Recognizing Competitive Cultures: A case for describing the complexity of coordination between dynamic crisis response actors

John Sabou
Leiden University
john.sabou.js@gmail.com

Nadia Noori
La Salle - Ramon Llull University
nadias@salleurl.edu

Jerri Husch
The Graduate Institute Geneva
Jerrihusch@gmail.com

ABSTRACT

Crisis management frameworks are typically associated with concepts related to command and control or "hierarchical" decision-making. However, advancements in communication technologies and new media platforms have brought new prospects to the design of crisis management frameworks. Social media platforms, for example, enable volunteering citizens to actively take part in crisis response efforts. In our paper we explore comparing and contrasting two forms of crisis management frameworks: a formal, the well-tested Incident Command System of the US, and an informal example, the Community Emergency Response Teams (CERT) program. The goal of the paper is to outline potential ways to examine the disparities in network structure and collaboration linkages in different forms of crisis management frameworks.

Keywords

Crisis management, Incident Command Systems, organizational coordination.

INTRODUCTION

The majority of existing crisis management frameworks are organized in a centrally ruled hierarchy (US FRP, 1999; Richter, Huber & Lechner, 2002; Kapucu, 2009; CFRP, 2011). In such

frameworks organizational constellations operate within a structure called an "Incident Command System" (ICS). ICS is a number of protocols describing communication and coordination between response organizations. ICS is the "standard operating procedure" that is used in management and training for crisis response and is often used in military or other highly formalized institutions, to facilitate collaboration among different actors in a response group. However, such highly hierarchical arrangements of agency-to-agency collaboration frameworks have proven to fail in several occasions (Comfort, 2007; Kapucu, 2009).

With such failures and the current revolution in information technology and new media, it has become evident that there is a need to reconsider the design of response plans. In recent emergency situations, such as Hurricane Sandy 2012 or the Bombing of Boston Marathon 2013, and recent outbreak of Ebola in western Africa 2014, new actors have emerged in crisis management, that is, the involvement of citizens and citizen networks. The emergent involvement of citizen networks combined with new media has introduced a new set of influential actors and variables to the dynamic, and amorphous set of structures and processes of existing response procedures (Yates & Paquette, 2011; Hughes and Palen, 2014). Through peer communication, new citizen constellations of social networks have made important contributions to relief efforts in the form of information provision and direct engagement at the crisis zero point (Vieweg et al. 2008). The emerging influence of social networks drew our attention to the interaction dynamic of two fundamentally different ways of communicating, sharing information, and controlling activities. The two forms are found in different entities: 1) the formal, purposeful hierarchy (i.e. the government command and control function), and 2), informal, emergent structures (i.e. citizens and groups that comprise social networks). Given inherent differences in power, authority and responsibility, these new informal emergent collaborations would appear to be fraught with difficulties, yet they continue play an increasing role for emergency services. There is however a gap in understanding the differences in composition between these two models or their patterns of interaction, social structures, and dynamic processes that organizationally defines these two vastly different structures.

In this paper we use Action Research, social network analysis (SNA) and clustering techniques to begin this analysis and to understand evolving collaboration patterns in both formal (planned) and informal (ad-hoc) response networks.

METHODOLOGY

The goal of this paper is to offer an appropriate method and tools to examine the structures and processes involved with linking and aligning different "levels" of actors across and within multiple response networks (either agency or citizen) Figure (1) illustrates the inherent complexity of collaboration across sectors and organizations. As different "levels" of actors and activities exist around a crisis core, the relationship between citizens and organizations possesses unique properties that need to be understood. These "properties", i.e. the "who communicates with whom, where, when and why, are fundamental to understanding the

linkages that, when aligned and clearly coordinated, can make a multi-actor response to emergency successful.

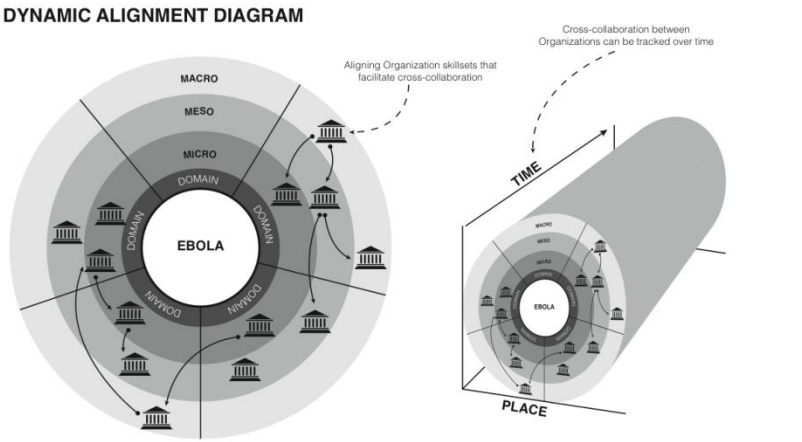

Figure (1) Multi-level organizational alignment in crisis management. Source: "Monitoring Complexity: Using "Action Intelligence" in the Ebola Crisis", from ICCM 2014 presentation, Husch, J. Visiting Fellow, Graduate Institute of International and Development Studies, University of Geneva.

In short, this wide spectrum of actors involved with emergency response, from macro institutions to micro individual creates a set of complex relationships that needs to be identified and their different contributions mapped and measured (Kapucu, 2005; O'Sullivan, et. al., 2013).

To begin, this paper views crisis management as a dynamic and ongoing complex set of social processes, which are the foundation of a constellation of activities that emerge between crisis managers groups and willing citizens under very critical circumstances. The process is viewed as dynamic and these emergent, yet ongoing sets of relationships require continuous assessment and analysis of the contributions from key actors in any crisis setting. There is an urgent need for a method that can response, assess and understand that ongoing dynamic (Calderon, Hinds and Johnson, 2013).

To study this dynamic, a combination of Action Research and network theory provides the foundation to effectively begin to evaluate the contributions of various actors and constellation alignments over a longitudinal study.

Systemic Action Research

Systemic Action Research (SAR) and Participatory Systemic Inquiry (PSI) for impact assessment (Burns 2006, 2007, 2011, 2012, 2013;Wadsworth 2001, 2010) is an action research methodology which embeds design, planning, action and evaluation into a single process. It is an iterative learning process, which supports real-time assessment across social systems. SAR can be embedded within programmes or layered into programmes later on in their development (Burns, 2007). PSI is a shorter process, which allows a system to be mapped as a baseline against which changes in the dynamics of the system can be assessed (Burns, 2012).

The first step of analysis is to understand and extract the relationships between different actors and their actions within a response network. Over time, patterns of interaction are repeated, and pathways are formed which are often made visible as norms. In complexity terms we can see these patterns as representing a

dominant 'attractor', which like a magnet, draws people into established patterns of movement and behavior. It is argued in this paper that even the ad-hoc system can follow a structured dynamic that can be organized around a tier-based structure yet it is not planned as in the formal systems (Calderon, et. al 2013).

NETWORK ANALYSIS

Despite the hierarchical design of the response plans, it has been observed that organizations follow a "net-centric approach" when it comes to the actual response to a disaster (Gerstner, Siegfried, Kratzke, 2010; Boersma, et. al, 2014). Net-centric approach means a decentralized, self-directed networks of heterogeneous actors, within an environment enabled by shared technological and organizational infrastructure (Moynihan, 2009; Boersma, et. al, 2014). Therefore, to understand the transformation between centralized environments to a decentralized one, we use Social Network Analysis (SNA) techniques to codify the relationships of organizational shift in a hierarchical environment. For the purpose of this paper, we looked at cluster formation inside structures of coordination as described in the ICS. The network analysis assists identifying and quantifying the coordination patterns beyond the formal and traditional organizational structure (Kapucu, 2005, Moynihan, 2009; Hossain & Kuti, 2010; Comfort, et. al, 2014; Boersma, et. al., 2014; Lanham, et. al., 2014).

In an attempt to quantify the decentralization levels in a network (or a community), we are measuring the degree of centrality of the agencies involved and calculating the possible cluster formation within the ICS network. Such analysis helps to understand the interactions among the sub-groups and how such groups function within the greater response network. (Kapucu, 2005; Hossain & Kuti, 2010). Finally calculating the modularity factor that measures the divisibility of a network (Jackson 2008; Kapucu, 2008; Fortunato, 2010).

AGENCY – TO – AGENCY COORDINATION

The ICS is a standardized on-site management system designed to efficiently handle incidents by facilitating coordination among a combination of personnel, equipment, procedures and communications. The ICS originated from the National Fire Academy in the United States where it was used to handle the wildfires in California and Arizona in the 1960's and 1970's (Bigley & Roberts, 2001; Kapucu, 2009; Moyhinan, 2009). ICS later was integrated within the National Incident Management Systems (NIMS).

Figure (2) shows an example of the ICS in 1999 where we can see that the response agencies are organized in a top-down command and control hierarchy. There are four main categories for the response groups (Operations, Planning, Logistics and Finance/Administration). Within each category there are a different a number of support agencies involved, and one (or more) agency is the primary coordinator.

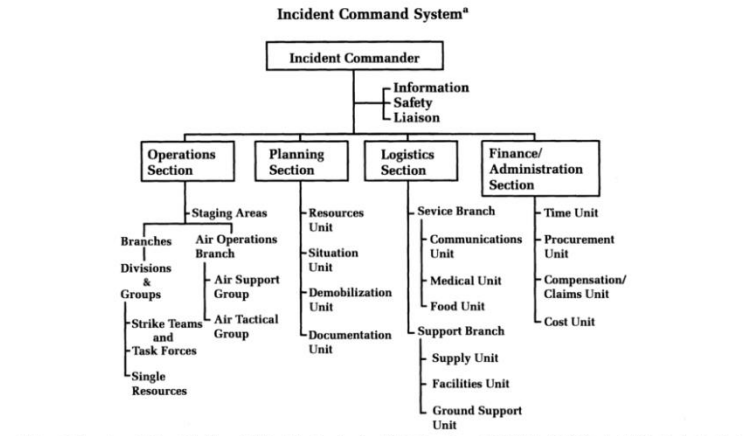

Figure (2) Example of the 1999 ICS. (Bigley & Roberts, 2001)

Since 1999, the United States ICS has gone through several changes geared toward decentralizing the collaboration and coordination activities within the response agencies (Kapucu, 2009, Moyhinan, 2009, Comfort, et. al., 2014)). The results can be seen in the more recent ICS structures where the concept of Emergency Support Function (ESF) is introduced.

ICS - EMERGENCY SUPPORT FUNCTIONS (ESF)

The ESF facilitates a flexible coordination framework for the Federal inter-agency operations in crisis management. The ESF is a manifestation of decentralizing ICS plans where organizations are grouped based on the functionalities executed by these organizations during crisis response operations. Figure (3) illustrates a snapshot ICS that was part of 2003 Federal Response Plan. The ICS consists of 12 ESF's based on functionality and each ESF there is a number of agencies listed as supporting members that will be engaged in tasks related to the specifies ESF (e.g. DoD under transportation). These organizations would operate under the command of a primary agency as a coordinator (e.g DoT is a primary agency). We can also notice that an agency can be involved in more than one ESF, such arrangement has its own impact on the flexibility of the response operations (e.g. USDA is a support agency in 10 ESF and Primary in 2).

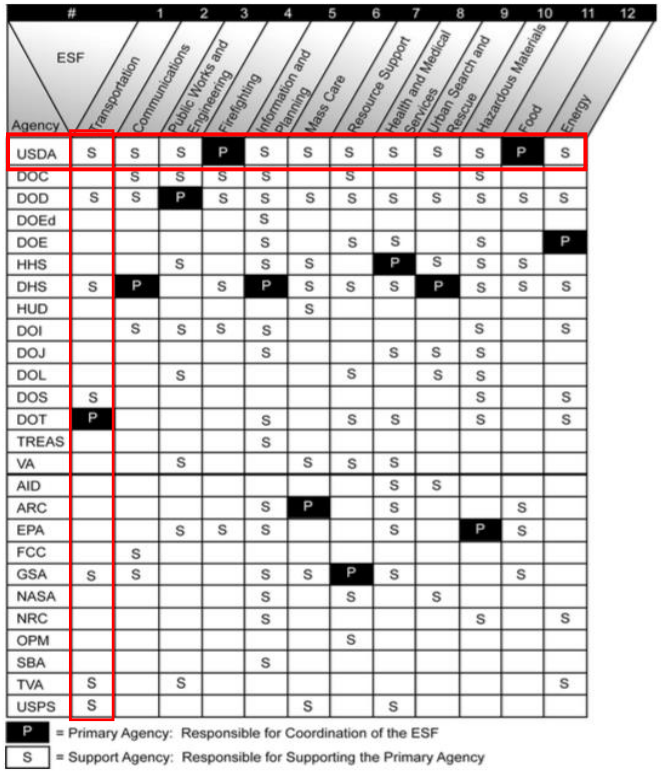

Figure (3) Emergency Support Functions (ESF) Designation Matrix. Source: Federal Response Plan, January 2013.

Table (1) represents a summary of the ESF's in the 2003 ICS and the number of organizations to coordinate within each ESF.

	Emergency Support Function	Primary coordinator	No. Of agencies
1	Transportation	DoT	8
2	Communications	DHS	7
3	Public Works and Engineering	DoD	9
4	Firefighting	USDA	6
5	Information and Planning	DHS	17
6	Mass Care	ARC	9
7	Resource Support	GSA	11
8	Health and Medical Services	HHS	13
9	Urban Services and Rescue	DHS	8
10	Hazardous Material	EPA	13
11	Food	USDA	7
12	Energy	DoE	9

Table (1) ESF and the associated primary and support agencies.

ICS NETWORKED VIEW

In order to examine the ICS in its networked format, we have applied the SNA. Later, to examine the structure of the network, we used a clustering analysis to the ESF matrix to take a closer look at the planned structure of the ICS network. Table 2 is a summary of the cluster analysis, the results showed that there were 14 clusters in the network with size ranges from 6 – 26 node per cluster. Example of that, the USDA was the representative of cluster size of 25. The

cluster of 25 nodes scored 4 for the frequency, that means there are 4 other agencies could be involved in such structure, e.g. DHS (Department of Homeland Security).

	Cluster size	Representative	Frequency
1	6	FCC	1
2	8	HUD	1
3	9	OPM	1
4	13	TVA	1
5	14	AID	1
6	15	DOS	2
7	16	DOL	3
8	17	DOEd	3
9	18	NASA	1
10	20	DOI	2
11	21	DOJ	1
12	22	DOC	3
13	23	HHS	2
14	25	USDA	4

Table (2) Clustering results of the ESF's for 2003 ICS.

Another measure of the inter-connectivity is the degree of centrality, which shows the level of dependencies in coordination efforts within the planned system. In general, the primary coordinator agencies had scored high degree of centrality (between 23-25). A number of support agencies had a high score on centrality like DOJ (Department of Justice) with 22. See Figure (4).

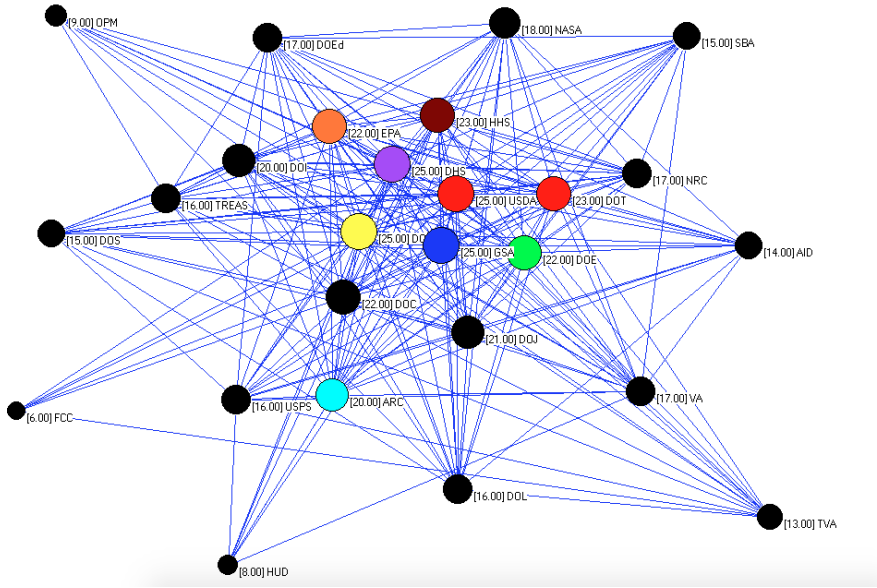

Figure (4) ESF-ICS 2003 network graph including degree of centrality.

From the network graph we can observe the formation of a core group of highly connected agencies with scored between 25 – 23 degree of centrality. A first tier of secondary support agencies with high centrality values (between 22-20), such as DOC and DOJ indicates that such organizations play important role in the response

network despite the fact they are not a primary agency. The other support agencies with score between 6-17 formed a second tier for the response structure.

Another measure to gage the decentralization in the coordination matrix of agencies is the modularity, where ESF 2003 network scored -0.058 on modularity that shows the poor distributions among the agencies, as they are still highly interconnected.

AGENCY – TO - CITIZEN COORDINATION

In contrast to a formal response by established agencies, another model of response has been introduced, that of the "Community Emergency Response Team". See figure (5).

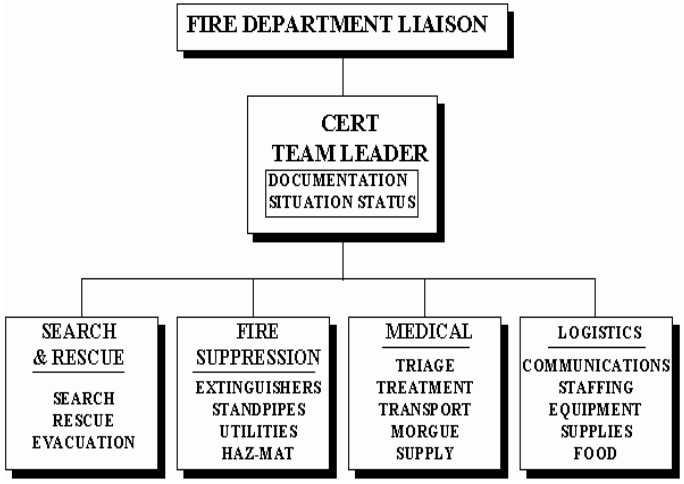

Figure (5): [Newport Beach Fire Department C.E.R.T. liaison model]. Retrieved from http://nbcert.org/disasterpreparation.htm. Last accessed January 29th, 2015.

In this model, following a major emergency, citizens will rely on each other for help in order to meet their immediate life saving and life sustaining needs. This was the case following the 1985 Mexico City earthquake where untrained, spontaneous volunteers saved 800 people. Immediately after the first shock, there was an enormous response and solidarity among the city population of 18 million people. Ordinary citizens organized brigades to help with rescue efforts and to provide food, clothing and emotional support to devastated communities (Soberon, 1986). However, 100 people lost their lives while attempting to save others. Preparing a citizenry with basic skills needed to interface with first responders and/or life saving and decision making skills creates the ideal response both for the people and the government that serves them. As such, there is a growing trend of empowering citizen constellations of purposeful volunteers as stakeholders in the crisis response and decision process. The role of these "citizen teams" can be both on the ground with physical involvement or as a new form of "support mechanism".

REACHING BEYOND THE AGENCY

For organizations that place mission value in citizen input and stakeholder engagement, benefits can be gained from connecting with stakeholders internal and external to the agency and communicating within the local, regional, and national communities.

The citizen network can form an extension to the tiered structure of the ICS where civilian groups take an active part of the response efforts. With such a proposition however, the challenges to the

integration of citizens and citizen networks into the response plan emerge. For example the credibility if information sources and the use of social media for situational awareness purposes is often unwieldy, and draws skepticism from those who are concerned with the verification of such information. In 2010, for example the US Army posted Techniques Publication 2.22.9, Open Source Intelligence, establishing a doctrine which, "highlights the characterization of OSINT as an intelligence discipline, its interrelationship with other intelligence disciplines and its applicability to unified land operations," according to the service's Intelligence Center of Excellence (Carr, 2013). However, an Army source confirmed that the classified publication "does not address social media. (Hodges, 2012)".

The US PrepareAthon, sponsored by the Federal Emergency Management Agency (FEMA) can be seen as an example of creating this extra tier. It is an ambitious Agency to Agency/ Agency to Citizen collaboration network (See: "United We Serve"). The PrepareAthon enables individuals and organizations to prepare for specific hazards through informative presentations, group discussions and activities, and tabletop exercises. Organizations have tremendous influence on their members and constituents when it comes to preparing for a disaster (See: America's PreparAthon)[1].

Case Study: Bedrijfshulpvereleners (BHVs)2: Citizen volunteer clusters in the Netherlands

Similarly, the Netherlands is making efforts to implement better-informed crisis management models under the Occupational Health and Safety Act3, which requires every company and institution to ensure proper emergency services training to an individual or group of individuals in their employ so action can be taken during an emergency to prevent loss of life and property damage. The number of operating BHVs within a company depends on the company size, risk assessment, and evaluation. Once certified, a BHV has limited authority coordinate with authorities during an emergency (BHVCase).

One of the research project objectives is to assist one BHV working group to design effective protocols to integrate the BHV network of volunteers within the formal emergency management framework in the Netherlands (GRIPS). This represents an ambitious grassroots endeavor that connects fellow BHVs to each other and their formal counterparts.

One of the steps in that direction was a decision to acquire an ICT platform that would facilitate coordination among the working groups within BHV network yet applicable to all students and staff at the University. Hypothetically, the desired phenomenon would

1 "America's PrepareAthon: an opportunity for individuals, organizations, and communities to prepare for specific hazards through drills, group discussions, and exercises."[FEMA/DHS: Ready Campaign]. 500 C St, Washington, DC. Retrieved from http://tinyurl.com/lxeqne8. Last Accessed January 22nd, 2015

2 ["BHVNederland, uw partner in BHV certificating."] BHVCase: PANGEA I.m. Retrieved from http://tinyurl.com/myyvtx2. Last accessed September 22nd, 2014.

3 "BHVNederland, uw partner in BHV certificating." BHVCase: PANGEA I.m. Retrieved from http://tinyurl.com/myyvtx2. Last accessed September 22nd, 2014

include a special purpose MissionMode Situation Center4 designed to support emergency services with ICT driven situational awareness by providing a common operational picture across all involved parties in the crisis response effort . This would help coordinate work between the "official" response agencies and BHV certified working groups.

PROJECTED RESULTS AND CONCLUSION

Using the models we have presented, and judging the value of similar data conducted in related studies, this paper anticipates that the lack of a formal command and control structure in the BHV case will yield interesting results regarding the emergence process of nascent collaborative networks. Tracing the emerging "working groups" and observing the growth of that network over time will enable better understanding through SNA.

If this logic holds true it may lead to a richer understanding of how building reliable interface between organizational entities of varying hierarchy and composition, and as such seeks to enlighten a standardized framework for dealing with these interactions. Or at the very least open discussion in decision making circles to the possibility of revisiting existing models to consider a more decentralized approach to crisis management in the Netherlands.

4 Incident Management: MissionMode Situation Center. Kruisboog 42 3905 TG Veenendaal The Netherlands. Retrieved from http://tinyurl.com/n7yf3w5. Last accessed December 21st, 2014.

From that we conclude that citizen networks play an important role in crisis response, yet organizing such collective efforts requires richer explanation to consider a formal integration as natural extensions within existing emergency management frameworks.

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