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A CASE OF ORGANIZATIONAL LEARNING: SEISMIC RESPONSE TO THE DUZCE EARTHQUAKE[1]

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ABSTRACT

The dynamic relationships among physical, social and constructed systems make organizational learning and adaptation more than necessary for disaster organizations. Sociotechnical disaster systems with sufficient organizational, technical, and cultural capacities can self-learn and self-adapt to the changing conditions in their environments. This paper examines the organizational learning that occurred after the 1999 Marmara earthquake. The study uses 44 semi-structured interviews as well as post-disaster critiques by participating organizations, analyses by researchers, national and international professional organizations, and news reports from Cumhuriyet daily news paper. The findings of the study reveal that the 1999 Marmara earthquake started a change process in the Turkish disaster management system. Although the change process was not sufficient for creating a sociotechnical disaster system, the improvements in the organizational, technical, and cultural aspects facilitated better coordination and faster response operations after the Duzce earthquake.

Keywords:*Organizational learning, disaster management, Duzce earthquake, sociotechnical systems.*

BİR ÖRGÜTSEL ÖĞRENME OLAYI: DÜZCE DEPREMİNE SİSMİK MÜDAHALE

ÖZET

Fiziksel, sosyal ve inşa edilmiş sistemler arasındaki dinamik ilişkiler örgütsel öğrenme ve adaptasyonu afet organizasyonları için zorunlu kılmaktadır. Yeterli örgütsel, teknik ve kültürel kapasiteye sahip sosyoteknik afet sistemleri kendi kendine öğrenme ve çevrelerindeki değişime adapte olma kabiliyetini kazanmaktadırlar. Bu makale, 1999 Marmara depreminden sonra gerçekleşen örgütsel öğrenmeyi incelemektedir. Çalışma, 44 adet yarı yapılandırılmış mülakat, görevli organizasyonların yapmış oldukları kritikler, bilim adamları, ulusal ve

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uluslararası organizasyonların analizleri ve Cumhuriyet gazetesinde yer alan Düzce depremi ile ilgili haberleri elde veri olarak kullanmaktadır. Araştırmanın sonuçları, 1999 Marmara depreminin bir değişim süreci başlattığını göstermektedir. Her ne kadar söz konusu süreç, sosyoteknik bir Türk afet yönetim sistemi oluşturmak için yeterli olmasa da, Düzce depremi öncesinde kaydedilen örgütsel, teknik ve kültürel gelişmeler, Marmara depremine kıyasla daha iyi koordine olan ve daha hızlı bir afet müdahale operasyonuna olanak vermiştir.

Anahtar Kelimeler: Örgütsel öğrenme, afet yönetimi, Düzce depremi, sosyoteknik sistemler.

1. INTRODUCTION

Turkey is located on the historically earthquake prone Anatolian Peninsula. People who have lived in this region have been subject to seismic risk for thousands of years. Turkey's location in the Eastern Mediterranean sector of the Alpine-Himalayan earthquake belt exposes 95% of the nation to seismic risk. Nevertheless, the degree of exposure to risk is not the same for all. It depends on whether the communities take action against it or not. A dynamic disaster response system that can learn and adapt to changing conditions in its environment is necessary for reducing vulnerability of local communities to seismic risk and improving seismic response (Comfort 2002). Failure to learn from previous mistakes is a critical problem of the Turkish disaster management. The analysis of the recent Duzce earthquake provides important insights for developing a more effective Turkish disaster management.

2. ORGANIZATIONAL LEARNING

Organizational learning is a key to developing dynamic organizations that can adapt to new information and conditions in their environments. The dynamic relationships among physical, social and constructed systems (Mileti 1999) make organizational learning and adaptation more than necessary for disaster organizations (Wildavsky 1988, Comfort 1994, Comfort 1999). In their analyses of various disaster cases, Turner and Pidgeon (1997) argue that failure to change the culturally accepted beliefs, associated precautionary norms set out in laws, codes of practice, mores, and folkways contributes to disasters. According to the authors, as long as an inquiry or assessment is carried out and precautionary norms are adjusted to fit the newly gained understanding of the world through organizational learning, disaster organizations cannot minimize the vulnerability of the communities to disasters.

Considering the different aspects of organizational learning in literature, we can define organizational learning as an interactive collective process of change and adaptation for effective action that occurs by correcting errors and anomalies, in response to altered conditions, through information processing, improved collective knowledge and understanding.

Organizational learning takes place through shared mental models developed by ongoing dialogue among members of an organization (Kim 1993, Stata 1989, Arygris and Schon 1996). The shared mental models represent the active organizational memory and make the rest of the organizational memory usable (Kim 1993). However, individuals must learn first for organizational learning to occur (Cohen & Levinthal 2000).

Arygris and Schon (1996) contend that learning becomes organizational when members of an organization detect error or anomaly and correct it by restructuring the organization's theory of action (or "theory in use"), embedding the results of their inquiry in the images of organization held in its members' minds (mental models)/and or in the epistemological artifacts such as maps, memories, and programs.

Levitt and March (1996) use the term routine, which is a very similar concept to the term mental model in explaining organizational learning. They argue that organizations are seen as learning by encoding inferences from history into routines that guide behavior. The routines include the forms, rules, procedures, conventions, strategies, technologies, and the structure of beliefs, frameworks, paradigms, codes, and cultures (Levitt and March 1996).

Organizational learning includes two feedback loops that connect actions with strategies and governing values (Arygris and Schon 1996). According to Arygris and Schon (1996), organizational learning (double loop learning) represents an inquiry that explores and restructures the governing values and criteria of an organization. Therefore, organizational learning involves questioning and, if necessary, changing values that govern strategies of action in an organization (Argyris 1993). The organizations that can question strategies but not the governing values are not true learners. Argyris and Schon contend that organizations must be double loop learners for self-evaluation, self-adaptation, and change.

3. SOCIO-TECHNICAL DISASTER SYSTEMS

Sufficient organizational structure for information acquisition, dissemination, storage, and interpretation, yet sufficient flexibility for processing information help organizations to learn and adapt each other as well as to changing conditions in their environments (Comfort 1999). The characteristics of sociotechnical systems are clasifed under three categories; organizational, technical, and cultural (Comfort 1999).

Sociotechnical systems necessitate a balance between order and flexibility that requires a dynamic organizational structure in and between organizations (Comfort 1999). The lateral communication and coordination among a range of organizational and interorganizational actors (Garnett 1992) and the integration of

micro and macro level decision makers through information flow facilitate learning and adaptation (March 1988). The flexibility of sociotechnical systems enables its organizations to relax or eliminate other functions temporarily, when needed. As a result, the organizational structure is continually modified through actions, as the interdependent disaster organizations interact with their dynamic environments (Comfort 1993). Moreover, as well as information flow and lateral coordination, quality of human resources and emergency plans play important roles for developing sufficient organizational capacity (Comfort 1999).

Simon (1997) stresses the importance of information flow and technology for individual and organizational learning. The 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 & 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 & Tiwana 2003). Two-way information processes among participating organizations create a shared understanding of emergency requirements and support effective collective action (Comfort & Cahill 1987). Comfort (2002) argues that adaptation of organizations and jurisdictions to one another can be achieved through sufficient communication. 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 system (Comfort & Cahill 1987). Since different phases of disaster management closely related to each other, the technical capacity of a disaster system goes beyond information infrastructure. Existence of emergency management centers, sufficient resources, and implementation of earthquake codes are also important for developing the technical capacity of a disaster system (Comfort 1999).

Organizational culture shapes the type of learning and shared mental models in use. Complexity and change require mental models that involve openness to change (Comfort 1999). Disaster organizations should be able to change their contemporary practices and adapt to changing and complex conditions upon receiving reliable information (Comfort 1999). For achieving such a goal, individual decision makers and organizations need to be open to valid information and take action on obtaining it (Arygris 1993). Moreover, control must be replaced by an ability to trust individuals and groups to carry out critical organizational tasks without close supervision (Edmondson and Moingeon 1999).

4. RESEARCH METHODOLOGY

This is a small-n exploratory case study. The data have been collected from the five sets of sources: on-site observations; 44 semi- structured interviews between

October 5 and December 20, 2002[2]; review of official reports, post-disaster critiques by participating organizations, analyses by researchers, national and international professional organizations, and news reports from Cumhuriyet daily newspaper. Data from different sources are used to corroborate the results and minimize the threats to validity. The study`s unit of analysis is organizations that played important roles and involved in response and recovery operations. The unit of observation is the public and nonprofit managers and researchers that played important roles in response to the Marmara and Duzce earthquakes. The managers are directors/deputy directors of public and nonprofit organizations or their departments and teams that were involved with the operations. Researchers are prominent scholars that researched both earthquakes. The paper inquires if Turkish disaster management learned from the Marmara earthquake and adapted itself to the requirements of the dynamic disaster environments.

5. CONTEXT OF THE CASE: THE 1999 DUZCE EARTHQUAKE

The 1999 Duzce Earthquake was the second earthquake that hit Duzce district [3] of Bolu province in less than three months. The earthquake caused heavy damage in Duzce district, especially Duzce city and Kaynasli Municipality[4]. Duzce was located in North West Turkey and bordered Bolu, Zonguldak, and Sakarya provinces. The city was on the Ankara-Istanbul Highway (241 km to Ankara and 205 km to Istanbul) and geographically close to other provinces and districts that were stricken by the 1999 Marmara Earthquake.

The Duzce Earthquake occurred at 7:02 pm (local time) on November 12, 1999 with a magnitude of 7.2. The earthquake killed 761[5] people and injured 4948 people (Basbakanlik Kriz Yonetim Merkezi 2000a). Duzce fault which was a segment of North-Anatolian fault line caused the earthquake (Erdik 2000). This fault was 70 km long and extended between Akyazi and Kaynasli (Duzce Valiligi 2000). Other two faults in the area were Hendek (50 km long) and Cilimli (13 km long) that did not brake. The Marmara Earthquake had already ruptured the 30 km long Duzce fault until Efteni Lake. The 1999 Duzce Earthquake created 40-45 km surface fault rupture between Efteni Lake and Pirahmentler (Duzce Valiligi 2000, Erdik 2000). The epicenter of the earthquake was 6 km south of Duzce city (Erdik 2000).

While most of the casualties were in Duzce city and Kaynasli, the fire and smoke caused by traditional heaters significantly increased the number of deaths and injuries, especially in Kaynasli. As a result, at least 50 people died by fires only in Kaynasli[6]. Deaths due to smoke and fire were also reported in Duzce[7].

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[2] The research involves 20 interviews for the Duzce earthquake and 24 interviews for the Marmara earthquake.

[3] Duzce became a province on December 3 1999, shortly after the Duzce Earthquake.

[4] Kaynasli became a district of Duzce province on December 9 1999.

[5] According to Gulkan (2002) the total number of deaths is 812.

[6] Interview with Kaynasli Municipality

[7] Interview with Duzce Municipality

Two earthquakes less than three months apart created heavy damage in the region. The Duzce Earthquake caused heavy damage in Bolu province, Duzce city and Kaynasli municipality, as well as impacting Bursa, Eskisehir, Istanbul, Karabuk, Kocaeli, Sakarya, Yalova, and Zonguldak provinces (Basbakanlik Kriz Yonetim Merkezi 2000). The Duzce Earthquake hit the buildings that were already weakened by the Marmara Earthquake. According to the Prime Ministry Crisis Management Center's Press Release on February 2, 2000, the earthquake damaged 41,920 properties in Bolu Province.

Both the Marmara and Duzce Earthquakes significantly damaged Duzce's economy by heavily damaging 3228 businesses and slowing down the economic development (Duzce Valiligi 2000, Devlet Planlama Teskilati 2001). The estimated cost of the earthquake was 1 billion US dollars (Gulkan 2002).

As was the case in the Marmara Earthquake, the Duzce Earthquake immediately knocked out the power and telecommunication systems (Comfort and Sungu 2001). While Turkish Amateur Radio Club was the primary mean of communication on the first day, limited communication was available by the third day (Comfort and Sung 2001). Both the telecommunication and power was largely restored in Duzce by the fifth day (Comfort and Sungu 2001). The damage to the water and sewage systems caused delays for water distribution for the first few days in Kaynasli and Duzce cities (Kara Kuvvetleri Komutanligi Egitim ve Doktrin Komutanligi 2000). The most significant damage on highways occurred on a section of the Trans-European Motorway (TEM) between Bolu and Duzce. Bolu viaducts #1 and #2, Bolu Bridge and Bolu Tunnel located in the last segment of the TEM were strongly affected by the earthquake (Erdik 2000). Additionally, collapses blocked the inner city roads in Kaynasli[8] and Duzce[9].

The 1999 Duzce earthquake was a stronger earthquake in a smaller region when compared to the Marmara earthquake. The Duzce response and recovery operations were impacted by the Marmara earthquake since the problems encountered were similar in both disasters. The organizational, technical, and cultural capacities of the Duzce response operations are crucial to determine whether any organizational learning and adaptation occurred between two disasters.

6. ORGANIZATIONAL CAPACITY

This section reviews the organizational capacity of Turkish disaster management during the Duzce response operations. The section examines emergency planning, intergovernmental organization and coordination, sufficiency of information flow, and existence of professional personnel and reserves.

[8] Interview with Kaynasli Municipality
[9] Interview with Duzce Municipality

a. Emergency Planning

Emergency planning for disasters tended to be on paper for the regular times and ineffective for the intergovernmental coordination before the Marmara response operations[10]. Although there was not any substantial change in the formal emergency plan since the Marmara earthquake, the organizations knew when and what to do in response to an earthquake. The respondents asserted this fact as follows:

> "…Our committees were ready with the experience of the Marmara Earthquake. Organizations that came for help also had experience. They were faster and knew what to do[11]."

> "…We did not have any experience before the Marmara Earthquake. The Practice of plans was not done seriously. But, we had individual experience from the Marmara Earthquake[12]."

Although Duzce did not have any time for reflecting its experience and learning in planning, the managers had a master plan in their minds[13]. The interview responses about the implementation of emergency plans reflect this improvement. Out of 20 respondents, 11 or 55% acknowledged that emergency plans were implemented to good extent, while four or 20% stated that plans were implemented to some extent. However, 25% of the respondents were not satisfied with the implementation of plans (15% not at all; 10% not to any extent). The improvement is significant when the responses for the Marmara earthquake are considered. Out of 24 respondents, 19 or 100% stated that the implementation of emergency plans were not implemented at all or not implemented to any extent (%63 not at all and %37 not to any extent) during the Marmara response operations.

b. Organization and Coordination

The symmetry breaking effects of the Marmara Earthquake started a change process in Turkish disaster organization. The Duzce 1999 earthquake occurred when the change process was in its early steps. The only major institutional change was the foundation of the Disaster Regional Coordination Governorate for the coordination of resources and recovery efforts in Bolu, Kocaeli, Sakarya, and Yalova provinces after the Marmara Earthquake. Immediately after the earthquake, the regional governorate sent aid to Duzce:

> "…We loaded 40 trucks with emergency aid and sent it to Duzce. The aid reached Duzce about 2 AM on the same

[10] Interviews with General Directorate of Disaster Affairs, Yalova, Kocaeli, and Duzce provinces, and Golcuk/Kocaeli District
[11] Interview with Duzce District
[12] Interview with Duzce Health Department
[13] Interview with Duzce Municipality and Police Department

night. We transformed the local aid center to a province level logistic support center by the next day[14]."

As a reflection of their experience from the Marmara Earthquake, both civil and military authorities quickly decided to block the roads from both Istanbul-Bolu and Ankara-Bolu directions so that the rescue and relief organizations could move faster to the disaster areas[15].

One interview question was asked to determine the extent to which public organizations operating at central, provincial, district, and local levels were coordinated for timely collective action. Out of 20 respondents, 14 or 70% stated that the extent of coordination for timely action was to good or great extent (60% to good extent and 10 % to great extent). While five or 25% rated the level of coordination to some extent, one or five % thought that the extent of coordination was not to any extent. The responses indicated an improvement in coordination when compared with the responses for the Marmara earthquake. Out of 23 respondents, 21 or 91% respondents stated that the extent of coordination was not to any extent or not at all (56% not to any extent and 35% not at all) in the Marmara earthquake.

Despite the improvements, the integration of organizations from multiple jurisdictions and sectors were difficult. The Land Forces Education and Doctrine Command (2000) reported the issues that negatively influenced the coordination efforts. The major factors can be summarized as follows: 1) occurrence of the earthquake at the end of the day, when civil and military personnel left for their homes; 2) insufficient organization capacity of the local crisis management for effectively and efficiently dispatching arriving rescue and relief organizations to disaster sties; 3) difficulty in finding interpreters for the international teams; 4) the dependence of public personnel from other provinces for food and accommodation on the local authority and; 5) the difficulty in the coordination of the military organizations and the local crisis management center for collective action.

Although numerous nonprofit organizations were involved in the rescue and relief operations after the Marmara earthquake, they were also not prepared and thus their efforts were not coordinated (Karanci and Aksit 2000). However, the 1999 Marmara Earthquake represented a turning point for volunteer organizations. Taking the highly publicized nonprofit search and rescue organization AKUT as a model, numerous volunteer search and rescue teams were founded (Corbacioglu 2004). Similarly, The Red Crescent Society, the most criticized nonprofit mass care organization, started shifting from merely providing humanitarian assistance to helping local communities in preparing for and mitigating seismic risk (Ergunay 2002). In an attempt to coordinate nonprofits, the General Directorate of Civil Defense issued a regulation asking these organizations to register with its local offices in 2000.

[14] Interview with Disaster Regional Coordination Governorate.
[15] Interview with Turkish Armed Forces 15th Army Corps.

c. Availability of Sufficient Information and its Exchange

The 1999 Duzce Earthquake disrupted the local telecommunication and power systems. Communications were mostly inhibited during the first three days. Although there was not any substantial change in the technical infrastructure in the region since the Marmara Earthquake, public managers and organizations were aware of the importance of information flow between the Duzce District and Bolu Province, between Duzce district and neighboring provinces, and between Duzce and central government (Comfort and Sungu 2001)

A television company, that arrived on the same night after the earthquake, helped Duzce district to inform Bolu province about its needs through live broadcasting[16]. Members of the Turkish Amateurs Radio Club also immediately responded to the Duzce Earthquake.

A respondent explained the status of communication after the earthquake[17]:

> "…Turk Telecom provided special line for the Duzce crisis management center by the next day. Until then The Turkish Radio Amateurs Club provided communication with outside world. The satellite phones that existed in the district did not work because the company had recently gone out of business."

Communications within the city were still limited but significantly better than the communications during the Marmara operations. The Health Department had the radio system including 20 hand radios already installed after the Marmara Earthquake.

Additionally, the health team from Istanbul Province brought in a radio system[18]. The Duzce municipality had 4 satellite phones donated by international organizations[19]. The central government also provided satellite phones to the province centers after the Marmara Earthquake. Unfortunately, these phones did not work because the company had gone out the business before the Duzce Earthquake.

While the communication within organizations worked better, interorganizational communication was more problematic. Some organizations tried to overcome this problem by exchanging their hand radios[20]. Duzce police department provided communication with Kaynasli through the Regional Traffic Police' automobile radios[21]. The Turkish Radio Amateurs also helped the

[16] Interview with Duzce District
[17] Interview with Duzce Municipality
[18] Interview with Duzce Health Department
[19] Interview with Duzce Municipality
[20] Duzce Police Department
[21] Duzce Police Department

communications within the city[22]. However, face to face meetings were still an important way of communication[23]. By the second day, the Turk Telecom brought in a satellite system and provided private lines for critical public organizations for communicating within the city and between the city and the Prime Ministry Crisis Management Center. Both the telecommunication and power was largely restored in Duzce by the fifth day (Comfort and Sungu 2001).

The Marmara Earthquake showed the importance of intergovernmental databases, especially Geographic Information Systems. However, the region was still in the recovery period and these systems did not exist when the Duzce Earthquake occurred[24]. The only available intergovernmental system was an interprovincial intranet among the logistic support centers under the earthquake region coordinating governorate. This network was created by the disaster coordinator governor for effective and efficient use and the reallocation of resources to the communities stricken by the Marmara earthquake. Although, the system did not include Duzce, the regional governorate used the system for regional reallocation of existing resources[25].

d. Professional Personnel and Reserves

The local community did not have any professional rescue personnel or specially trained reserves for response operations. Similarly, most of the military personnel, police, and medical staff, and other responsible public personnel that were primarily used in response operations did not have any significant training to work in emergencies before the Marmara earthquake. However, the Marmara Earthquake provided a real life experience and training for public personnel and volunteers in Duzce and other neighboring provinces and districts. As a result, most military personnel, police and health professionals were much more ready than ever in responding to the 1999 Duzce Earthquake.

The insufficiencies in local human resources were overcome by the help of personnel who flowed into Duzce and Kaynasli. In addition to the Turkish Armed Forces, the General Directorate of Civil Defense, AKUT, coal miners, provincial/district Health Departments, the Red Crescent Society, many volunteer organizations that were founded after the Marmara Earthquake actively participated in the search, rescue, medical, and mass care efforts in Duzce and Kaynasli[26].

Kaynasli municipality described the availability of rescue personnel as follows:

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[22] Interview with TRAC
[23] Interview with Duzce District
[24] Most stricken provinces and/or province center municipalities of the Marmara earthquake installed Geographic systems after the Duzce earthquake.
[25] Interview with Disaster Regional Coordinating Governorate
[26] Interview with AKUT

> "…There were many rescue teams after the earthquake. We assigned a team for each emergency site. Rescue operations were completed by November 14 (two days after the earthquake)[27]."

The situation was similar in Duzce:

> "…There were not trained personnel in rescue operations at the time of the Marmara Earthquake. People were attacking the collapsed buildings unconsciously. We had experienced personnel at the November 12 earthquake. All aid organizations flowed into Duzce. People in Duzce also had gained experience (from the Marmara earthquake)[28].

Consequently, the 1999 Duzce response operations attracted sufficient number of and qualified personnel

7. TECHNICAL CAPACITY

The technical capacity of the Duzce operations is summarized in this section. The data presented about information infrastructure, emergency centers and resources, and implementation of earthquake codes will allow us to evaluate the technical capacity of the Duzce response operations, as well as the change occurred after the Marmara response operations.

a. Information infrastructure

The information infrastructure of contemporary disaster management was not significantly different from the 1999 Marmara response operations, yet the local communities started taking substantial steps to improve it. The central government's distribution of satellite phones to the provinces, and the existence of four satellite phones at Duzce municipality might have made an important difference in information infrastructure, if the satellite company did not go out business shortly before the Duzce Earthquake. The Regional Disaster Coordination Governorate and stricken provinces were planning to develop Geographic Information Systems, while an interprovincial intranet system was already in use in the Marmara region.

Despite the limitations, there were improvements in the communication infrastructure in Duzce. Duzce Health Department had radio system already installed after the Marmara Earthquake. Moreover, the quick installation of private lines by the second day was essential for continuous communications among the crisis management centers. Moreover, response organizations were also more prepared

[27] Interview with Kaynasli Municipality
[28] Interview with Duzce District

and brought in their radio systems, as was the case for the Istanbul Health Department[29].

At the central level, the General Directorate of Disaster Affairs correctly informed the Prime Ministry Crisis Management Center about the magnitude of the earthquake and possible damage in Duzce through seismic risk monitoring network and damage estimation models, while the Turkish Armed forces used helicopters immediately after the earthquake for exploring the damage in the regions.

Although respondents still relied on field observations for information search, timely use of information technologies including live broadcasting contributed to information search efforts. As a result, contemporary information infrastructure significantly influenced organizational learning and adaptation in response to an increasing volume of information search, exchange, and dissemination among organizations. When the respondents were asked to assess the influence of information infrastructure on rescue and relief efforts, all of them asserted the importance of it. Out of 18 respondents, 16 or 89% stated that information infrastructure influenced the operations to a great extent, while two or 11% thought that the influence of information infrastructure was to good extent.

b. Emergency Management Centers and Resources

Duzce established a crisis management center at the front yard of the department of Rural Affairs shortly after the earthquake while amateur radio operators (TRAC) used the flag pole at the yard for communications[30]. Even the cooperation with TRAC was an important improvement, since the district administration refused doing it during the early hours of the Marmara response operations[31].

Duzce district or Duzce Municipality did not have sufficient time or funding for purchasing equipments for seismic response operations. Additionally, the fire departments collapsed in both Duzce and Kaynasli, and killed some firemen. There was some equipment such as power generators and machines available from the Marmara response operations[32]. The needed equipments, machines, and medical supplies were essentially brought by responding organizations, starting as early as the same night[33].

c. Implementation of Earthquake Codes

Failure in implementing the earthquake codes for building construction and soil analysis was an important reason for heavy damage in the 1999 Marmara earthquake. The same thing was true for the damage caused by the 1999 Duzce

[29] Interview with Duzce Health Department.
[30] Interview with Duzce Health Department
[31] Interview with Turkish Radio Amateurs Club
[32] Interview with Duzce Health Department
[33] Interview with Duzce District

Earthquake (Erdik 2000). However, Duzce Municipality was considering the enforcement of the building construction and development principals for reducing seismic risk before the Duzce earthquake[34].

Duzce district took another essential step that was identifying the major vulnerable facilities after the 1999 Marmara Earthquake. Although this effort was a part of general damage estimation made by the Public Works and Settlement Ministry, the public organizations and people were more conscious for not using risky buildings. Keeping away from the risky buildings significantly reduced the trauma to the public personnel after the Duzce earthquake[35].

8. CULTURAL CAPACITY

The response to the 1999 Marmara earthquake became a turning point in Turkish disaster management. The local communities had a fatalist perspective in the sense that they did not take significant predisaster action to reduce seismic risk. The symmetry breaking Marmara Earthquake facilitated a double loop learning that caused change in the governing assumptions of the disaster system. The earthquake struck the most developed and populated region of the country. The destructive impacts of the earthquake and the organizational and technical problems were extensively covered by newspapers and the broadcasting companies. The universities and research centers such as the Middle East Technical University, Istanbul Technical University, and Kandilli Observatory and Research Institute extended their efforts to inform people and organizations about seismic risk and ways to reduce it. The result was a tremendous public outcry for change. The policy makers finally found out that the linearly designed laws and regulations were not sufficient by themselves for reducing seismic risk. The central government started reviewing and implementing reform proposals that were presented before the Marmara Earthquake[36]. The provinces and municipalities were also under public pressure, and started taking new policy initiatives to reduce seismic risk, especially in the stricken communities (Balamir 2001). The Duzce earthquake reinforced the ongoing change (Corbacioglu 2004).

Although the change process just started, the experience of public and nonprofit organizations through learning of their members resulted in a different response and recovery operation. Especially, (1) the increased awareness of seismic risk; (2) understanding of the importance of timely information search, exchange, and dissemination; and (3) the experience that public managers and organizations gained on, when, how and, what to do helped a quick and timely response.

Public and nonprofit managers from different organizations and jurisdictions immediately reacted to the inflowing information about the Duzce earthquake. Having the experience of the Marmara earthquake, many organizations

[34] Interview with Duzce Municipality
[35] Interview with Duzce Police Department
[36] Interview with Middle East Technical University

and their personnel moved to Duzce without waiting a direct order, demand or approval from higher authorities.

Sakarya deputy governor was one of them. He immediately went to the logistic support center. The door was locked, because the day was already ended. He ordered his staff to break the lock. After loading the aid materials, he moved to Duzce[37]. Similarly, miners from the coal mines in Karabuk and Zonguldak did not wait for any order or help request from the Prime Ministry Crisis Management Center. Upon receiving information, they were organized and moved to Duzce for rescue operations (Cumhuriyet November 23 1999). Many former and newly established nonprofit organizations also did the same thing and provided timely professional and material aid for Duzce and Kaynasli[38].

The interviewee responses regarding the commitment of the local communities for reducing seismic risk also indicated a changing mitigation culture in the local communities after the Marmara Earthquake. Out of 20 respondents, seven or 35% stated that the level of commitment was to some extent, while two or 10% stated that it was to good extent. A majority of the respondents, 11 or 55% were still satisfied with the level of commitment (25 % for not to any extent; 30% for not at all). However, this was still an important development when compared with the interview responses from the Marmara earthquake. Out of 24 respondents, almost all respondents asserted that the commitment of local community for reducing the seismic did not exist at all (14 or 58%) or was not to any extent (8 or 33%) before the Marmara earthquake. Only two respondents or 9% stated that the commitment was to some extent.

9. CONCLUSION

The changing organizational, technical, and cultural conditions facilitated a pattern of double loop learning and adaptation during the 1999 seismic response operations.

The destructive Marmara Earthquake revealed the most critical problems of the Turkish disaster management system to both policy makers and the public. Although the Duzce Earthquake occurred at an early stage of the transition, public and nonprofit organizations and their managers already knew when and what to do in responding to the earthquake. Moreover, both the central government agencies and provinces started improving information infrastructure. Learning the importance of timely information, response organizations more effectively used the available information technology for faster reallocation of national and regional informational resources. The cultural change in the perception of information and its importance, as well as emphasis on self-response upon the received information also

[37] Interview with Sakarya Province
[38] Interview with AKUT

significantly contributed to learning and adaptation during the 1999 Duzce response operations.

Despite the organizational learning and steps taken to improve organizational and technical capacity before and after the Duzce earthquake, the Turkish disaster system has not achieved a self-learning and adapting sociotechnical system status yet. The multi organizational, multi jurisdictional and multi sectoral nature of Turkish disaster system requires the integration of critical actors for creating a dynamic system that can self-adapt itself to the changes in its environments during the regular and emergency times.

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