# USAGE OF SOCIAL NETWORK ANALYSIS (SNA) IN CRISIS MANAGEMENT

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**ABSTRACT.** Social systems are complex structures that consist of different sub-systems. Therefore, understanding social systems is more difficult than comprehending electronic or mechanical systems. What makes social systems more complex than other systems is that society is not simply the sum of each individual in the society. In the current global system, the countries, which have become small villages, try to meet national security needs by converting the unknown to known and identifying the correlation among political, military, social and economic events. The current crisis management concepts are conducted through systematic approaches. Besides, the management of social, economic and political crises need to be conducted in a holistic approach covering all sub-systems. At this point, the function of Social Network Analysis (SNA) emerges. SNA, which forms the main subject of this paper, is a tool for examining the structure of a crisis through correlating the sub-elements. The aim of this study is to show how SNA can be used in crisis management. First, SNA is performed on a generic crisis situation and the results are presented. Then, the additional critical data requirements are put forward to manage the crisis effectively.

## Introduction

Hosting different systems of social systems makes them to possess a complex structure. Thus it is harder to understand social systems than electronic and mechanical systems. With a simple glance, what makes them more complicated is that society is not only the sum of individuals. It could be paraphrased by a well-known slogan "The whole is only the sum of the constituent parts." (Abacı, 2013, p. 35). Today more closely connected global networks revealed highly dependent systems which are hard to understand.

Networks are methods revealing complex systems, which emerge by the interaction of the components, visually. Linearity is very rare in their nature. Understanding and expressing the structure of the non-linear necessitate the drawing of complex networks, classification, analysis and interpretation (İpekçi, 2011, p. 23). A network consists of nodes and links connections. To mention a network, at least two nodes should be connected. The majority of the nodes in the network is an indication of major networks.

Social network theory identifies the interrelations of the units ranging from person to organizations. It is a theory that focuses on the way of configuring the flow of information in order to produce information for an individual or group. According to this theory the relation between individuals creates social networks (Arslan, Yanık, 2015, p. 69).

Social Network Analysis (SNA) is a frequently used method in sociology, anthropology, social psychology, biology, geography, communications, information, business and in many areas such as economy. SNA facilitates to determine the important information that could be missed. It reveals the balance of power in crisis management. It shows the subgroups. It finds the elements that will change the network greatly when removed and it pursues the improvement of the change of the network with time.

## The Relation of Crisis Management and SNA

Crisis is defined in Merriam-Webster as the turning point for better or worse in an acute disease or fever; a paroxysmal attack of pain, distress, or disordered function; an emotionally significant event or radical change of status in a person's life; the decisive moment; an unstable or crucial time or state of affairs in which a decisive change is impending; especially: one with the distinct possibility of a highly undesirable outcome; a situation that has reached a critical phase (see: the Merriam-Webster İnternet Site).

According to JP 3-0 Joint Operations, crisis is an incident or situation involving a threat to the United States, its citizens, military forces, or vital interests that develops rapidly and creates a condition of such diplomatic, economic, or military importance that commitment of military forces and resources is contemplated to achieve national objectives.(JP 3-0, 2011, GL-8).

Crisis does not have a common definition shared by everyone. The variety of crisis, levels, strategies and the way of management differs according to the interests of countries, or organizations. While the USA, EU and NATO call the crisis management process "crisis management", the UK calls it Emergency Management. The OSCE uses Conflict Prevention and Termination. Turkey uses Emergency and Disaster Management. (Arpat, R. Sait, 2016, p. 5)

Contemporary crises are emergency situations that cannot be determined at first, in which relations of cause-result cannot be set properly, and implications that cannot be determined. The crises can be managed better by some analysing tools in case of difficulty to estimate the size of expected damage.

SNA can be applied in crisis management:

- To determine limits of crisis,

- To determine hazards regarding crisis,

- To provide flexibility to decide during crisis,

- To determine crisis dynamic structure and interconnected factors,

- To eradicate equivocality related with crisis,

- To determine end states.

SNA can be used in the context of system approach to understand the complex systems as crisis. It opens new perspectives to understand complex systems as market, economical systems social systems, crime and terrorist networks. To analyse the crisis with SNA, detecting the dynamics and the structure       with       a holistic view is necessitated (Goztepe, Kerim, 2015, p. 57). By this way the points that are affected by the crisis can be detected.

There are some different processes in crisis management. Crisis management consists of six phases shown in the result of the literature review (Arpat, R. Sait, 2016, p. 180).

a.  Preparation, determination and pursuit possible or current crises;
b.  Assessment;
c.  Development of response options;
d.  Planning;
e.  Execution;
f.  Termination of the crisis and transaction phase.

Social network analysis is a tool that can be used at the first three phases of the crisis management process. At the first phase the crisis network must be improved to generate situational awareness after gathering information regarding the crisis through PMESII systems. In this context the relations of the PMESII units should be put forward clearly. In this way the measures against crisis could be detected realistically.

At the second phase data is assessed and information is determined. The second phase (assessment) is the process in which how the crisis proliferates is examined, what its action of process development is and how its context is composed. A reaction to a crisis that has a diameter of effect and structure that is not known may not bring positive results. That timeline is the period in which the bases of reaction to the crisis have begun to be formed and the response road map is set.

At the third phase is the decision about using the SNA and hard/soft power. In this context the options are analysed with SNA. To determine the strategies for managing the crisis is the most critical issue for the decision-makers. It should not be forgotten in crisis management that a reaction to a crisis can affect the other factors. In this case, an action which is not implemented by a determined strategy can give rise to bigger and more serious crises. As a result of it, one can make the crisis bigger while the main aim is to end the crisis. That situation carries enormous risks. An operational fault performed in this phase can result in the loss of lives. Ultimately it may put the crisis management in a difficult situation.

Understanding of the effects of a crisis to the systems and their interaction with each other determines the effects of actions to the crisis. Understanding PMESII systems makes it easy to cooperate with other organizations.

**SNA Terms**

To comment on the results of the SNA some terms should be known. In addition to the variety of terms of SNA, some terms required to comment on the crisis network are shown in the following.

The effect of a network is assessed according to the intensity and distance of the network. Intensity of a network examines the quality of connection by comparing the available connection

number and probable connection number. Distance measures the number of "scheme". Measuring the distance of a network helps to understand how knowledge transmits in a network. Distance impedes the proportion of knowledge due to lessening the probability of successful interaction.

Centrality is a criteria related with any node in the network. In a crisis network, the elements in the centre are more influential than the non-centric and have more effect in crisis solution. Centrality generally can be measured in three terms as "degree", "closeness" and "betweenness".

A unit's degree centrality shows the number of connections the unit has. Closeness centrality is a unit's direct or indirect closeness to another unit and it reflects connection. Betweenness centrality is the degree of unit's position among the other units, which do not have any connection with each other. High betweenness centrality shows its importance about being a bridge between the other. (Gürsakal, 2009, pp. 92-94).

**Methodology**

A network consists of interconnected nodes and links in SNA. Nodes represent concrete elements, which can be affected by crisis or have direct impact on crisis. Links are functional relations between these elements. Links establish the connection between the nodes to work collaboratively as a system. Both nodes and links are symbolic representations simplifying the complexity of the real world. They are also very useful in determining the centre of gravity and the factors that they influence upon.

A crisis network has been developed through determining all-important elements of PMESII system and sub-systems in a good example of crisis management. Understanding the interactions and relationships of systems with each other over time reveals how crises affect other systems. SNA can be used in order to reveal the

relationship between elements of national power and the connection of elements with each other in crisis management.

Identifying the all nodes and links during the creation of the crisis network is a difficult process. Besides, all the identified nodes and links may not be related to the current crisis (Karaman, Çatalkaya, 2015, p. 4). Defining nodes and links correctly in an exact time improves the effectiveness of the crisis response strategy and reduces the response time.

Detection of more nodes will increase the benefits to be derived from crisis network. Different methods can be conducted in detection. This article has utilized PMESII sub-elements for the detection of nodes. Alternative methods may include (JDP 5-00 Joint Doctrine Publication, July 2013):

> PESTL – Political, Economic, Social, Technological, Legal.
>
> STEEPLEM – Social, Technological, Economic, Environmental, Political, Legal, Ethical, Military.
>
> ASCOPE – Areas, Structures, Capabilities, Organization, People, Events.

The sample shows a crisis network and the nodes in the network which was detected by using PMESII method:

- Political Points: Advisers, governors, mayors, courts.

- Military Points: Leaders of different levels, plans and orders, air defence systems, critical land, and ammunition depots.

- Economic Points: Banks, companies, trade unions, markets, ports, smugglers.

- Social Points: Ethnic groups, tribes, clans, religious groups, unions, associations, cultural centres, health centres.

- Infrastructure Points: Nuclear power plants, hydroelectric plants, dams, oil and gas pipelines, railways, air and sea ports, related factories, hospitals.

- Information Points: Plans and orders, newspapers, ministry of information, press and media, intelligence agencies, information technology centres, websites, etc.

Nodes and links have both horizontal and vertical directions. Nodes and links to be focused upon are determined in accordance the severity and type of crisis. In this case, the crisis network can consist of only a few nodes or may include much greater number of nodes.

Links are the relations between the dots. The graphical representation of dot-link relationship demonstrates some important dots that should be influenced. The number of the links of the dot with other dots displays the importance of that point.

Network Analysis shows the relationship between the factors and actors in a chart. These links or relations are a part of the group. They can represent different forms of interaction that include role-based, interactive and effective relationships. Dots are represented by circles and the colours show a particular system. The size of the dots varies according to their importance. Connections are indicated by lines.

## PMESII Interaction Network

The interaction network that shows the interaction of the sample PMESII elements is shown in Figure-1. In this figure every element's primary related element and the possible element that it can affect in an emergency is shown related with each other. In Figure-1 the interaction of the 93 PMESII elements in the PMESII interaction network is shown. There are 391 links in the network. The work can determine more PMESII elements through the time and location.
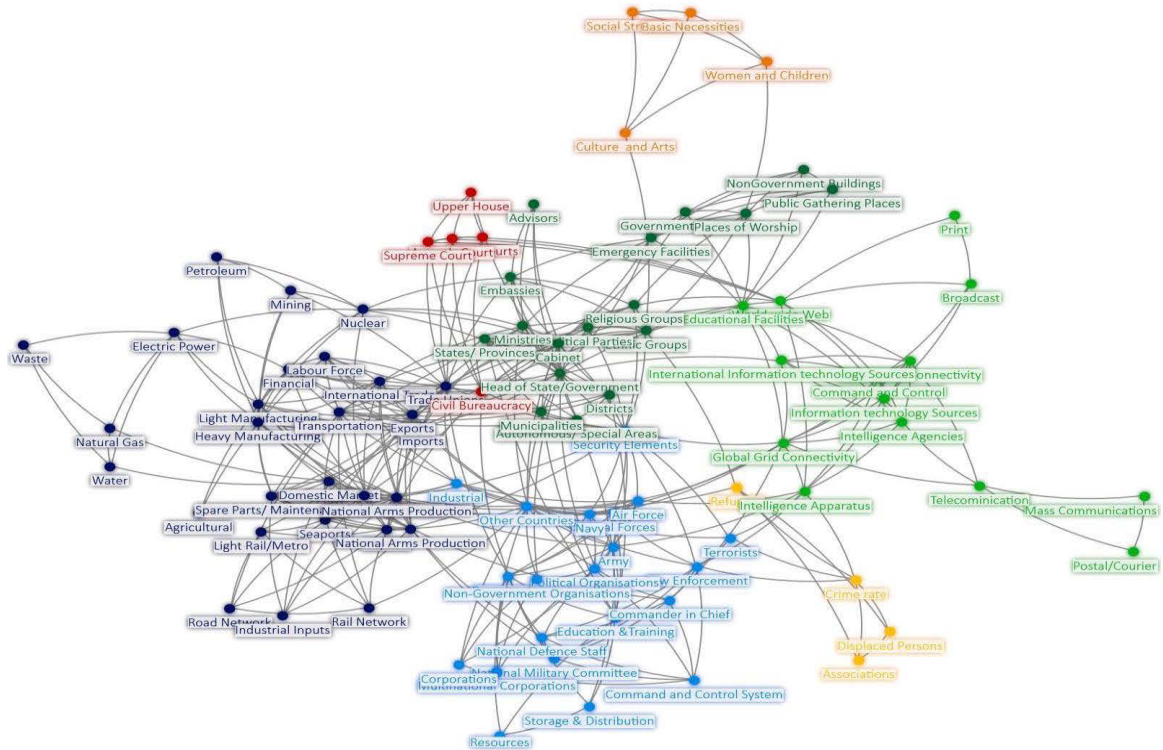
**Figure 1.** PMESII Interaction Network.

## 2005 London Bombings

After the 7 July 2005 bombing in London the aspects of administration, transportation, homeland security, sanitary system, economic system,    network, broadcast and etc. system were paralyzed. Due to the case different measures were taken by the UK       government.    For    detailed    information (http://en.wikipedia.org/wiki/Reactions_to_the_2005_London_ bombings, 12.05.2015) address can be checked.

The crisis network of the London bombings is shown in Figure-2. The measures detected from the sources are used in detecting the elements affected by the crisis. These elements are the primary elements in the crisis. The elements affected by the measures and the primary affected elements and the other elements' relations are shown in the crisis network. The indirectly related elements with the crisis should be informed bound to the speed of improvement of the crisis and measures should be taken. By taking measures in the elements of the affected elements a proactive behaviour will be taken.

75 elements that are thought to be affected from the terrorist attack and 319 relations among the elements are detected. The degree, closeness, betweenness and centrality analysis are made on the terrorist attack. The 20 elements those have the highest values of closeness, betweenness and centrality, which are detected after the analysis of the generated crisis network are shown in the Table-1.
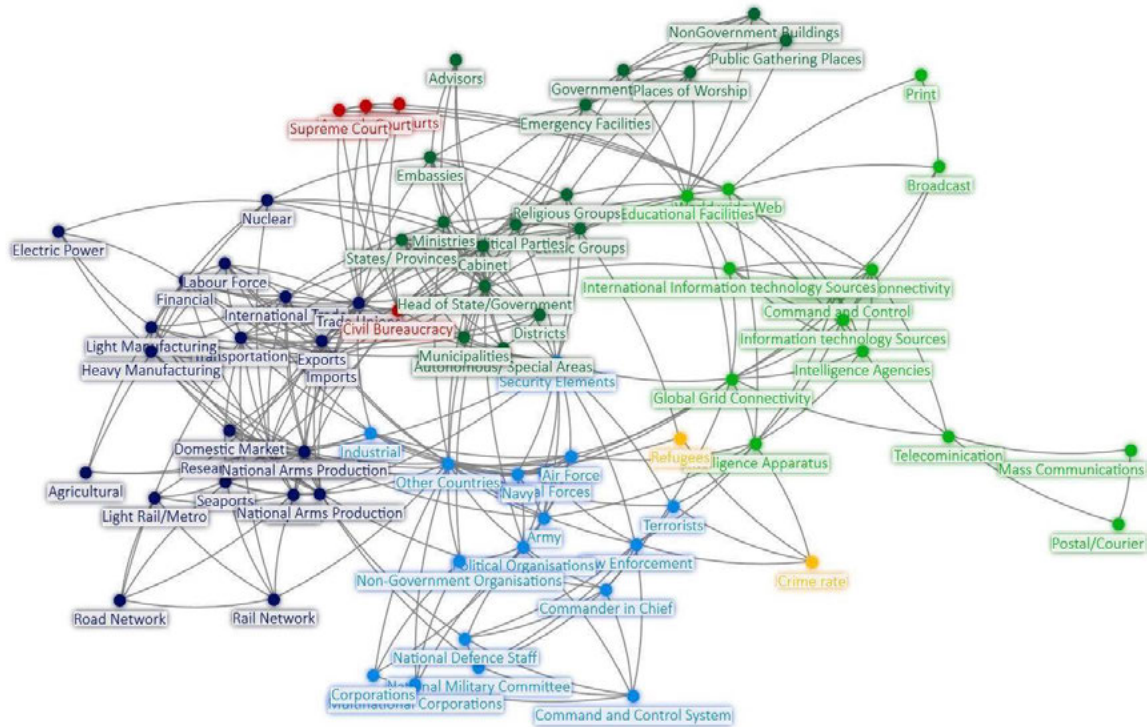
**Figure 2.** 2005 London Bombings Crisis Network

**Table 1.** Social Network Analysis Results

| | DEGREE CENTRALITY | | BETWEENNESS CENTRALITY | | CLOSENESS CENTRALITY | |
|---|---|---|---|---|---|---|
| NO | PMESII ELEMENTS | VALUE | PMESII ELEMENTS | VALUE | PMESII ELEMENTS | VALUE |
| 1 | Head of State/Government | 19 | Head of State/Government | 335,8281 | Security Elements | 0,006897 |
| 2 | Trade Unions | 19 | Global Grid Connectivity | 304,1108 | Head of State/Government | 0,006757 |
| 3 | Cabinet | 18 | Trade Unions | 276,0478 | Other Countries | 0,006667 |
| 4 | Research and development | 17 | Security Elements | 256,1592 | Cabinet | 0,006579 |
| 5 | Security Elements | 16 | Cabinet | 238,2472 | Trade Unions | 0,006452 |
| 6 | Exports | 15 | World wide Web | 174,3688 | Exports | 0,006369 |
| 7 | Imports | 15 | Educational Facilities | 160,8124 | Imports | 0,006369 |
| 8 | National Arms Production | 14 | Telecommunication | 144 | Ethnic Groups | 0,00625 |
| 9 | Global Grid Connectivity | 13 | Ethnic Groups | 130,7681 | Ministries | 0,00625 |

| 10 | Transportation | 13 | National Arms Production | 119,2723 | Air Force | 0,006211 |
|----|----------------|----|--------------------------|----------|-----------|----------|
| 11 | International Trade | 13 | Intelligence Apparatus | 113,4945 | Special Forces | 0,006173 |
| 12 | Ministries | 12 | Research and development | 112,3825 | Navy | 0,006061 |
| 13 | Financial | 12 | Political Organizations | 98,61913 | Global Grid Connectivity | 0,005952 |
| 14 | Civil Bureaucracy | 12 | Transportation | 91,41306 | Civil Bureaucracy | 0,005917 |
| 15 | Political Organizations | 12 | Law Enforcement | 85,9523 | International Trade | 0,005882 |
| 16 | National Arms Production | 12 | Civil Bureaucracy | 81,50439 | Political Parties | 0,005848 |
| 17 | Educational Facilities | 11 | Exports | 77,91196 | National Arms Production | 0,005814 |
| 18 | Ethnic Groups | 11 | Imports | 77,91196 | Religious Groups | 0,005814 |
| 19 | Airports | 11 | Int. Info. Tech. Sources | 71,68685 | Research and development | 0,00578 |
| 20 | Heavy Manufacturing | 10 | Airports | 68,93757 | Airports | 0,00578 |

The element with the highest value in the table is Head of State/Government. Head of State/Government is the most affected unit by the terrorist attack and it is the element that will play a maximum role in managing the crisis. Trade Unions are among the elements that are most affected by the crisis of commercial organizations and have a significant role to terminate the crisis.

The degree centrality indicates the links of the element. Looking at the degree centrality analysis Head of State/Government is seen to be associated with the greatest number of elements. Head of State/Government's activity in solving the crisis will naturally affect the elements that are directly linked.

An element's betweenness centrality is the degree of being among other elements. Having a high degree of betweenness indicates that the element serves an important coordinating role in the network. Head of State/Government is the most important unit to ensure coordination between the elements. Also Global Grid Connectivity and Trade Unions can play an important role to synchronize the other elements.

The degree of closeness centrality is proximity to other elements, either directly or indirectly. Security Elements are closest to the other elements in the crisis network. Even if they are not associated directly they are close to other elements and affect them.

Results of the analysis revealed which elements have the coordination tasks and orientate elements and which elements must be taken measures firstly during a crisis. In the phase of the Development of response choices, tasks can be assigned.

## Conclusion

As a result, using analysis tools at the three phases of crisis management as respectively preparation, identification of the possible/current crisis; assessment and development of the response options gives the possibility of an effective management.

This study shows the importance of the exposure of the interrelations and the analysis of the elements. This analysis is done through different values as degree, betweenness and closeness. The analysis enhances the situational awareness of the managers and brings out the measures to be taken by the help of the crisis network. The detection of the core elements provides the effective distribution of the time and resource efforts. The execution of the crisis response plan considering SNA increases the effectiveness of the plan. Apart from crisis management SNA can be used in different functions. The important case is the detection of the elements that are affected by the process and putting forward the realistic interrelations.

While implementing the crisis action plan new elements can show up. In the reaction process everything could be assessed carefully. At the same crisis the reaction process is around 24 hours but some urgent crises need to be handled even in minutes. The time and the way the crisis erupts are not clear. Thus, it is necessary to be ready for the crisis all the time and crisis management plans should be kept updated.

## Bibliography

Abacı Zeynep Dörtok, "Bilgi Çağında Tarihçi Olmak": Sosyal Ağ Analizi Yaklaşımı ve Osmanlı Tarihi Çalışmaları", 2013.

Arpat, R.Sait, Acil Durum ve Kriz Yönetimi (Emergency and Crisis Management) NATO, AB, ABD, Birleşik Krallık Analizleri ve Türkiye Modeli, Gece Kitaplığı Yayınları, 02 Şubat 2016.

Arslan Çetin, Yanık Murat, A New Discipline of Intelligence: Social Media, ICMMS, 2015.

Birmingham threat 'real' – police, BBC News,10 Temmuz 2005, Accessed on: 16.04.2015

Gürsakal Necmi, Sosyal ağ analizi, Dora Yayınları, Bursa, 2009.

Goztepe Kerim, Recommendations on Future Operational Environments' Command Control and Cyber Security, 2015.

İpekci Hülya, "Günümüz Çatışmalarında Sosyal Ağ Analizinin İstihbarattaki Önemi", Postgraduate thesis, 2011.

http://en.wikipedia.org/wiki/Reactions_to_the_2005_London_bombings,12.05.2015, Accessed on: 16.04.2015.

JP 3-0 Joint Operations, 11 August 2011.

JDP 5-00 Joint Doctrine Publication, July 2013.

Merriam-Webster Web page, http://www.merriam-webster.com/dictionary/crisis, Accessed on: 18.08.2014.

Metropolitan Police Service – Homepage". Met.police.uk, Accessed on: 16.04.2015.

Karaman M., Çatalkaya H., Institutional Cybersecurity: A Case Study of Open Source Intelligence and Social Networks, ICMMSS, 2014, s.

Reports of an incident at Liverpool Street Station, 7 Temmuz 2005, Accessed on: 16.04.2015.

'Queens of the Stone Age'. The Guardian (London), 26 Ağustos 2005, Accessed on: 16.04.2015.