Proceedings of the 2013 Industrial and Systems Engineering Research Conference
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Social Network Analysis for Humanitarian Logistics Operations in Latin America

Abstract ID: 1416

Abstract

This paper uses Social Network Analysis as a tool for the analysis of communication patterns in organizations involved in humanitarian logistics operations in Latin America. The objective of this paper is to present a methodology to compare communication policies and patterns in order to define and analyze network structures in three different countries in Latin America: Mexico, Panama and Chile. Social Network Analysis consist of the use of network topologies to map and measure relationships and flows between people, groups, organizations, or other information/knowledge processing entities. Measures such as centrality degree, closeness, and betweenness among others, will be translated into measures of efficiency and effectiveness among the organizations, institutions and individuals involved in humanitarian logistics in these countries to help generate knowledge about best practices and procedures applied in each of these countries.

Keywords

Social Network Analysis, humanitarian logistics, communication patterns, structural analysis.

1. Introduction

The increase in natural and man-made disasters in the recent years has highlighted challenging problems in humanitarian operations, in addition to major long-term humanitarian development challenges [1]. According to Tatham and Houghton [2] the last decade has seen a significant increase in the number of disasters affecting the world from a figure of around 220 per year in the mid-1990s, to a current annual figure of some 350-400. The primary goal of humanitarian organizations is to limit human loss and suffering by quickly restoring acceptable living conditions prior or after natural and man-made disasters [3].

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Humanitarian aid operations are complex in nature, connecting several different sectors, actors, and spheres of activity. Logistics is a crucial area in preparing for, and responding to, unwanted events and encompass purchasing, transport, distribution and storing of food, water, shelter, energy, etc. A multitude of different organizations participate within a framework of heterogeneous interests and priorities from donors, aid agencies, local and national authorities and the international society. Duran et al (in [1]), list the stakeholders in a humanitarian supply chain as the affected population, governmental institutions, NGOs, commercial institutions, and donors.

This paper aims to present a methodology for the analysis and definition of communication patterns and practices between agencies, organizations and institutions coordinating and executing disaster management, including but not limiting to planning, acting and controlling humanitarian relief before, during and after the disaster has occurred.

To reach this goal Social Network Analysis (SNA) will be used to study and understand how communication is conducted among the organizations involved in disaster management. The notion of SNA is based on relationships among social entities, and on the patterns and implications of these relationships [4]. From this approach, the social environment can be expressed as patterns or regularities in relationships among interacting units. These patterns are called structures and the variables and quantities that measure these structured are called structural variables.

2. Literature Review

Thomas and Mizushima in [1] refers to humanitarian logistics as “the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials, as well as related information, from the point of origin to the point of consumption for the purpose of meeting the end beneficiaries' requirements (p. 20)." On the other hand Apte, also in [1] define humanitarian logistics as “the special branch of logistics managing response supply chain of critical supplies and services with challenges such as demand surges, uncertain supplies, critical time windows and vast scope of its operations (p. 29),"

Kovács and Spens [5] summarize crucial characteristics of humanitarian logistics to consist of the unpredictability of demand, in terms of timing, location, type, and size; suddenness of the occurrence of demand in large amounts but with short lead; times for a wide variety of supplies; high stakes associated with the timeliness of deliveries; and lack of resources in terms of supply, people, technology, transportation capacity, and money.

Hence, humanitarian logistics emphasizes not only on preparedness for and response to natural and man-made disasters, but also to involves logistics activities related to preventing, reducing, preparing for, responding to disaster or recovering from human suffering and environmental and financial effects due to a disaster or a long-term development issue. Further, challenges in humanitarian logistics are immense since in many cases the disaster unfolds with little warning. To respond to the needs of populations in need and at risk, humanitarian organizations manage three distinct types of supply chains: development, recovery and emergency supply chains. Thus, preparedness and communication between agencies and organizations coordinating humanitarian logistics is a key issue in humanitarian relief.

Humanitarian organizations engage in a mix of development and relief activities. Relief refers to the emergency food, shelter and services provided in the immediate aftermath of a natural or man-made disaster. By contrast, development refers to the longer-term aid aimed at creating self-sufficiency and sustainability of a community. Research has shown [6],that environmental factors, such as the unpredictability of disasters, and the nature of funding have resulted in logistics operations highly uncoordinated, with fragmented communication between stakeholders; thus, affecting relief and development activities.

As Howden [7] affirms, information plays a significant role in humanitarian logistics. Since there is a decoupling between the end recipient of aid and the providers, the providers have no influence on what the beneficiary receives. As supplies are determined external assessment of the needs, it is necessary to evaluate with more detail the fulfillment of needs since additional analysis and information coordination is needed to determine if the needs have been timely met by the supplies and relief effort. Activities such as procurement, warehousing, fleet management, transportation of people and supplies, asset management, security, information and communications, among others, are usually included in humanitarian logistics and are normally individually provided by different organizations and agencies involved in the relief process.

Although disaster management involves several stages [8] (Preparation, response, reparation and mitigation), humanitarian logistics is related with the response and reparation stages. The response phase refers to the various operations that need to be instantly implemented after a disaster occurs. According to Cozzolino [8] the objectives of this stage are:

- To immediately respond by activating the ‘‘temporary networks,
- To restore in the shortest time possible the basic services and delivery of goods to the highest possible number of beneficiaries.

In the response stage, coordination and collaboration among all the actors involved in the humanitarian emergency deserve particular attention. Connections to feasible donors, suppliers, NGOs, and other have to be activated when the catastrophic event takes place. Then, all the actors involved operate as quickly as possible, at any cost since the first 72 h are crucial [8].

The reconstruction phase, on the other hand, refers to different operations conducted after the disaster, and aims to address the relief from a long-term perspective. Thus, the humanitarian logistics system must act with agility and ability involving a transition from stages with operational performance such that it is possible to act the following stage efficiently [8].

According to Garcia [9], the main problem after a crisis is to coordinate communication and actions. In recent disasters the main critic of the relief effort has been the lack of effective response, mainly due to failures in the logistic systems. Pettit and Beresford [10], mention several critical factors that make a logistic company successfully. Among them are Strategic Planning, Inventory Management, Transportation Planning, Capacity Planning, and Information

Management. Thus, all of them require coordinated actions, communication among agents and continuous control and follow-up.

Howden [7] considers that information in the humanitarian supply chain is needed in order to satisfy certain elements in the relief process. Information flow can:

- Enhance needs assessments by ensuring the knowledge of what supplies are available, either in local warehouses, pre-positioned emergency stocks or from local and international markets.
- Share lists of supplies available in both local and international markets, including prices and lead times, allowing staff to understand the existing constraints and to plan the procurement activities.
- Provide more accurate financial information budget holder, to avoid the over or under spending of budgets.
- Provide warehouse inventory reports to ensure the effective and efficient utilization of the supplies.
- Share information on the distribution of supplies to better monitoring and evaluation of the different activities and avoid the duplication of actions.
- More accurately determine logistics overhead costs such as warehouse rental, transportation and logistics staff wages into program budgets according to the relief activities.

Although several publications regarding the conceptual analysis, modeling and applications of humanitarian logistics and information systems for humanitarian supply have been found [11-18] this paper presents a different approach to study information flow among actors in the humanitarian relief and logistics. In order to analyze the communications practices among stakeholders in the humanitarian logistics network, a methodology using Social Network Analysis is proposed.

3. Social Network Analysis

A social network is a set of social relations that can be represented as a set of points connected by lines, where nodes represent individuals and arcs or edges represent social relationships [19-21]]. Let A; B, C; be a collection of nodes (people, organizations or groups) connected by a collection of arcs L(A; B; C). The set of arcs incorporate a set of attributes. Each set of arcs can be empty (no link between a pair of nodes or be of the form:

$$L(A;B) = \{p_1, p_2, \ldots, [\delta_1 : d_1, \ldots, [\delta_n : d_n]\} \quad (1)$$

In expression 1, values of p_i indicate the type of relationship between A and B, including type and value of the relationship. Additionally, the set $[\delta_i : d_i]$ type and characteristics of the distance between A and B. In other words, if A and B are physically connected, and the strength of the connection.

Social Network Analysis ((SNA) is a branch of mathematical sociology that analyzes relationships between entities applying network topology [19]. The main objectives of SNA are:

- To visualize the communications and relationships between individuals and groups using graph theory.
- To study the different factors affecting the relationships shown in the graph and the correlation between these relationships.
- To generate conclusions about relational data, including but not limiting them to bottlenecks where information is retained.
- To recommend about better communication policies and procedures.

The founder of this approach is the German sociologist Georg Simmel in the first decade of the twentieth century [20]. He said for the first time in sociology that social reality is fundamentally relational, in other words, relationships are interactions, with interdependence or reciprocity effect. As a quantitative tool it was applied by Alba in the early 70's [19]. It is a multidisciplinary tool that includes areas of mathematics, statistics, sociology, organizational sciences, among others. Multiple applications can be found in the literature, although in this document only the fundamental concepts are presented.

Although there really isn't anything about social network data that is all that unusual, social scientist use a specialized language for describing the structure and contents of the sets of observations used in the network analysis [22]. Data sets used in network analysis present a structure quite different from the conventional rectangular data array traditionally used in statistic analysis.

The following information has been summarizes and adapted from Wasserman and Faust [4], and Hennerman and Riddle [22]. Traditional data consists of a rectangular array of measurements. The rows of the array are the cases, or subjects, or observations. The columns consist of scores (quantitative or qualitative) on attributes, or variables, or measures. Network data, on the other hand, consists of a square array of measurements. The rows and the columns of the array are the same set of cases, or subjects, or observations. In each cell of the array describes a relationship between the actors. By comparing rows of the array, it is possible to see which actors are similar to which other actors in whom they choose. By looking at the columns, it is possible to see who is similar to whom in terms of being chosen by others.

Further, network analysis studies the structure of connections, within which the actors are embedded. In addition, the relations themselves are just as fundamental as the actors that they connect. Thus, the main difference from traditional analysis is that network analysis focuses its applications in relations and actors rather than attributes.

As said before, social networks are composed of nodes and arcs. The nodes are actors (subjects, people or organizations. Network studies are much more likely to include all of the actors who occur within some boundary instead of using random samples of a population. Thus, they tend to include all of the actors in some population or populations.

The other important components of networks are the arc or ties. The ties represent the relations between actors and there might by many different kinds of ties and relations. Hence, relations are usually selected, or sampled, from among a set of kinds of relations that have been measured.

Social network uses two kinds of tools to represent information about patterns of ties among social actors: graphs and relational matrices. Network analysis uses one kind of graphic display that consists of points (or nodes) to represent actors and lines (or edges) to represent ties or relations. Although called socio-grams by sociologists, they are directed graphs that show the type and direction of the different relations between the actors

In the relational matrix:

$$x_{i,j} = \begin{cases} 1 \, if \; actor \; i \; is \; connected \; j \\ 0 \, otherwise \end{cases} \quad (2)$$

In addition, the main diagonal is filled with zeroes, since no relationship exists between oneself. This matrix helps in the generation of the social network graph such that each actor is a node and each tie is a connection between actors as defined in the matrix. There are different tools that allow the handling of the data. One of them is UCINET with NetDraw. This software generates graphs such as the ones shown in figure 1.

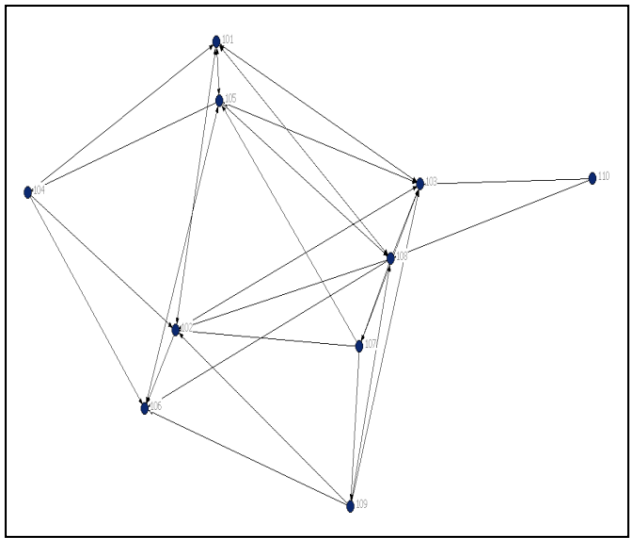

Figure 1: Social network from a relational matrix

Within the scope of graph theory and network analysis, there are various types of measures of the centrality of a vertex within a graph that determine the relative importance of a vertex within the graph Thus, actors who have more ties to other actors may be in better positions. Because they have many ties, they may have alternative ways to satisfy needs, and hence are less dependent on other individuals. Because they have many ties, they may have access to, and be able to call on more of the resources of the network as a whole. In addition, they are often third-parties and deal makers in exchanges among others, and are able to benefit from this brokerage. So, a very simple, but often very effective measure of an actor's centrality and power potential is their degree.

In undirected data, actors differ from one another only in how many connections they have. With directed data, however, it can be important to distinguish centrality based on in-degree, from centrality based on out-degree. If an actor receives many ties, it seems that many other actors seek to direct ties to them, and this may indicate their importance. Actors who have unusually high out-degree are actors who are able to exchange with many others, or make many others aware of their views. Actors who display high out-degree centrality are often said to be influential actors.

Moreover, in connected graphs there is a natural distance metric between all pairs of nodes, defined by the length of their shortest paths. The closeness of a node is defined as the sum of its shortest distances to all other nodes. Thus, the more central a node is the lower its total distance to all other nodes. Closeness can be regarded as a measure of how fast it will take to spread information from a given point to all other nodes sequentially.

Finally, betweenness centrality quantifies the number of times a node acts as a bridge along the shortest path between two other nodes. It was introduced as a measure for quantifying the control the communication between other humans in a social network.

4. Model description

As mentioned in previous sections, communication between the stakeholders in the humanitarian logistics, and in the relief and disaster management system is critical in reaching the goals of efficiency and effectiveness of the different activities. The model proposed is based on two elements: in the type of actor, and the level of action of the actor in the humanitarian logistics system.

The type of actor will be adapted from the original taxonomy defined by Thomas [6]: Governmental national and local, NGO's national and local, private national and local, voluntary associations and civic organizations. In terms of the level of action, organizations will be classified in managerial, control and operational organizations.

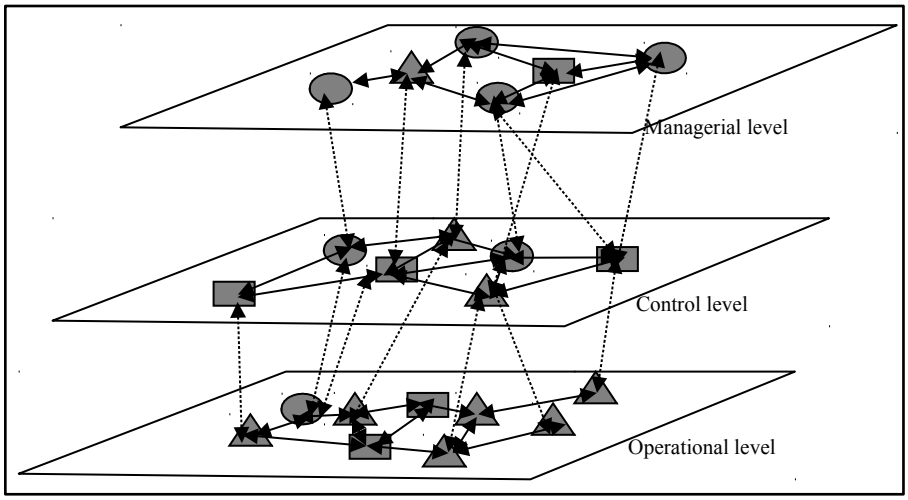

Figure 2: Multi Level model of humanitarian relief communication

Figure 2 shows the proposed model. The model is multilevel communication model with multiple actors on it. The dotted line shows the inter-level communication and the straight lines show the intra-level communication processes. Shapes give the idea of the multiplicity of organizations and agencies involved in the humanitarian relief. At this stage the model does not consider the trans-communication across the different stages of the disaster management cycle.

To define and analyze the communication characteristics and practices as shown in the model, one example will be stated. In the case of Panama, the National System if Civil Protection (SINAPROC) is the state agency in charge of planning, coordinating and acting in case of disaster management and when humanitarian relief actions are needed [23]. Although the National Strategic Plan of Operations shows several processes regarding coordination communications in relief activities, the general complain from public and affected communities is that there are lack of coordination, knowledge of needs, and logistic in delivering humanitarian aid.

For this institution and according to the National Plan for Emergency Response [24], a set of 33 organizations and groups was defined as part of the planning and operations processes. Preliminary data, based on perception of the public was gathered and a relations matrix was built. Table 3 in the appendix shows the organizations and the codes used to describe them. The different entities were classified according to the context of action: National, Local and International; and the level of action: Managerial, Control and Operational. Results of the analysis are presented in the following section.

5. Model Solution Methodology and Results

Figure 3 shows the social network diagram of the different institutions and groups involved in humanitarian relief. The graph has been grouped by the level of actions in which each of the institutions is involved. Additionally, the graph shows the institutions or groups with the greatest level of communications.

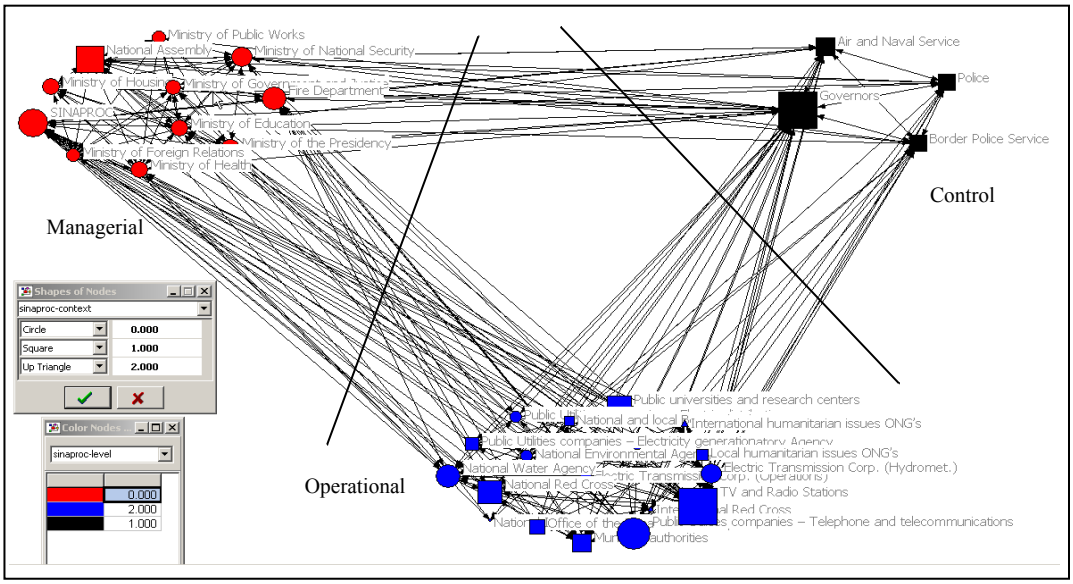

Figure 3: Social Network for SINAPROC

Further, figure 4 shows statistics for degree centrality. As seen, governors, telephone companies and TV and Radio Stations have the greatest level of out-degrees, while TV and Radio Stations also have, by large, the greatest level of in-degrees.

On the other hand, figure 5 shows closeness centrality figures. As seen, information will take longer to reach Boy Scout groups and utility organizations, while information organizations will provide better linkages than other organizations in the network. Finally, figure 6 shows that the Ministry of the Presidency and the Regulatory Agency will have the control of the communications between the different actors.

		1 OutDegree	2 InDegree	3 NrmOutDeg	4 NrmInDeg
21	Governors	23.000	15.000	71.875	46.875
29	Public Utilities companies - Telephone and telecommunications	21.000	8.000	65.625	25.000
30	TV and Radio Stations	18.000	21.000	56.250	65.625
20	National Assembly	18.000	11.000	56.250	34.375
23	Public universities and research centers	17.000	5.000	53.125	15.625
12	Electric Transmission Corp. (Hydromet.)	15.000	7.000	46.875	21.875
25	National Red Cross	14.000	10.000	43.750	31.250
9	Ministry of National Security	13.000	14.000	40.625	43.750
2	Ministry of the Presidency	12.000	14.000	37.500	43.750
19	Fire Department	12.000	15.000	37.500	46.875
1	SINAPROC	12.000	19.000	37.500	59.375
8	Ministry of Government and Justice	10.000	12.000	31.250	37.500
4	Ministry of Housing	10.000	12.000	31.250	37.500
27	Public Utilities companies - Electricity generation	10.000	5.000	31.250	15.625
18	Air and Naval Service	9.000	11.000	28.125	34.375
6	Ministry of Education	9.000	11.000	28.125	34.375
15	National Water Agency	9.000	12.000	28.125	37.500
3	Ministry of Public Works	9.000	10.000	28.125	31.250
5	Ministry of Health	9.000	12.000	28.125	37.500
7	Ministry of Foreign Relations	9.000	10.000	28.125	31.250
17	Border Police Service	9.000	9.000	28.125	28.125
16	Police	8.000	13.000	25.000	40.625
24	Office of the Panama First Lady	8.000	8.000	25.000	25.000
28	Public Utilities companies - Electric distribution	8.000	5.000	25.000	15.625
10	National Environmental Agency	7.000	5.000	21.875	15.625
31	National and local Boy and Girl Scouts groups	7.000	5.000	21.875	15.625
32	Local humanitarian issues ONG's	6.000	7.000	18.750	21.875
11	Electric Transmission Corp. (Operations)	5.000	8.000	15.625	25.000
33	International humanitarian issues ONG's	4.000	6.000	12.500	18.750
22	Municipal authorities	3.000	14.000	9.375	43.750
26	International Red Cross	3.000	5.000	9.375	15.625
14	National Institute of Sports	2.000	3.000	6.250	9.375
13	Public Utilities Regulatory Agency	2.000	9.000	6.250	28.125

Figure 4: Degree indicators for the SINAPROC Social network

		1 inFarness	2 outFarness	3 inCloseness	4 outCloseness
30	National and local Boy and Girl Scouts groups	43.000	46.000	74.419	69.565
1	Ministry of the Presidency	46.000	53.000	69.565	60.377
19	National Assembly	50.000	52.000	64.000	61.538
21	Municipal authorities	50.000	41.000	64.000	78.049
2	Ministry of Public Works	51.000	53.000	62.745	60.377
16	Border Police Service	52.000	58.000	61.538	55.172
22	Public universities and research centers	52.000	67.000	61.538	47.761
9	National Environmental Agency	53.000	56.000	60.377	57.143
5	Ministry of Education	53.000	61.000	60.377	52.459
18	Fire Department	54.000	57.000	59.259	56.140
15	Police	54.000	56.000	59.259	57.143
8	Ministry of National Security	55.000	59.000	58.182	54.237
25	International Red Cross	56.000	50.000	57.143	64.000
4	Ministry of Health	56.000	60.000	57.143	53.333
20	Governors	56.000	46.000	57.143	69.565
29	TV and Radio Stations	57.000	43.000	56.140	74.419
7	Ministry of Government and Justice	58.000	60.000	55.172	53.333
6	Ministry of Foreign Relations	59.000	61.000	54.237	52.459
3	Ministry of Housing	59.000	61.000	54.237	52.459
12	Public Utilities Regulatory Agency	59.000	49.000	54.237	65.306
17	Air and Naval Service	59.000	56.000	54.237	57.143
24	National Red Cross	59.000	60.000	54.237	53.333
11	Electric Transmission Corp. (Hydromet.)	61.000	63.000	52.459	50.794
13	National Institute of Sports	61.000	79.000	52.459	40.506
10	Electric Transmission Corp. (Operations)	63.000	58.000	50.794	55.172
32	International humanitarian issues ONG's	67.000	65.000	47.761	49.231
33		67.000	74.000	47.761	43.243
26	Public Utilities companies - Electricity generation	68.000	72.000	47.059	44.444
31	Local humanitarian issues ONG's	69.000	70.000	46.377	45.714
14	National Water Agency	69.000	90.000	46.377	35.556
28	Public Utilities companies - Telephone and telecommunications	72.000	61.000	44.444	52.459
27	Public Utilities companies - Electric distribution	73.000	55.000	43.836	58.182
23	Office of the Panama First Lady	79.000	48.000	40.506	66.667

Figure 5: Closeness indicators for the SINAPROC Social network

		1 FlowBet	2 nFlowBet
1	Ministry of the Presidency	105.103	10.595
2	Ministry of Public Works	21.823	2.200
3	Ministry of Housing	13.060	1.317
4	Ministry of Health	40.849	4.118
5	Ministry of Education	14.972	1.509
6	Ministry of Foreign Relations	30.255	3.050
7	Ministry of Government and Justice	28.066	2.829
8	Ministry of National Security	14.155	1.427
9	National Environmental Agency	22.274	2.245
10	Electric Transmission Corp. (Operations)	76.746	7.737
11	Electric Transmission Corp. (Hydromet.)	94.742	9.551
12	Public Utilities Regulatory Agency	119.380	12.034
13	National Institute of Sports	13.369	1.348
14	National Water Agency	2.894	0.292
15	Police	22.138	2.232
16	Border Police Service	23.073	2.326
17	Air and Naval Service	14.323	1.444
18	Fire Department	14.164	1.428
19	National Assembly	27.743	2.797
20	Governors	25.056	2.526
21	Municipal authorities	62.382	6.289
22	Public universities and research centers	16.887	1.702
23	Office of the Panama First Lady	45.591	4.596
24	National Red Cross	23.245	2.343
25	International Red Cross	42.631	4.298
26	Public Utilities companies - Electricity generation	19.995	2.016
27	Public Utilities companies - Electric distribution	78.245	7.888
28	Public Utilities companies - Telephone and telecommunications	14.009	1.412
29	TV and Radio Stations	90.908	9.164
30	National and local Boy and Girl Scouts groups	44.088	4.444
31	Local humanitarian issues ONG's	17.228	1.737
32	International humanitarian issues ONG's	32.199	3.246
33		30.794	3.104

Figure 6: Betweeness indicators for the SINAPROC Social network

From the figure it is possible to conclude that in the social network of SINAPROC, communication organizations have a great influence. On the other hand, it seems that SINAPROC does not have the relevance in the management, control and operations in the logistics of humanitarian relief. In general, humanitarian relief activities are highly dependable of communication networks [1, 8]. Hence for this case, and according to the general public, TV Stations, Governors and communications companies are central for the humanitarian effort and disaster management activities.

6. Conclusions and Future Work

This paper presents a Social Network Analysis to study communication patterns in organizations involved in humanitarian logistics operations in three countries in Latin America: Mexico, Panama and Chile. A multilevel communication model with multiple actors on it is considered, which includes inter-level and intra-level communication processes, as well as insights on the multiplicity of organizations and agencies involved in humanitarian relief. As previously described, the model does not consider trans-communication across different stages of the disaster management cycle. An example in the context of Panama is stated, which considers the state agency for emergency response SINAPROC and a set of thirty three organizations and groups defined as part of the planning and operations processes. By performing such analysis, communication organizations are identified as key stakeholders because of its significant influence towards the success of humanitarian efforts.

The study has limitations that need to be addressed and which open avenues for further research. The first limitation is on the number and size of the organizations considered, where such size is measured in terms of the number of volunteers, employees or participants involved in humanitarian relief; since there may be some instances where the capabilities for communication and timely information sharing will be influenced by these factors. The second limitation is on defining measures for the specific role played by stakeholders involved in humanitarian logistics operations, since this kind of activity –in comparison to commercial logistics- usually has several organizations and people involved in humanitarian relief and may take charge of specific activities which need to be measured and controlled on an overall basis.

We would like to call for more research on Social Network Analysis to study communication patterns and relationships among organizations and stakeholders involved in humanitarian logistics operations. This is of special importance in developing economies like the ones in Latin America, since reliable communication, timely and accurate decision-making among various sectors that intervene in relief and aid activities connecting the various places where humanitarian logistics take place is imperative for the success of any operation. The transmission of data, the exchange of information, the confirmation of supply movements, the request for new deliveries, and the safety of the teams on the ground, these are only a few of the needs that Social Network Analysis can serve during humanitarian relief operations.

Acknowledgments

This project was partially supported by a grant from the National Secretary of Science, Technology and Innovation of Panama. In addition it is supported with facilities and infrastructure by the Technological University of Panama and Tech de Monterrey.

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Appendix

Table 3 Organizations involved in humanitarian relief

Instituion	Context	Level	Code Context	Code Level
SINAPROC	N	M	0	0
Ministry of the Presidency	N	M	0	0
Ministry of Public Works	N	M	0	0
Ministry of Housing	N	M	0	0
Ministry of Health	N	M	0	0
Ministry of Education	N	M	0	0
Ministry of Foreign Relations	N	M	0	0
Ministry of Government and Justice	N	M	0	0
Ministry of National Security	N	M	0	0
National Environmental Agency	N	O	0	2
Electric Transmission Corp. (Operations)	N	O	0	2
Electric Transmission Corp. (Hydromet.)	N	O	0	2
Public Utilities Regulatory Agency	N	O	0	2
National Institute of Sports	N	O	0	2
National Water Agency	N	O	0	2
Police	L	C	1	1
Air and Naval Service	L	C	1	1
Fire Department	L	C	1	1
National Assembly	N	M	0	0
Governors	L	M	1	0
Municipal authorities	L	C	1	1
Public universities and research centers	L	O	1	2
Office of the Panama First Lady	L	O	1	2
National Red Cross	L	O	1	2
International Red Cross	I	O	2	2
Public Utilities companies – Electricity generation	L	O	1	2
Public Utilities companies – Electric distribution	L	O	1	2
Public Utilities companies – Telephone and communications	N	O	0	2
TV and Radio Stations	N	O	0	2
National and local Boy and Girl Scouts groups	L	O	1	2
Local humanitarian issues ONG's	L	O	1	2
International humanitarian issues ONG's	I	O	2	2

Table 4 Context and levels attributes

Context				Level			
Initial	Meaning	Code	Symbol	Initial	Meaning	Code	Color
N	National	0	circle	M	Managerial	0	red
L	Local	1	square	C	Control	1	black
I	International	2	triangle	O	Operational	2	blue