MICE TOURISM NETWORK TOPOLOGY AS AN INNOVATION IN THE COMPLEMENTARITY OF AN SSM APPLICATION

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ABSTRACT

Socio-Technical systems are characterized by complexity, turbulence, and the diversity of points of view on how to deal with problem situations. However, they can be explored by the observer as learning systems.

This research establishes the problem situations that have avoided the viability of MICE Tourism in Mexico, such as legacy aspects, the missing relationships with the academia, and the lack of benefits for society. This was done by using the first three stages of Soft System Methodology (qualitative approach) and the Network Science tools (network analysis). The argument to use these tools is that they were developed to study, characterize and modelling the dynamic of complex systems. The approaches complement each other to enrich the diagnosis of the system.

The conception of the MICE tourism network is based on the relationships (links) between the elements (nodes) that interact in the system. This MICE tourism network is composed by 43 nodes and, at least, every node has six links with its neighbors, yielding 406 links. It means that the communication throughout the network is spreading, so that if more nodes are added to this network, the number of links will grow faster.

Keywords: MICE tourism, SSM, Network Science, complex system

INTRODUCTION

The MICE tourism as defined by the World Tourism Organization (UNWTO) (2006), is designed by the management of Meetings, Incentives, Conferences and Events.
In 2016 took place 12,212 rotating international association meetings (ICCA, 2017); however, it is important to remark that the data collected by this association is only a portion of the total number of events that are generated in the industry, as they only take in consideration the events that were carried out by international associations and rotated in at least three different countries, leaving apart the events that are done by corporate enterprises and that are local. In 2016 the International Congress and Convention Association (2016) reported historically data from the sector in a period from 1963 to 2012, showing an exponential growth in the number of events for each decade, without a decrease in the period.

In Mexico the National Tourism Plan (2012) places the MICE tourism as one of the main tourism markets to be promoted by the government, given the contribution that it generates to the national GDP of 1.5%, as well as an annual economic income of 17.7 million dollars and more than 501 thousand direct jobs (CPTM, 2016). According to ICCA, Mexico was ranked 21st in the World Ranking of countries in 2016 with 182 meetings and ranked number 5th in Latin America and North America for number of meetings (2017), and in 16th place for the attraction of participants with 97,559 delegates. Concerning the number of meetings per city, the following Mexican cities are ranked: Mexico City (position 34), Cancún (position 100), Guadalajara (position 169), Puebla (position 239), Monterrey (position 256), Puerto Vallarta y Querétaro (position 392).

The growth of the MICE activity has been favored by the characteristics presented by the MICE Tourism: i) regulates the seasonality of the tourist demand, because versus leisure tourism, MICE tourism is carried out throughout the year; ii) increase the average spending of visitors, MICE tourist spend money in pre and post tours, sometimes they travel with companion, and also, regularly, they have a better purchasing level than the regular tourist; iii) it is a phenomenon that covers numerous economic sectors driving the generation of direct and indirect jobs; iv) supports the professional specialization; v) provide a global scenario for hosting destinations; vi) supports technological development; vii) attracts the leaders and generators of knowledge of an industry; viii) encourages investment; ix) generates business networks, alliances and research; and x) promotes economic activity in the region (Oppermann and Chon, 1997; Mistilis and Dwyer, 1999; Zhang et al., 2007; Mohammadi and Mohamed, 2010; Ramgulam et al., 2012; Jones and Li, 2015).

Those characteristics provide benefits and opportunities for the hosting destinations of the events. However is important to take in consideration not only the benefits and opportunities derived from this activity but also to confront the weaknesses and challenges that this activity shows.

Despite it has been demonstrated, through some studies of economic relevance, the advantages that this activity generates to the income of a country (Kim et al., 2003; CPTM, 2016; Convention Industry Council, 2011; Visit Denmark, 2012; Deery et al., 2015; Jones y Li, 2015), there are insufficient studies that have been made in the discussion of the organization of events that include other impacts as those cultural and environmental.

Aguiar-Quintana (2015) and Getz (2015) give an account of the main Events Tourism studies that have been carried out over the years, identifying that the first studies on the subject were conducted in the 1970s, marking a great progression during the 1980s, derived from the interest in the events held at the time. On the other hand, the 1990s meant the introduction of scientific research studies, examining the importance of mega events, such as the Olympic Games. As can be seen, the tourism of meetings has been studied for several decades through different approaches, given the importance and growth that the phenomenon has had; however, most of them are focused on the analysis of the elements that affect the attraction of events and tourists of meetings in destinations, without considering the dynamics that occur between them and the behaviors that derive from it.

METHODOLOGY

According to context of the system under study and the paper presented in the 61st Annual Meeting of the ISSS (Ramírez et al, 2017), the MICE tourism system was studied through the Systems approach, to provide it with a holistic and integrating method. Specifically, the Soft Systems Methodology (SSM) was used.

The Systems approach seeks to solve system problems, that is, interrelationships among many variables. This provides a methodological approach that helps to conduct thoughts in an orderly, renewed and efficient manner when faced with unfamiliar problems that are much more complex and include totality (François, 2004). Through Systems Thinking we seek to build models with sufficient variety (complexity treatment capacity) in which the age of systems, as opposed to the era of the Industrial Revolution, is characterized by complexity, turbulence and diversity of points of view on how to deal with the dimension of problems (Pérez Ríos, 2008).

The System approach, accepting the basic propositions of science, assumes that the world contains structured wholes that can maintain their identity under a certain range of conditions and that present certain general principles of "totality" (Checkland, 2001).

Soft systems are those phenomena containing a high social, political, and human component. In these systems, there is complexity and confusion; however, this can be explored by the observer as a learning system (Checkland, 2001). In this type of systems, it is unknown what and how we are going to study it.

SSM

The Soft Systems Methodology (SSM) of Checkland (2001) is a methodology of social reality, based on the phenomenology derived sociologically by Weber and philosophically by Husserl (1983). In the SSM the researcher becomes a creative participant of the action and the process of change becomes the object of study.

Figure 1 represents the stages of the methodology, which, according to Checkland (2001), are described in a logical sequence and not necessarily in the sequence in which it is used, neither is it restricted its usefulness to the use of each one of its steps, but they adapt these and their sequence to the situation to be solved. The methodology contains two types of activities: "real world" activities, which necessarily include the human factor in the problem situation and "systems thinking" activities which involve other systems thinking, requiring the use of a higher order language or metalanguage.

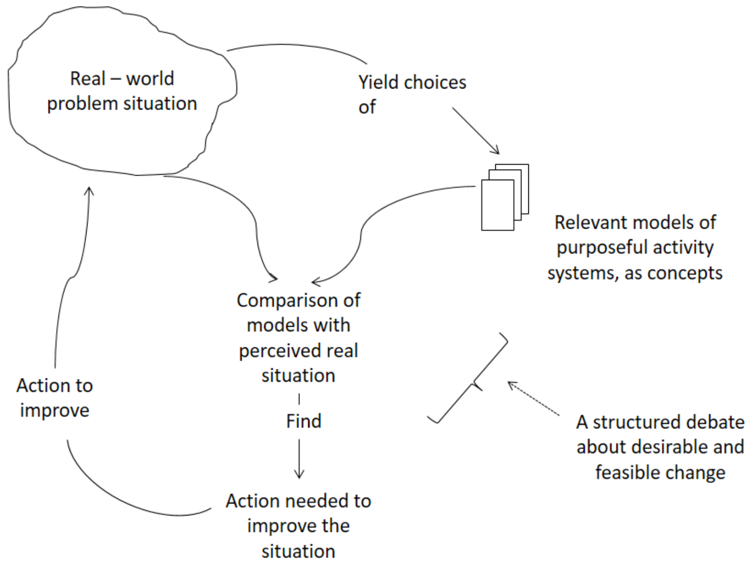


Figure 1. Soft Systems Methodology (Checkland, 2001).

Stage 1 has the function of showing the situation under study to reveal a range of possible and relevant options. This stage is carried out in the real world and involve perception.

Stage 2 incorporates the formal use of systems ideas, involving prediction.

Stage 3 involves comparing the model with the real world, and stage 4 deciding what to do in response to the comparison.

Finally, stage 5 represent the implementation of those changes.

The methodology is iterative due to a soft system will present always a problem situation to improve.

One of the advantages of the Systems approach, and especially of the SSM, is the capability to work with other methodologies to make a more robust study.

In the present work the Network Science is used as a complementary tool in the diagnosis derived from the first three stages of SSM in order to construct a complete diagnosis of MICE tourism system, designing the topology of the MICE tourism network.

Network Science

Networks are present in the everyday life (Cohen and Havlin, 2010): communication networks as the telephone, computer communication network, airline network and the world wide web network; society networks as friendship network, working relations; economic networks as business relations networks between enterprises and individuals; epidemics networks, among others.

Graph theory

Graphs are used for describing mathematical systems in networks. Graphs represent the essential topological properties of a network by treating the network as a collection of vertices and edges, the edges represent the links between nodes. This simple concept, within its simplicity, considers different complex systems, using the same mathematical tools and methods and, in many cases, the properties of the networks are similar.

In a direct graph *(digraph)* the edges are taken as ordered pairs. A *multigraph* is a graph in which more than one edge is allowed between a pair of vertices and edges are also allowed to connect a vertex to itself.

A graph is represented frequently by an Adjacency Matrix (A_{ij}), which is a matrix in which every raw and every column represents a vertex of the graph. The A_{ij} entry is 1 if a link exists between ij and ji or 0 otherwise. In a directed graph the matrix will be asymmetrical and in the multigraph the entries can also be larger than 1, and the diagonal entries are not necessarily 0.

Graph theory is rooted with the work of Euler, who is the father of the field of topology.

Network science

The Network Science is based in the Graph Theory, but the main difference between them is that Network Science focus on data, function and utility, and Graph Theory, as is expressed, is only an abstract mathematical tool.

The Networks Science take the architecture of networks emerging in various domains of science as similar each other, like a consequence of being governed by the same organizing principles.

Networks have properties encoded in their structure that limit or enhance their behaviour (Barabási, 2016).

The Networks Science take the same properties of the Graph Theory, considering a Network as a catalogue of a systems components called nodes and the direct interactions between them, called links.

Topology of the MICE tourism network

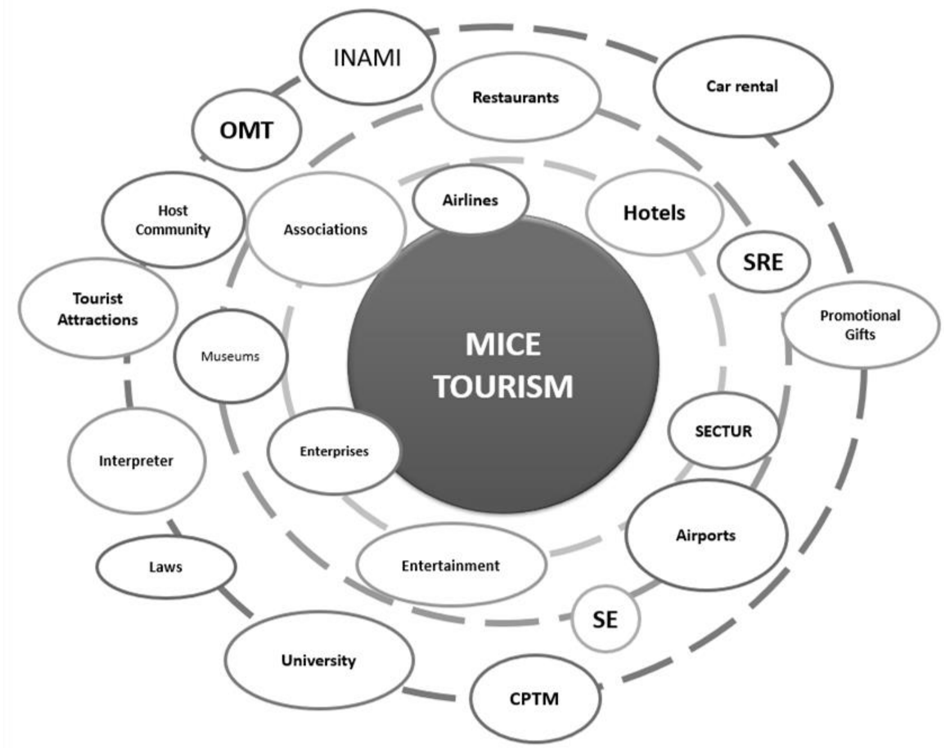
In the present work the topology of the MICE tourism network is presented as a complementary tool in the use of the first three stages of SSM to obtain the diagnosis of MICE tourism in Mexico.

An organizational, undirected network was built.

RESULTS

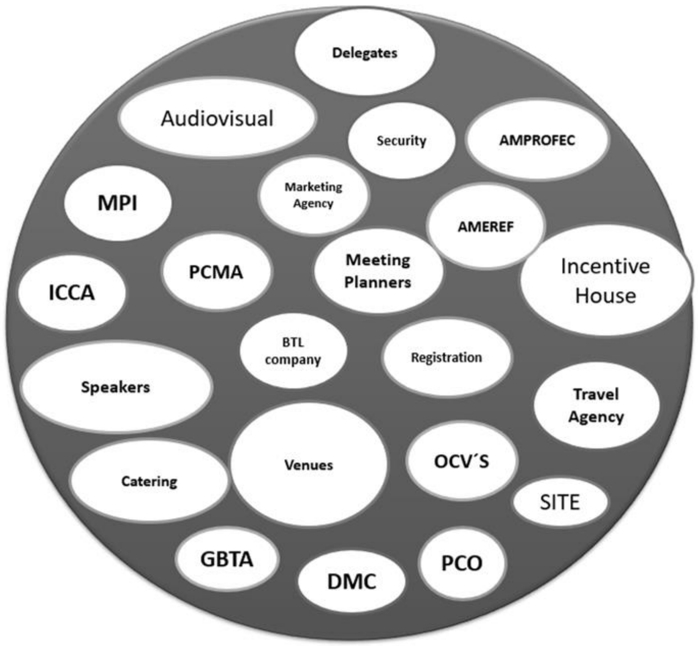
Diagnosis by the SSM

The elements that compose the MICE tourism are showed in figures 2 and 3 as a part of the first stage of the SSM which consist in identifying the stakeholders of the system under study.



ACRONYM	MEANING
CPTM	Mexico Tourism Board
INAMI	Migration's National Institute
OMT	World Tourism Organization
SE	Ministry of Economy
SECTUR	Ministry of Tourism
SRE	Ministry of International Affairs

Figure 2. Stakeholders of MICE Tourism.



ACRONYM	MEANING
AMPROFEC	Mexican Association of Professionals in Fairs, Exhibitions and Conventions
AMEREF	Mexican Association of Exhibition Centres
DMC	Destination Management Company
ICCA	International Congress and Convention Association
GBTA	Global Business Travel Association
MPI	Meeting Professionals International
OCV´s	Congress and Visitors Offices
PCMA	Professional Convention Management Association
PCO	Professional Congress Organisers
SITE	Society for Incentive Travel Excellence

Figure 3. Elements of MICE tourism.

Subsequently, enriched visions which describe the organizational structure, activities and interrelationships of the system are stablished with the objective of finding the anomalies presented in the system and linking them to the general problem situation. The complete picture of the enriched vision was presented in the 61st Annual Meeting of the ISSS (Ramírez et al, 2017). As a result, it was found 56 relations in the systems and 18 of conflict.

The main conflict relationships are related with their environment, like the lack of relationships between different elements, which are necessary for the proper functioning of the system, such as those of the system with the host community and with the universities that impart studies in tourism.

On the other hand, despite the relationship between the system and the specialized associations of the sector, more communication and feedback are needed in the training and certification processes, as well as working together to promote the growth of activity in the country and the level of competition of Mexican destinations at the international level. It is important to mention the lack of data collection and statistical information that allows the measurement of activity performance and thus lead their evolution.

Regarding government regulation, previously there was in the Mexico Tourism Board (CPTM in Spanish) the MICE Tourism Office, through which Mexican destinations and companies specializing in the organization of congresses and business events were promoted, through different channels and strategies; currently this Office has ceased to exist in the CPTM, however, the activity is still promoted from this same government agency. Even though greater synergy is required between SECTUR and CPTM with the different chambers and associations of the sector and the suppliers of the MICE tourism, it has been implemented the ¨National MICE tourism Board¨ aiming to reinforce the activity.

MICE tourism network

The topology of MICE tourism network as an undirected and organizational network was obtained. The network is composed by 43 nodes, 406 links, showing the 44,97% of connectivity. The Table 1 shows the main parameters of the network.

Table 1. Parameters of MICE tourism network.

Variable	Parameter	Definition
Nodes N	43	Number of components
Links L	406	Interactions between the components (nodes)
Connectivity c	44,97%	The percentage of connection of the network.
Average degree $\langle k \rangle$	18,88	Average number of links of each node with the others.
Maximum links $L_{máx}$	903	Maximum possible links in the network.
Clustering coefficient $\langle C \rangle$	0,73	The $\langle C \rangle$ captures the average degree to which the neighbours of a given node links to each other.

The equations to obtain these parameters are as follows.

Connectivity

$$c = \frac{N(100)}{L_{máx}}. \quad (1)$$

where N represents the number of nodes and $L_{máx}$ the maximum possible links in the network.

The result for the MICE networks is 44,97%, in this case the network shows that it is barely below half of possible connections.

Average degree

$$\langle k \rangle = \frac{2L}{N}. \quad (2)$$

where L represents the number of links in the network.

The average degree for the network is 18,88 from 42 possible links ($N-1$). That means that most of the nodes in the network are connected with just less of the half of total nodes.

Maximum links

$$L_{máx} = \frac{N(N-1)}{2}. \quad (3)$$

The $L_{máx}$ is 903 for the network. Actually, there are 406 links, but it can grow to 903, it means that by now the links of the network are less than the half of the total possible links.

Average Clustering coefficient

$$\langle C \rangle = \frac{2L}{\langle k \rangle (\langle k \rangle - 1)}. \quad (4)$$

The average clustering coefficient for the network is 0,73. The parameter goes from 0 to 1, where 0 means the null interaction between the nodes and consequently if more nodes are added there will be not connection; otherwise, if there are 1 means that the network is totally connected. In the MICE tourism network, the parameter is more than 0,5 which means that the communication throughout the network is spreading, so that if more nodes are added to this network, the number of links will grow faster.

Figure 4 shows the MICE tourism system network. The figure shows in blue the internal elements of MICE tourism system and in purple their stakeholders.

The size of each node represents its degree been the CPTM, SECTUR, OCV´s, PCO´s, Associations, Meeting Planners, DMC´s and Incentive Houses the most connected elements in the network. These elements can be considered as the relevant systems.

As can be seen, OMT is one of those elements that have few links but is one of those important in the regulation and recompilation of information about the operation of the system.

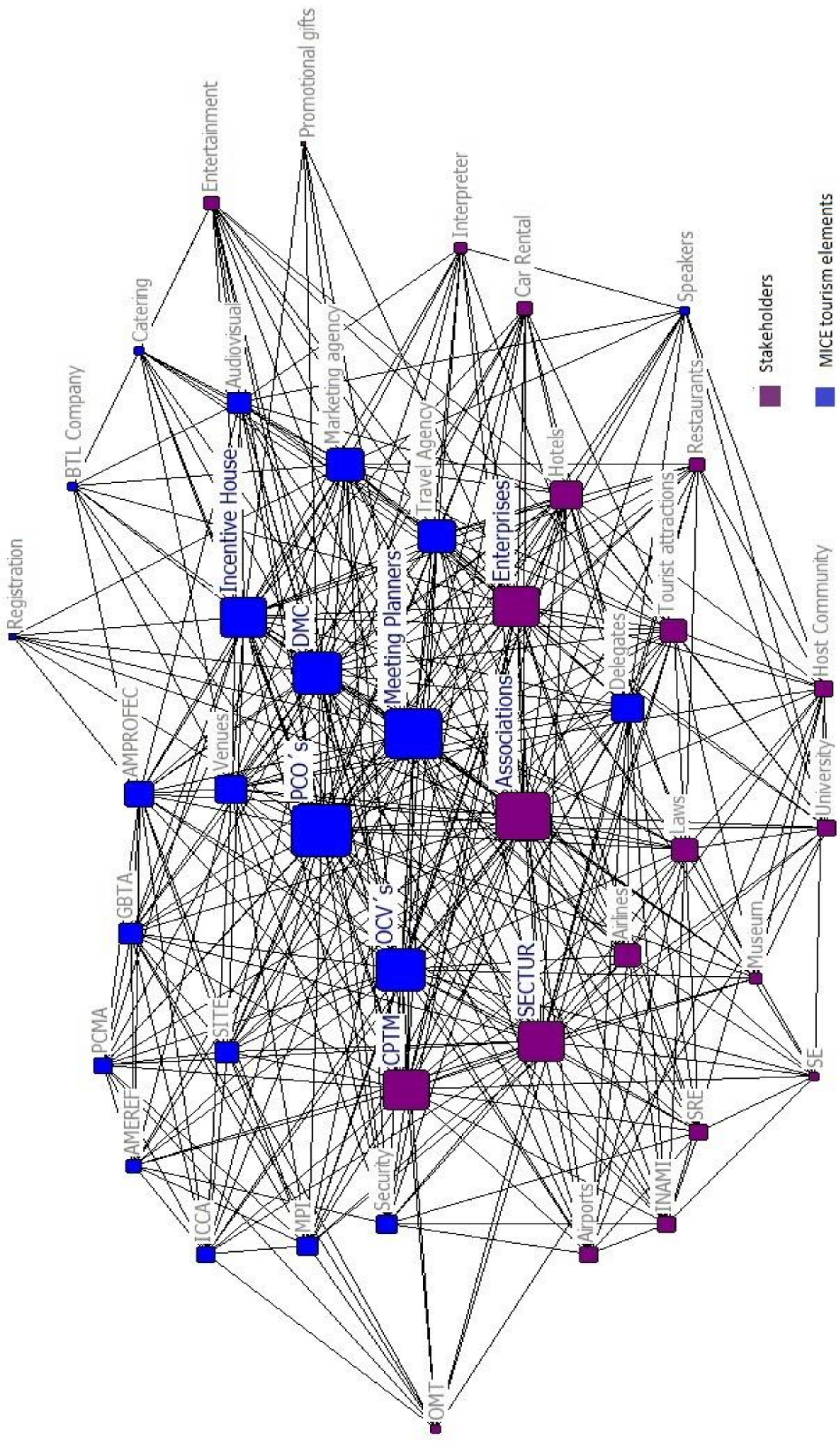


Figure 4. MICE tourism system network.

DISCUSSION AND CONCLUSIONS

The MICE tourism as a complex socio-technical system needs for its study tools than can cover its complexity.

Despite that the systems methodologies had been demonstrated its capacity to cover that complexity, however they allowed the use of other methodologies to enrich the vision of the observer about the relationships in the system and its environment. Network Science has been demonstrated to be a reliable approach to represent the elements and the links between them serving as a complement of the first three stages of SSM to design a robustness diagnosis of the current situation of the system under study.

Starting from the fact that most real networks are sparse, that is, the percentage of connectivity does not exceed 5 to 10%, depending on the number of nodes for which it is formed, the network of the system under study has a high connectivity with almost $c \approx 45\%$ connectivity. This idea is reinforced by the fact that the average clustering coefficient, which has a value of $\langle C \rangle = 0{,}73$, means a very high probability of connectivity between the surrounding nodes of any node in the network.

Regarding the average degree, the value of this was $\langle k \rangle = 18{,}88$, that is, on average each node of the network is connected with 19 nodes (of 42 possible nodes).

Based on the foregoing, it is concluded that when more nodes are incorporated to the network, they will be linked with the existing ones, which is in accordance with Barabási (2016).

The construction of the topology of the system under study network allowed the identification of 350 more relations that those found in the application of SSM. With this more conflict relationships could be established. This will support the construction of the model taking in consideration as much as possible the conflicts to establish the relationships between the elements within the system and their environment and ensure the viability of the system.

Based on the above, the contribution of the SSM to incorporate methodologies and the Network Science to be a consistent approach to represent the topology of a system was proved. Likewise one of the advantages in the use of Network Science in SSM is that it can be used in other stages of the methodology as the design of the model and the comparison between the real situation and the model. However, is important to remark that despite the advantages of this discipline is needed to take always in consideration the observer who will take the decision in considering the elemental information for the performance of the system.

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