (YACMC), Golcuk Crisis Management Center (GOCMC) and the Prime Ministry Crisis Management Centers (PMCMC) are at the center of interorganizational activity. The measures of centrality and clique analysis are presented below

Figure 1: Interorganizational Network in Response to 1999 Marmara Earthquake



Centrality

The measures of centrality provide information on the organizations that played important roles in the coordination of the 1999 Marmara Earthquake seismic response operations. The following section presents the degree, betweenness, and flow betweenness centrality.

The Degree Centrality

The degree centrality measurement (Freeman's degree centrality) assumes that the more ties an actor has, the more power and centrality it may have (Hanneman 2001). The Freeman's degree centrality shows the Kocaeli Crisis Management Center, Sakarya

Crisis Management Center, Yalova Crisis Management Center, Bolu Crisis Management Center, and Istanbul Crisis Management Center as the most influential local organizations that worked in separate provinces. The Freeman's degree centrality also shows that the Prime Ministry Crisis Management Center, the Red Crescent Society (Kizilay), Military, and Interior Ministry were influential state or nonprofit organizations (Table 3).

Table 3: Freeman's Degree Centrality for the Marmara Operations

Actor Number	Actor Name	Degree	NrmDegree	Share
13	KOCCMC	56.000	33.735	0.074
11	SACMC	44.000	26.506	0.058
14	YACMC	42.000	25.301	0.055
1	PMCCMC	39.000	23.494	0.051
9	BOCCMC	39.000	23.494	0.051
12	ISCCMC	31.000	18.675	0.041
7	Kizilay	31.000	18.675	0.041
5	Military	24.000	14.458	0.032
3	Interior M.	22.000	13.253	0.029
83	N. Educ. M.	15.000	9.036	0.020
8	Regional CMC	14.000	8.434	0.018
4	-Health M	13.000	7.831	0.017
135	GOLCCMC	13.000	7.831	0.017

Source: *Cumhuriyet* news reports, August 17 September 7 1999

Despite that Kocaeli, Sakarya, Yalova, and Bolu CMCs have the highest number of interactions, this does not mean that they have the same centrality in the coordination of other organizations. The betweenness centrality and flow betweenness centrality measures will give a better picture of the actors that play coordination roles.

Betweenness Centrality

The betweenness centrality measures the extent to which a particular organization lies between the various other organizations. A point of relatively low degree may play an important intermediary

role and so be very central to the network (Scott 2000). The betweenness centrality gives an actor the capacity to broker contacts among other actors (Hanneman 2001). That is to say that those other organizations may depend on this organization to make connections with others. Table 4 provides information on the betweenness centrality for the 1999 Marmara seismic response operations.

According to the Table, the Prime Ministry Crisis Management Center has the highest level of betweenness centrality followed by the Kocaeli Crisis Management Center the Red Crescent Society, Military, Bolu Crisis Management Center, Yalova Crisis Management Center, and Sakarya Crisis Management Center respectively.

Table 4: Betweenness Centrality for the Marmara Operations

Actor Number	Actor Name	Betweenness	nBetweenness
1	PMCMC	2.552.156	9.318
13	KOCCMC	1.922.243	7.018
7	Kizilay	804.001	2.935
5	Military	762.387	2.783
9	BOCCMC	762.234	2.783
14	YACMC	730.218	2.666
11	SACMC	610.451	2.229
50	Environment M.	447.167	1.633
2	PWSM	317.500	1.159
3	Interior M.	285.000	1.041
12	ISCCMC	260.467	0.951

Source: *Cumhuriyet* news reports, August 17 September 7 1999

While the Prime Ministry Crisis Management Center was the fourth most central organization according to the Freeman's degree centrality, it is the most central organization according to the betweenness centrality. Similarly, the Red Crescent Society and Military have the third and fourth place in the betweenness centrality list, as they have the seventh and eighth places in the previous list. Bolu, Yalova, and Sakarya Crisis Management Centers follow the first four organizations with considerably high degrees of betweenness centrality.

Flow Betweenness Centrality

The flow betweenness approach to centrality expands the notion of betweenness centrality by assuming that actors use all pathways that connect them proportionally to the length of the pathways. The flow betweenness shows us the ability of an actor in using alternative pathways for coordinating with others. The flow betweenness is measured by the proportion of the entire flow, through all of the pathways connecting them, that occurs on paths of which a given actor is a part (Hanneman 2001)

The flow betweenness centrality indicates that the Prime Ministry Crisis Management Center is the most influential actor with a very high score of flow betweenness centrality. Two other organizations are Kocaeli Crisis Management Center, Yalova Crisis Management Center, Bolu Crisis Management Center, Interior Ministry, the Red Crescent Society, Environment Ministry, and the Military.

Table 5: Flow Betweenness Centrality for the Marmara Operations

Actor Number	Actor Name	FlowBet	nFlowBet
1	PMCMC	4303.363	15.711
13	KOCCMC	1440.825	5.260
14	YACMC	1275.794	4.658
9	BOCCMC	1192.773	4.355
3	Interior M.	663.691	2.423
7	Kizilay	660.041	2.410
5	Military	507.704	1.854
50	Environment M.	517.727	1.890

Source: *Cumhuriyet* news reports, August 17 September 7 1999

The analysis clearly indicates that the Prime Ministry Crisis Management Center plays the most important coordination role in the seismic network. This result is also corroborated by the content analysis of *Cumhuriyet* that shows the reallocation of national resources for rescue and aid operations were made by the PMCMC. This is an important finding for two reasons. First, the data shows the command and control orientation of the disaster management system

in which the PMCMC is central to the network. Second, it invalidates an important assumption of the Disaster Law Number 7269 that gives provincial and district administrations the responsibility and authority for the coordination of organizations and resources after disasters.

Sub-organizational Interactions (Cliques) in the Response Operations

A clique is simply a sub-set of actors who are more closely tied to each other than they are to actors who are not part of the group. All cliques are maximal sub-sets of points in which each point is in a direct and reciprocal relation with all others (Scott 2000). The network analysis is important to understand the macro level emergent behavior through a bottom up approach. Cliques can show us: 1) how separate are the cliques—do they overlap and share members?; 2) how large are the connected cliques; and 3) whether any particular actor/s can play network roles or be isolated (Hanneman 2001). Appendix 1 provides information on the cliques identified in the 1999 Marmara response and recovery operations. According to the table, 80 maximal complete sub-groups (cliques) are present in the data. The largest sub-group or clique is composed of four actors out of 167 public and nonprofit actors. The Prime Ministry CMC is member of 24 of the 80 existing cliques. The total number of clique memberships is 11 for Military, 10 for the Red Crescent Society, 10 for the Interior Ministry, 2 for the Health Ministry, 40 for Sakarya CMC, 27 for Kocaeli CMC, 21 for Bolu CMC, and nine for Yalova CMC. To see the extent to which the cliques overlap and to determine which actors are most central from the cliques, it is necessary to look at some other outputs produced by UCINET. The Actor-by-Actor Clique Co-Membership Matrix and Hierarchical Clustering of the Equivalence Matrix shows that Kocaeli CMC and Sakarya CMC are closest in sharing 22 of 80 clique memberships. The Prime Ministry Crisis Management Center shares seven clique memberships with Kocaeli and Sakarya CMCs, and six clique memberships with Military and the Red Crescent Society. Bolu CMC shares 18 memberships with Sakarya CMC and no membership with Kocaeli CMC. Out of 167 public and

nonprofit organizations, 107 organizations do not have any group membership, which indicates their isolation. Additionally, when the Clique by Clique Co-membership matrix is examined, the first 27 cliques overlap. The rest of the sub-cliques (53) do not overlap.

When the content and purpose of cliques are examined, the data indicates that cliques consist of relationships that emerged from the dynamic conditions of this disaster. Many organizations that did not work together during non-emergency times shared clique memberships. Cliques had various purposes such as medical aid, material aid, food aid, rescue, repair of infrastructures and communication channels, accommodation of victims, fire fighting, as well as religious services. Very limited technology-based communications within the local communities and differences in work methods and organizational cultures significantly decreased the effectiveness of the cliques. Authorities could not get the site-specific information, which would have enabled them to rush the right type of aid to the right locations (Gulkan 2000). The military and civil public organizations had difficulty in coordination, because they did not practice it beforehand (Kara Kuvvetleri Komutanligi Egitim ve Doktrin Komutanligi 2000). Similarly, some nonprofit organizations found it difficult to coordinate with public organizations.⁸

Comparison of Formal and Informal Organizational Networks

The network analyses showed that preparation for a major disaster is not an isolated problem of the stricken community, as principally assumed by Disaster Law Number 7269 and Regulation Number 12777. Instead, organizations from different jurisdictions and sectors indicate the importance of multi sectoral and multi jurisdictional response and recovery operations. The content analysis and interviews identify 366 public, nonprofit, and private organizations from different parts of Turkey and abroad. As a result, a distinctive informal response and recovery system, different from the disaster management system designed by laws and regulations, has emerged from the dynamic conditions of the Marmara earthquake.

The 1999 Marmara earthquake disaster has shown that any major disaster goes beyond the capacity of a province and requires

the reallocation of national resources. The results of the network analysis have indicated the influential actors and their roles in the response and recovery system. Although the crisis management centers of heavily damaged Kocaeli, Sakarya, Yalova, and Bolu have the highest number of interactions, they have not played the most influential coordination role. Instead, the betweenness centrality and flow betweenness centrality measures clearly indicate that the central coordination body, the Prime Ministry Crisis Management Center plays the most important coordination role in reallocating resources and coordinating organizations to respond to the earthquake. Instead of coordinating with and immediately moving to the stricken communities, most provincial and central organizations coordinate with the Prime Ministry Crisis Management Center.⁹ The Military, the Interior Ministry and the Red Crescent Society are other influential central and nonprofit organizations that play important coordination roles in the local communities, according to the results of the network analysis.

Although Kocaeli Crisis Management center seems to follow PMCMC, the coordination role of Kocaeli Crisis Management Center along with other stricken provincial and district centers were insignificant especially during the first three days in which the local communities were in trauma and there were limited local and inter-provincial communications. As content analysis indicates, most interactions between the stricken communities and other public organizations were based on sending and receiving aid materials and personnel rather than coordinating public organizations. The clique analysis indicates that some organizations that are formally responsible for the response operations are not parts of any cliques/sub-groups, while some others that are not responsible for the response operations become parts of cliques and play significant roles. The Health Ministry and Labor and Social Security Ministry, National Defense Ministry, Environment Ministry, Energy Ministry, National Education Ministry, Forestry and Rural Affairs Ministry, Public Works and Settlement Ministry, Interior Ministry, the General Directorate of Civil Defense, and the General Directorate of Disaster Affairs have clique memberships in the network. Although they are part of the central crisis management structure, the Transportation

Ministry, Foreign Affairs Ministry, Agricultural Ministry, Industry and Trade Ministry, and National Security Council do not have any clique membership in the network.

Although the provincial and district plans ignore neighbor provincial and municipal organizations, organizations from Ankara, Aksaray, Bartin, Edirne, Izmir, Eskisehir Provinces, Ankara and Istanbul Greater City Municipalities, Istanbul Water and Sewage Administration, and Esenyurt Municipality have become involved in cliques to serve the stricken local communities. Additionally, even though they are not in any clique, many other provincial and district organizations from other communities responded to the Marmara earthquake.

As presented by the network analysis, seismic response is also a multi sectoral activity. Despite the contemporary national plan's ignorance of the nonprofit sector, except the Red Crescent Society, the clique analysis indicates that Turkish Radio Amateurs Club, Ankara Chamber of Commerce, and Turkey Bakeries Federation interacted with public jurisdictions and organizations in separate cliques. Additionally, even though they did not participate in cliques, a total of 36 domestic and 13 international nonprofit organizations as well as 86 private organizations contributed to the response and recovery operations during the Marmara response and recovery operations.

The emerging interorganizational network has represented a significant gap between the formal and the informal organizational structures. The interorganizational response to the Marmara Earthquake shows that the linearly designed formal disaster response system cannot be effective without the integrated efforts of other critical public, nonprofit, and private actors before and after earthquakes.

Implications for Management, Policy and Theory

This study has important implications for public organizations and their managers that are parts of a disaster management system. The linearly designed policies that focus on command and control inhibit the system level integration of major public actors and their partnership for timely intergovernmental action. The complexity,

change, and uncertainty requires a transformation from traditional bureaucracies to complex adaptive systems that introduce lateral coordination, interactive and informed organizational decisions for learning from past experience as well as responding to emergent conditions. Finally, the intergovernmental network cannot be isolated from the nonprofit sector. Especially since some nonprofits provide essential and critical services such as mass care, communications, and rescue services. Insufficient predisaster interactions with critical nonprofit organizations reduce the capacity of a disaster system. Therefore, coordinating with nonprofits in preparing local communities for emergencies is essential to reducing vulnerability to disasters.

The study also has implications for Turkish disaster management policy. Disaster response and recovery needs to be perceived as a system level collective action rather than the responsibility of provinces or districts. The formal disaster organization is ineffective in response to any major disaster. The policy makers need to consider all critical organizations from different jurisdictions and sectors, and integrate them with each other in mitigating and preparing, as well as responding to disasters. The partnership with nonprofits at the central, provincial, and district levels can significantly contribute to the effectiveness of response and recovery operations.

Additionally, this research has used social network analysis along with complex adaptive systems theory for showing the evolution of the Marmara response and recovery system. The research findings have been used to understand the centrality of actors and their relationships with others. This methodology in conjunction with the theory of complex adaptive systems has become one of the few examples of analysis of intergovernmental collective action in dynamic disaster environments.

Conclusion

The research shows that the actual response and recovery organization is significantly different from the formal organizational structure that was introduced by the law and regulations. Insufficient attention to multi jurisdictional and multi sectoral interactions among

critical organizations inhibit integration of response organizations for seismic response operations. Despite the Turkish national emergency plan's focus on provincial and district level relations, public organizations from neighbor provinces, municipalities, and foreign countries as well as from other societal sectors contribute to the response and recovery operations. The formal system fails to achieve coordination between these organizations and jurisdictions before and after disasters.

The coordination and collaboration of public organizations, as well as reallocation of needed resources require us to employ the perspectives of complex adaptive systems in dealing with seismic risk. Holding the local provincial and district organizations responsible for the response and recovery operations without providing necessary interorganizational and inter-jurisdictional links is ineffective and increases the vulnerability of local communities to seismic risk.

Assigning roles and responsibilities to public organizations through laws and regulations and expecting a timely and well coordinated response and recovery system is insufficient. As the Marmara Earthquake has shown, an informal disaster response emerges from the dynamic conditions of a major disaster. Rather than attempting to control the complexity, harnessing it through improved capacity can significantly contribute to a timely intergovernmental coordination. Achieving such a goal requires preparing and integrating critical public, nonprofit, and private actors of a disaster system through sufficient information flow facilitated by sufficient organizational flexibility, information infrastructure, and cultural openness to change.

Disaster management requires constant information flow between major actors of the Turkish disaster management system. Information search, exchange, and distribution capacities of public organizations are crucial for this purpose. The nationwide investments in risk prone communities and the integration of existing information systems at different levels of the Turkish state can significantly improve the integration of the critical actors for a complex system of disaster preparedness and response. Finally, it is important to note here that an intergovernmental network is an important policy challenge that goes beyond the boundaries of disaster affairs.

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Notes

1. Numbers of deaths and damaged buildings reflect the official report. Private investigations state higher amount of deaths and building damage (Gulkan 2002).
2. Another destructive earthquake occurred in the Duzce and Kaynasli districts of Bolu province in November 12, 1999. Duzce became a provincial district following August 17 Marmara and November 12 Duzce Earthquakes.
3. See Karanci, N. A., and Aksit, B. (2000) for more information on Turkish disaster management
4. Interview with the General Directorate of Disaster Affairs
5. Interview with Red Crescent Society
6. Interview with Turk Telekom
7. Please see Corbacioglu 2004 for a comprehensive review and discussions for the organizational, technical, and cultural changes made by the state and local authorities after the 1999 Marmara Earthquake.
8. Interview with Turkey Radio Amateurs Club
9. Interview with the Prime Ministry Crisis Management Center
10. Minimum set size selected is three. See Appendix 2 for the legend for abbreviations.

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Appendix 1. Cliques for the Marmara Operations¹⁰

- 1: PMCMC Kizilay SACMC KOCCM
- 2: PMCMC PWSM SACMC KOCCM
- 3: PMCMC SACMC KOCCM BOTAS
- 4: PMCMC SACMC KOCCM SSK
- 5: Health M SACMC KOCCM
- 6: Interior M. SACMC KOCCM Eskisehir P.
- 7: SACMC KOCCM Aksaray P.
- 8: SACMC KOCCM ACC
- 9: SACMC KOCCM Ankara GCMu. ANCCM
- 10: SACMC KOCCM Bartin P.
- 11: SACMC KOCCM Edirne P.
- 12: SACMC KOCCM E.Natural Resources Ministry
- 13: SACMC KOCCM Eskisehir P. National Education M.
- 14: SACMC KOCCM ISKI
- 15: SACMC KOCCM Religious A.A.
- 16: SACMC KOCCM State M. HG
- 17: SACMC KOCCM TEAS
- 18: SACMC KOCCM TEDAS
- 19: SACMC KOCCM TKI
- 20: SACMC KOCCM TPAO
- 21: SACMC KOCCM TBF
- 22: Kizilay SACMC KOCCM TRAC
- 23: Interior M. Military KOCCM D.Civil Def.
- 24: PMCMC Military Kizilay KOCCM
- 25: PWSM KOCCM D.Disaster Af.
- 26: PMCMC KOCCM Environment M.
- 27: PMCMC KOCCM Ministers Cabinet
- 28: PMCMC Kizilay Regional CMC
- 29: PMCMC Regional CMC A.Rural Af. M.
- 30: PMCMC Regional CMC National Defense Ministry
- 31: PMCMC PWSM BOCCM SACMC
- 32: PMCMC Kizilay BOCCM SACMC
- 33: PMCMC BOCCM SACMC BOTAS
- 34: Interior M. BOCCM SACMC Eskisehir P.
- 35: Health M BOCCM SACMC
- 36: BOCCM SACMC AIBU
- 37: BOCCM SACMC ACC
- 38: BOCCM SACMC Ankara GCMu. ANCCM
- 39: BOCCM SACMC Bartin P.

- 40: BOCMC SACMC E.Natural Resources Ministry
 - 41: BOCMC SACMC Eskisehir P. National Education M.
 - 42: BOCMC SACMC ISKI
 - 43: BOCMC SACMC Religious A.A.
 - 44: BOCMC SACMC TEAS
 - 45: BOCMC SACMC TEDAS
 - 46: BOCMC SACMC TKI
 - 47: BOCMC SACMC TPAO
 - 48: BOCMC SACMC TBF
 - 49: Kizilay BOCMC DUZCMC
 - 50: Interior M. BOCMC Golcuk Muni.
 - 51: BOCMC TBF KaramurselCMC
 - 52: Interior M. BUCMC YACMC
 - 53: BUCMC YACMC National Education M.
 - 54: BUCMC YACMC State M. HG
 - 55: Interior M. BUCMC GOLCMC
 - 56: ISCMC TBF GebzeCMC
 - 57: ISCMC TBF GOLCMC
 - 58: ISCMC TBF KaramurselCMC
 - 59: Interior M. ISCMC GOLCMC
 - 60: Interior M. ISCMC Golcuk Muni.
 - 61: ISCMC E.Natural Resources M. GOLCMC
 - 62: Kizilay ISCMC TRAC
 - 63: PMCMC Military Kizilay YACMC
 - 64: PMCMC PWSM YACMC
 - 65: PMCMC YACMC BOTAS
 - 66: PMCMC YACMC SSK
 - 67: Interior M. Military YACMC
 - 68: PWSM YACMC Esenyurt Mu.
 - 69: Dokuzeylul U. Izmir Province DEGCMC
 - 70: Military GPO DUZCMC
 - 71: Environment M. KOCI IZAYDAS
 - 72: PMCMC Military L. Social S M.
 - 73: PMCMC L. Social S M. SSK
 - 74: PMCMC Military National Defense Ministry
 - 75: PMCMC National Defense M. Golyaka CMC
 - 76: PMCMC Military Prime Ministry
 - 77: PMCMC Military Public Education Centers
 - 78: Military Kizilay DUZCMC
 - 79: Interior M. Military D.Civil Def. GOLCMC
 - 80: PMCMC Kizilay Golyaka CMC
-

Source: *Cumhuriyet* news reports, August 17 September 7 1999

Appendix 2. Glossary of Abbreviations

ACC	Ankara Chamber of Commerce
AIB	Abant Izzet Baysal University
ANCMC	Ankara Crisis Management Center
Ankara GCMU	Ankara Greater City Municipality
Bartın P.	Bartın Province
BoCMC	Bolu Crisis Management Center
CMC	Crisis Management Center
D.Civil D.	General Directorate of Civil Defense
D.Disaster A	General Directorate of Disaster Affairs
DEGCMC	Degirmendere Crisis Management Center
DUZCMC	Duzce Crisis Management Center
Dokuzeylu U.	Dokuzeylul University
Edirne P.	Edirne Province
Environment M	Environment Ministry
Esenyurt Mu.	Esenyurt Municipality
Eskisehir P.	Eskisehir Province
F.Rural Af.M	Forestry and Rural Affairs Ministry
GOLCMC	Golcuk Crisis Management Center
Golcuk Muni	Golcuk Municipality
Goyaka CMC	Golyaka Crisis Management Center
GPO	Golcuk Prosecutor's Office
Health M.	Health Ministry
Interior M.	Interior Ministry
IsCMC	Istanbul Crisis Management Center
ISKI	Istanbul Water and Sewage Administration
Kizilay	Red Crescent Society
KoCMC	Kocaeli Crisis Management Center
L.Social SM	Labor and Social Security Ministry
M.	Ministry
National Education M.	National Education Ministry
PMCM	Prime Ministry Crisis Management Center
PWSM	Ministry of public Works and Settlement
Regional CMC	Regional Crisis Management Center
Religious AA	Religious Affairs Agency
SaCMC	Sakarya Crisis Management Center
SSK	Social Security Administration
State M. HG	State Ministry
TBF	Turkey Bakeries Federation
TEAS	Turkey Electricity Corporation
TEDAS	Turkey Electricity Distribution Corporation
TKI	Turkey Coal Authority
TPAO	Turk Petrol Corporation
TRAC	Turkey Radio Amateurs Club
YACMC	Yalova Crisis Management Center
