Social networks analysis: A study on the linkage of relations and the hierarchy in the public sector

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Paulo Vanderlei Cassanego Junior[1] and Cristiane Ferreira de Souza Araújo[2]

ABSTRACT

The study used Social Network Analysis (SNA) to map interactions among public servants at the City Council of Sant'Ana do Livramento. A quantitative approach was employed, collecting data via questionnaires from 133 public servants, with 108 valid responses. The data were processed using Gephi 0.9.1 software to construct networks of information, friendship, and trust. Three networks were mapped: information exchange, friendship, and trust. The analysis used metrics such as degree centrality, betweenness centrality, closeness centrality, and eigenvector centrality. The information exchange network included 143 public servants with 1235 connections and a density of 6.1%. Key nodes, such as Councilor Ulberto Navarro, showed high capacity for information exchange and highlighted the importance of certain public servants in coordinating and controlling information within the network. SNA is valuable for understanding social dynamics in a public organization. Identifying informal leaders and analyzing networks of friendship, information, and trust provide crucial insights for enhancing communication and collaboration within the institution.

Keywords: Social Network Analysis, Public Management, Interpersonal Relationships.

[1] PhD in Business Administration
Federal University of Pampa
[2] PhD student in Production Engineering
Federal University of Rio Grande do Sul

INTRODUCTION

The analysis of social networks (ARS) we based on mapping, graphic formalization and quantification of interactions (edges) between actors (nodes) in a network, making it possible to survey the contents and particularities arising from these relationships. It consists of understanding social structures through relational data that we based on the ties and connections between agents and their role in the network, allowing us to know how a small group and its interaction become patterns for the creation of larger groups (Granovetter, 1973; Wasserman & Faust, 1999; Recuero; Bastos; Zago, 2015; Liu et al., 2017).

According to Scott (2000), the basis for understanding social networks lies in Moreno's theory (1934), which significantly contributed to the representation of the formal properties of social configurations, developing methods for measuring and analyzing the roles of individuals and groups, from the point of view of the interaction, the conglomerate and the prediction of future behavior. Mapping the structures allows the researcher to visualize communication channels and identify leaders and connections between people. The sociogram/graph represents the forces of attraction, repulsion, and indifference in groups (Bastos & Santos, 2007).

According to Kuipers (1999), there are two primary organizational networks: formal and informal networks. The formal social network consists of connections or ties prescribed between formal or standardized social positions, unlike informal social structures, which are not explicit or defined by organizations. We based on interactions that depend on the personal attributes of the participants.

For Silva et al. (2020), understanding the behavior of actors and their information flows within the organizational context is essential to identify the emerging potential of formal and informal leadership. Institutions and managers that support social interactions outside the workgroup encourage creativity among members, who, connected to different sources outside their group, cultivate weak, cross-border and cross-functional ties that can generate new ideas and solutions (Kim et al., 2016).

Social network theory sees organizations as a nexus of formal and informal social relationships between a set of organizational actors (Borgatti et al., 2009). These social ties we saw as the primary sources of benefits for individuals, including non-redundant information, social support and status, as well as responsibilities (Mehra et al., 2001; Duffy et al., 2002; Brass et al., 2004; Labianca & Brass, 2006; Borgatti et al., 2009; Kilduff & Brass, 2010; Ellwardt et al., 2011; Marineau et al., 2018). The awareness of a community of interests and values among people has been the basis for understanding the networks of relationships. Their participation has involved rights, responsibilities and various levels of decision-making (Aldrich & Zimmer, 1986).

In this context, as a way to understand formal and informal social relations, the following research problems were elaborated:

Q1. How are formal and informal social relations established in a public institution?

Q2. What are the implications of the intertwining of these relationships in the institution's current hierarchical environment?

Thus, this research aims to analyze formal and informal interpersonal relationships and their implications in the hierarchical environment established in a public institution of municipal management.

The literature points to controversies between sharing community mechanisms on social networks and their benefit for disseminating information (Liang & Fu, 2016). In addition, studies that identify influential nodes in complex networks capable of demonstrating advantages and disadvantages on the interactions and impacts of relationships in the workplace are emerging but scarce, as mentioned in the works of Wang, Du & Deng (2017); Khazanchi, Sprinkle, Masterson & Tong (2018) and Silva et al. (2020).

We noted that works favor the analysis of intra-organizational informal networks, such as Krackhardt & Porter (1986), Kuipers (1999), Cross & Prusak (2002), Kilduf & Tsai (2003), Silva (2003), have in common is the view that informal networks are invisible and powerful tools in the organization, as much of the work is carried out based on informal contacts. For Bastos & Santos (2007), when informal systems operate within organizational boundaries, they make information circulate, complementing formal channels, and the understanding of "the way things happen" can have a significant influence on organizational behavior (Bastos & Santos, 2007).

Furthermore, it is noteworthy that the potential of the methodology of social network analysis does not replace other attributes, such as the study of the institution itself or the different dimensions and perspectives we offered to these researchers. However, we expected that this tool provides a wide range of visual aspects, creating new possibilities for analysis.

BACKGROUND

INFORMAL SOCIAL NETWORKS FROM AN ORGANIZATIONAL PERSPECTIVE

In studies on social networks, we give informal relationships to the detriment of hierarchical structures (Régis et al., 2007). The work produced through networks of informal relationships constitutes a way of human organization present in the daily life of organizations in their different levels of structure (Marteleto, 2001).

For Regis et al. (2007), unlike formal organizations, studies on networks do not consider, a priori, a presumption of hierarchy. We noted that the analysis of network structures does not exclude the possibility of power and dependency relationships in internal associations and in relationships

that go beyond networks (Marteleto, 2001; Régis et al., 2007). In this way, it is possible to identify common or widely shared elements in networks, such as connection, bonding, and integration (Loiola & Moura, 1997; Minhoto & Martins, 2001; Bastos & Santos, 2007).

The relational dimension of a social network focuses on the role of direct ties between actors about the content transacted in interactions and their diversities, which are: friendship, information, respect, trust, norms, sanctions and identification (Nahapiet & Ghoshal, 1998; Inkpen & Tsang, 2005).

The mapping of networks makes it possible to identify various transactions, such as friendship, information exchange, trust, party affiliation, and mentoring. A social bond between two people based on a single role, we described as uniplex or mono-stratified (Boissevain, 1974). A social bond between two people we called multiplex or multi-tiered when it covers multiple parts. There is a tendency for uniplex calls (e.g., Maria is Ana's colleague at the company) to become multiplex (ex: Maria is Ana's colleague at the company and they have become friends) if they persist over time, as well as a tendency for multiplex calls be stronger than uniplex links, as the overlapping roles reinforce each other (Marinho-da-Silva, 2003).

Kuipers (1999) shows that some researchers distinguish between qualitatively different types of ties based on the kind of resource that flows through the network. The author considers that the interaction between individuals in a network is specific to how we formed and the ties we used to transfer any resource.

Kuipers is one of the pioneers in the approach to friendship, information and trust networks. For her, the content transacted on each of these types of networks is specific. Kuipers (1999) definitions for these three types of network are:

> - Information network: it is an informal network in which the transacted content concerns what is happening in the organization as a whole about opportunities for advancement, decision-making processes and organizational success. Such information typically affects all members of the organization;
> - Friendship network: it is an informal network, based on the exchange of friendship and socialization, which provides support and improves self-esteem, in addition to encouraging certain behaviors that increase acceptance among groups within the organization;
> - Trust network: it is a network of informal ties, in which an actor takes risks by giving up control of the results, by accepting dependence on another actor, without the force or coercion of the relationship, whether contractual, structural, or legal;

Costa (2017) says that the bonds of friendship are gaining, in the political process, a new characteristic of relationship and social feeling, armed with economic interests and often affirmative

contracts between peers. For Marconi (2013), the political process is where the "political structure we characterized by its trends, which allow its easy identification about the broader society," it is often found between the lines of interpersonal supplies and congestion of exchanges social.

In this way, we intended to understand how interpersonal social relations occur in the environment of the City Council of Sant'Ana do Livramento, in the spheres of exchange of information, friendship and trust, as proposed by Kuipers (1999), in which the actors they are exposed to all sorts of relationships with feelings and interests that may or may not extrapolate the organizational environment.

METHODOLOGICAL PROCEDURES

We determined that Social Network Analysis (ARS) is the most appropriate method for developing this research. We based on mapping, graphic formalization and quantification of interactions (edges) between actors (nodes) of a network, making it is possible to survey the contents and particularities arising from these relationships (Wasserman & Faust, 1999). This research has a quantitative approach, as it sought to specify and analyze characteristics of a population numerically (Richardson, 2012; Sampieri, Collado & Lucio, 2013). We adopted descriptive research's kind, as according to Gil (2010), type's research has as its objective the description of the characteristics of a given population or phenomenon or the simple identification.

For data collection, we defined by the application of a questionnaire (Zancan, Santos & Campos, 2012), we clarified that the questionnaire prepared based on Kuipers (1999) is composed of three blocks: in the first, institutional information is requested and functional, for purposes of identifying the profile of respondents. There are five multiple-choice questions in the second block to verify which legislative actions are developed together (between offices). In the third block, a nominal list of servers we presented, where respondents indicated which people (co-workers) they have social relationships with or have already had at some point, observing the three aspects of the relational dimension proposed by Kuipers (1999): exchange of work, friendship and trust information.

At the end of each questionnaire, there was a nominal list containing the names of all public servants organized by sector of work, and each name we assigned a number, this number being responsible for identifying and filling out the questionnaire.

This questionnaire we applied to public servants of the legislative house, namely: councilors, political agents (positions in commission) from councilors' offices, interns and permanent servants. Thus, considering the data presented by the institution's Personnel Department, 133 civil servants from the legislative house were deemed to answer the questionnaire.

It is noteworthy that questionnaires we delivered in person we being collected later, according to a deadline individually agreed with each of the respondents or according to a deadline stipulated by the head of the cabinet. However, due to the general difficulty, we decided to apply the questionnaires one by one, individually with each employee, although some refused to answer. Others claimed that they could not at the time, as they were busy (some public servants approached them. If more than 5 (five) times at different times) until the last day stipulated for collection, we answered 112 questionnaires, of which 04 were null and 108 were valid.

The decision of questionnaires nullity defined a priori, was because the third block they not answered in its entirety or that they answered with the respondent stating relationship in any aspect "with everyone" since it was necessary to reflect with which people the respondent had had a relationship in the last six months and "everyone" we considered a non-valid answer.

Regarding the social network mapping, the data provided by the respondents we listed in a relationships matrix where the representation of the relationship between the nodes and their connections (in this case, each pair of nodes there is a connection is represented in a spreadsheet line) when there is (Recuero, Bastos & Zago, 2015), as shown in Table 1.

Table 1 - Example of a matrix of relationships

Friends	
Marcia	Maria
Marcia	Felipe
Raquel	Felipe
Ana	Felipe
Ana	Marcia

Source: Adapted from Recuero et al. (p. 46, 2015).

We processed the network on Gephi 0.9.1 software and we build nodes and edges. Each relational dimension, e.g., information, friendship and trust.

We created a different matrix, originating three distinct networks. According to Recuero et al. (2015), we based the ARS on specific metrics built over the years by various researchers and works to analyze these networks, node and network metrics used.

Therefore, aiming to analyze the relational dimension of social networks mapped in their properties and characteristics, identifying communities or groups (clusters), as well as verifying their density (network metrics) and the centrality of each node, the following ARS metrics will be used, confirmed with the aid of the data laboratory-generated by the Gephi 0.9.1 software, cited and conceptualized in Table 2, below:

Table 2 - Social Network Analysis Metrics to we used in the research

Metrics		Concepts
Node Metrics	Centrality degree	A measure of the number of connections that each node has with the other nodes in the network, ranging from 0 to the maximum possible connections number (Shaw, 1964).
	Betweennes centrality	The measure of how much each node connects different groups (which do not link directly), serving as a "bridge" between them and reducing distances in the network (Freeman, 1979).
	Closeness centrality	The measure of close each node is to the other nodes in the network, considering the average distance between them. The smaller the Closeness measure, the closer the node is to the others (Sabidussi, 1966).
	Eigenvector centrality	A measure of central each node's connection is in the network. It considers the centrality of the non-direct links of each node (Bonacich, 1972).
Network Metrics	Density	The network interconnection measure refers to the number of identified connections about the total number of possible connections: the density greater and cohesion of the network (Borgatti et al., 2009).
	Modularity	The separation of network nodes by communities, e.g., nodes groups densely connected but fragilely with the other nodes. (Blondel et al., 2008).

Source: elaborated by the authors, based on Recuero et al. (2015).

RESULTS AND DISCUSSION

When applying the data collection instrument, 108 valid questionnaires, where three networks of interpersonal relationships we mapped: the networks of information exchange, friendship and trust, and each network we analyzed from five perspectives: Degree Centrality, Closeness, Betweennes and Autovector as can be seen in the graphs in Figures 1, 2 and 3.

We noted that the most prominent order nodes in each network followed the Degree Centrality metric, in which the nodes we organized from the highest values resulting in the degree centrality metrics, except the Closeness centrality measure, which according to Sabidussi (1966), the smaller the Closeness measure, the closer the node is to the others.

In cases of repeated values, the order of classification of the most prominent nodes in the network followed the alphabetical order from A to Z, while in the others, the order of highest centrality value was followed by the lowest.

Also, the graphic representation shown in the graphs, in which each node and edge color indicates the community to which it belongs (BLONDEL et al., 2008), as well label size reflects their importance, the higher label its the representative node within the network or the cluster to which it belongs, the meaning of the strength/representativeness/influence of this node will depend on the metric analyzed in each situation.

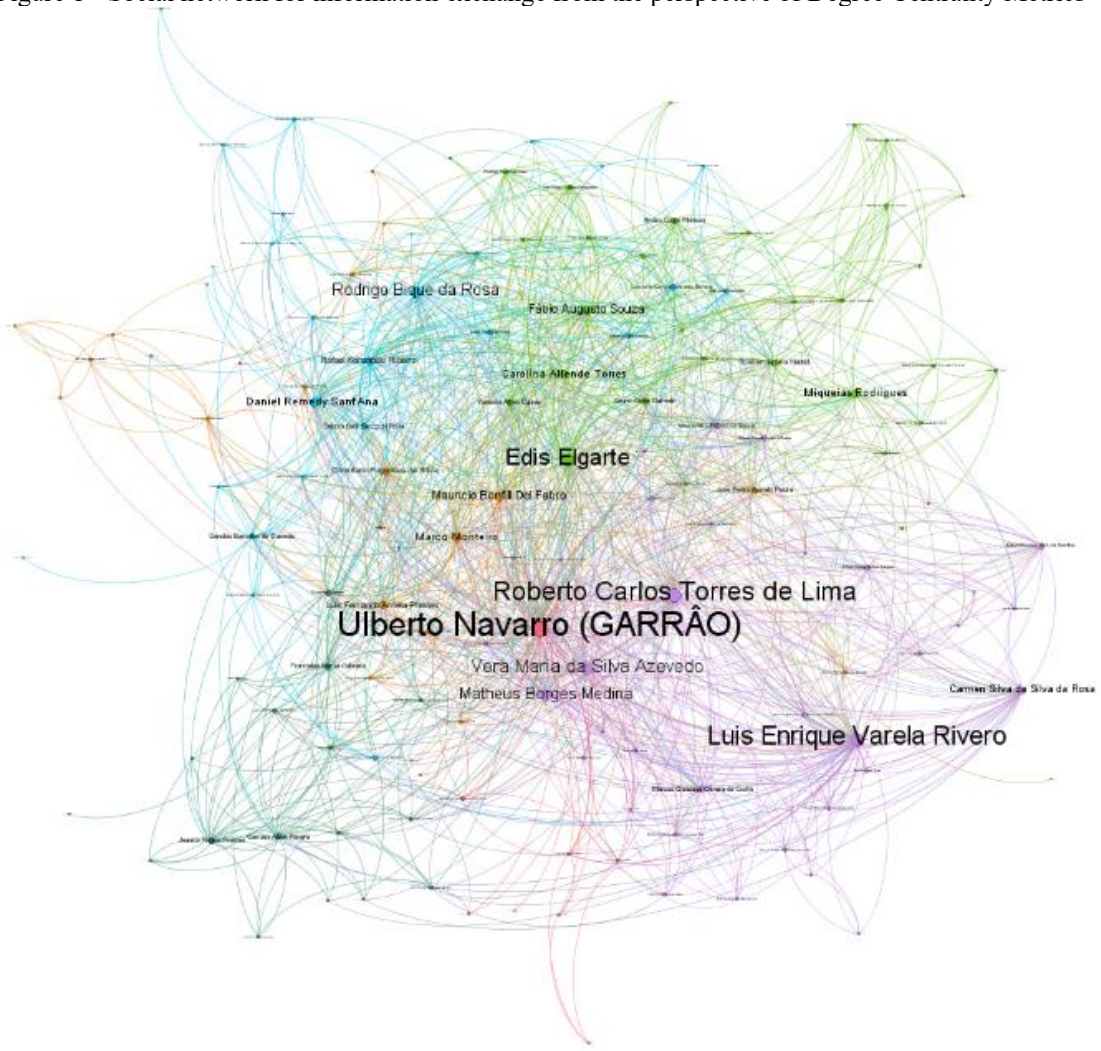
ANALYSIS OF SOCIAL NETWORKS FROM THE PERSPECTIVES OF THE EXCHANGE OF INFORMATION, FRIENDSHIP AND TRUST

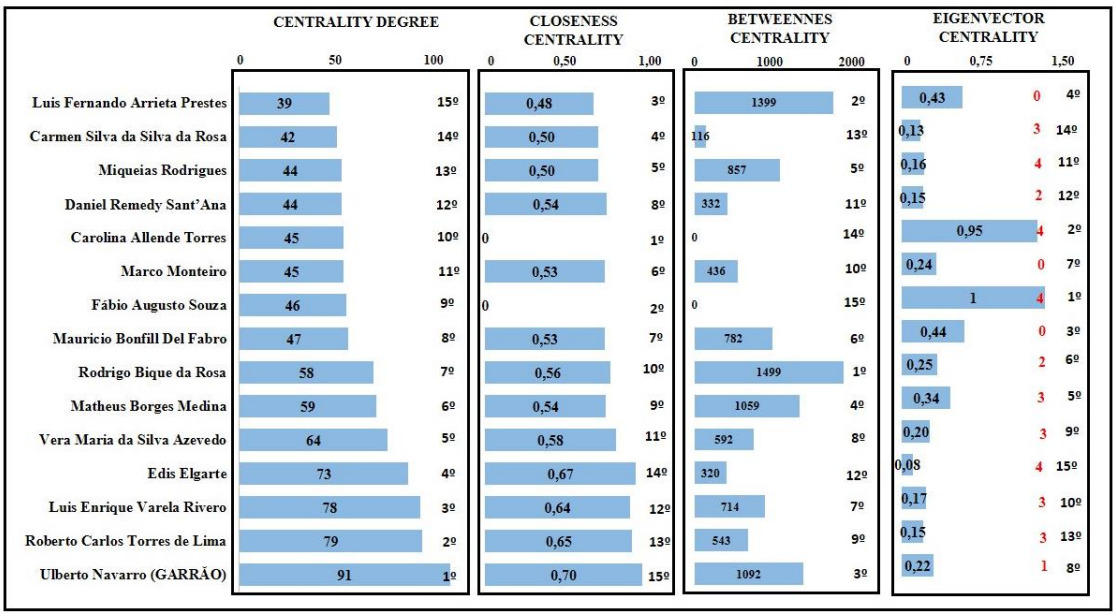
Thus, after the application of the questionnaire to map the networks and their due investigation, there is a social network for the exchange of information between public servants of the Municipal Council of Sant'Ana do Livramento, which we made up of 143 public servants. In this

way, we saw that 1235 edges interconnect 143 nodes or actors, that is, connections between the network nodes, signaling a directed graph.

When analyzing the density metric (BORGATTI et al., 2009), we noticed that it resulted in a value equal to 0.061. We said that it is a 6.1% dense or cohesive network. That is, of the possible connections between 6.1% network actors are effective. The modularity metric (BLONDEL et al., 2008) resulted in a value equal to 0.232 and distinguished 05 different communities. These communities we indicated by green, blue, lilac, orange and gray in the graph. We understood that these 05 large groups determine the behavior of the network. That is, they reflect how the actors they organized. The nodes belonging to each of these modules are not very densely connected. However, more fragile or null with the other actors belonging to the other clusters in the network. The graphical representation of the social network mapped in Figure 1 we presented below:

Figure 1 - Social network for information exchange from the perspective of Degree Centrality Metrics





Source: Prepared by the author with the help of Gephi Software 0.9.1.

The results in Figure 1, according to the degree centrality metric, the public servant (political agent) that connects more public servants in the interpersonal relationship of information exchange is Councilor Ulberto Navarro (GARRÃO) with 91 connections, followed by parliamentary advisor Roberto Carlos Torres de Lima, with 79 links, and Cabinet Coordinator Luis Enrique Varela with 78 direct connections. We noted that the three actors mentioned belonging to the same Office, and these actors (public servants) play an essential role in the network, having an excellent capacity for exchanging information with the most significant number of direct connections with other actors in the network. Regarding the Betweennes degree, press advisor Rodrigo Bique da Rosa and parliamentary advisor Luis Fernando Arrieta Prestes appear in 1st and 2nd place, with 1499 and 1399 degrees. That means that the more he finds themselves in a situation where other public servants have to go through them to reach other actors, the greater capacity for coordination, control and circulation of information on the network (LEMIEUX and OUIMET, 2004), according to the graph in Figure 1. We have seen the press officer circulates among all the offices to collect the information we can disclose, thus fulfilling his function, contributed to the degree of The Betweennes of this actor was high, as well as that of the parliamentary advisor Luis Fernando Arrieta Prestes, who was in charge of the President's Office in 2018, in which Councilor Danúbio Barcellos was presiding. This fact may have influenced the Betweennes capacity of this actor to have increased.

About the Closeness Degree, the legislative official Carolina Allende Torres and the Director Fábio Augusto Souza occupy the first place tied with 0 degrees, the parliamentary advisor Luis Fernando Arrieta Prestes with 0.48 degree, we understood that these civil servants are more influence subject. Considering that this metric proposes that the more an actor finds himself distant from other actors, the more autonomous he will be about his choice of actions (FREEMAN, 1979).

We noted that even though this node is more peripheral in the graph, it does not influence its measure of mathematical Closeness. The legislative official Carolina Allende Torres and the Director Fábio Augusto Souza understood that the role they play within the Legislative House requires rigor to comply and protocols inherent to their functions. These are influential positions requiring autonomy but rather a compliance with regulations. About the parliamentary advisor Luis Fernando Arrieta Prestes, we understood that his role before the Office of the President of the House in the 2018 term required him an authentic character of importance and adherence to the regulations to fulfill his functions.

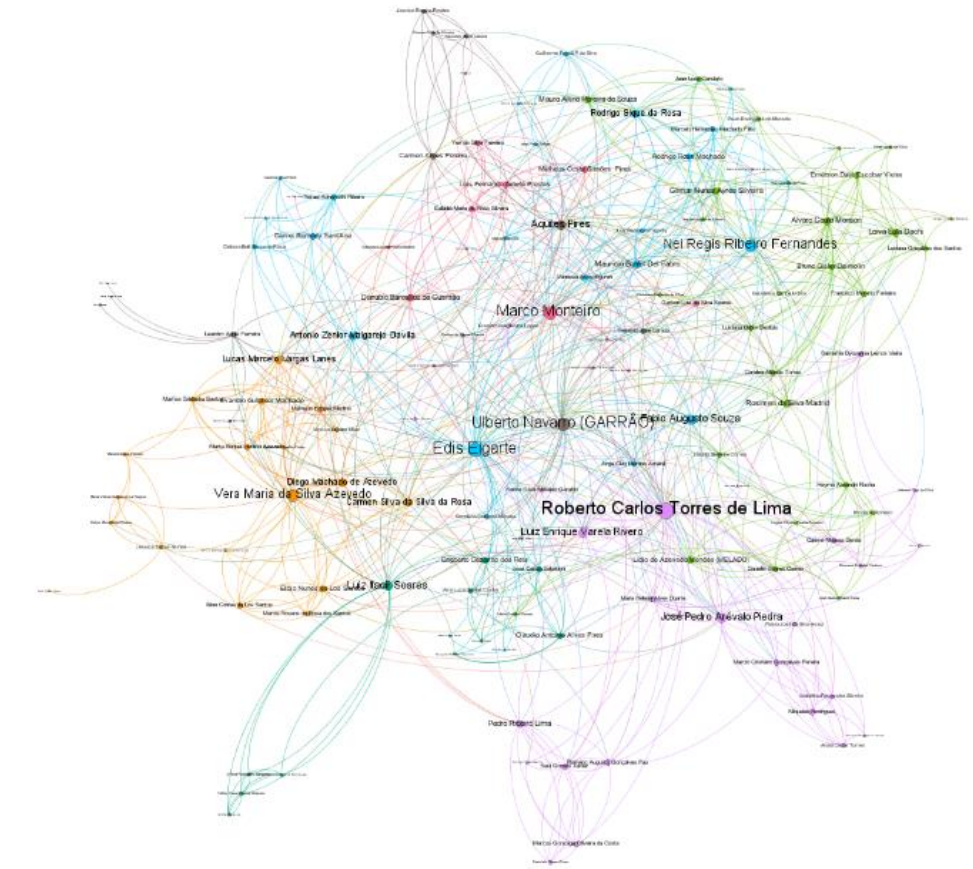
About the eigenvector centrality, we identified the director Fábio Augusto de Souza (cluster nº 4), the parliamentary advisor Luis Fernando Arrieta Prestes (cluster nº 4) and Councilor Mauricio Bonfill Galo Del Fabro (cluster nº 0), as the most prominent nodes of their clusters, that is, considering the direct and indirect connections, these political agents have an influence over the others in each group of public servants, thus increasing their prestige and power of force over the other nodes (Bonacich, 1972)

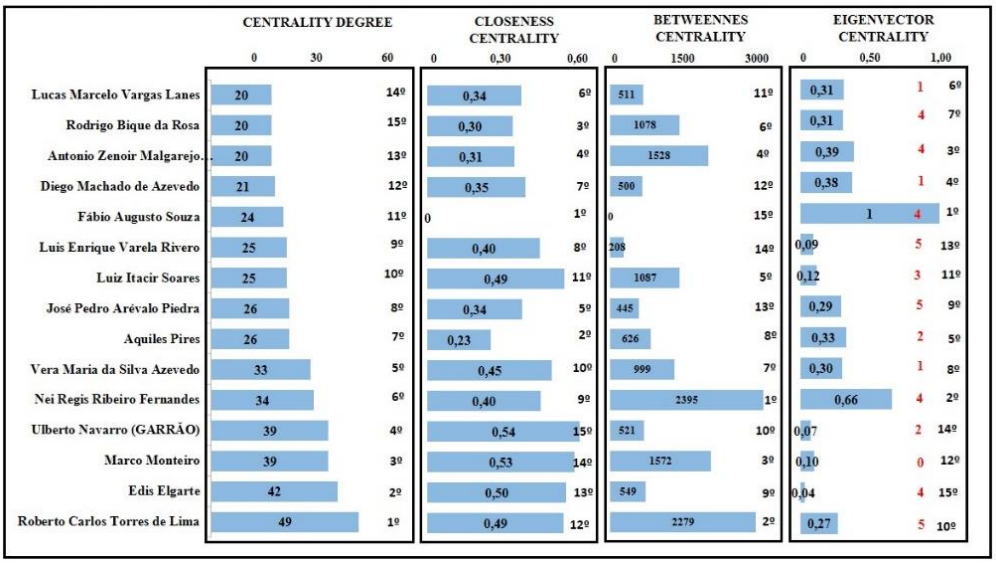
We have seen from the analysis that the director Fábio Augusto de Souza and the parliamentary advisor Luis Fernando Arrieta Prestes make up the same cluster, No. 4 and that both are representative of this group of actors that make up the information exchange network in the Legislative House.

As for the interpersonal social network of public servants of the City Council of Sant'Ana do Livramento, we said that 138 public servants form it. Thus it can be seen that there are 138 nodes or actors interconnected in the network by 786 edges, that is, connections between nodes, signaling a directed graph.

When analyzing the density metric (BORGATTI et al., 2009), we noticed that it resulted in a value equal to 0.042, which can be said to be a 4.2% dense or cohesive network, that is, the possible connections between the network actors 4.2% are adequate. The modularity metric (BLONDEL et al., 2008) resulted in a value equal to 0.393 and distinguished 07 different communities. These communities we determined by the colors green, light blue, lilac, orange, pink, brown and pool blue in the graph. We understood that these 07 large groups determine the behavior of the network. The nodes belonging to each of these modules are not very densely connected and are even more fragile or null with the other actors belonging to the other clusters in the network. The graphical representation of the social network we mapped in Figure 2.

Figure 2 - Friendship social network and the 15 most central nodes from the perspective of degree Centrality Metrics





Source: Prepared by the author with the help of Gephi Software 0.9.1.

According to the results shown in Figure 2, according to the degree centrality metric, the employee who connects the most public servants in the interpersonal friendship network of the Sant'Ana do Livramento City Council is parliamentary advisor Roberto Carlos Torres de Lima with 49 connections, followed by press advisor Edis Elgarte with 42 links and Councilor Marco Monteiro, in third place with 39 links in the network. We understood that these public servants play an essential role in the network, having the most significant number of direct connections with other actors in the

network. Interestingly, the actor Roberto Carlos Torres de Lima, who has the most considerable number of connections, had his network measurement questionnaire considered null by this researcher for not meeting the criteria specified for this research. However, the actor highlighted itself due to the indication of other actors, which reinforces the significance of this node for the network, as it also has the presence in this ranking of Councilor Ulberto Navarro (GARRÃO) in the 4th place with 39 connections and the Coordinator Luis Enrique Varela Rivero in 9th place with 25 direct links.

Regarding the degree of Betweennes of the network, parliamentary advisor Nei Regis Fernandes in 1st place with 2395 degrees, parliamentary advisor Roberto Carlos Torres de Lima in 2nd place with 2279 degrees and Councilor Marco Monteiro in 3rd place with 1572 degrees. That means that the more these public servants find themselves in a situation where other public servants have to pass through them to reach the other actors, the greater the capacity to coordinate, control and circulation information in the network (Lemieux & Ouimet, 2004), as can be seen in Figure 2.

We noticed that Councilor Marco Monteiro appeared in third place in the degree and Betweennes centrality network, which exposes the Councilor's relationship with the other nodes in the network as very representative. However, we highlighted the fact that no other member of this Councilor's Office we mentioned in the ranking of the 15 most representative nodes, which shows that the representativeness of this node may be more linked to the Personal Figure and not precisely to the position performed by this one in the Legislative House.

Regarding the Closeness Degree, we have seen that the Director of the Legislative House Fábio Augusto Souza occupies first place, Councilor Aquiles Pires and the advisor Rodrigo Bique da Rosa, with 0, 0.23 and 0.30 degrees, we understood that these civil servants are more influence subject because they have a smaller average distance measure from the most central nodes. The fact that the civil servants Fábio Augusto Souza and Rodrigo Bique da Rosa are more influenced than the others is justified because they perform their duties within the Chamber. However, about the analysis of Councilor Aquiles Pires, it is clear that the Second place in this metric shows that the Councilor's posture, always friendly and attentive to everyone's demands, reflects and highlights the figure of the Councilor in front of the network. The fact that Councilor Aquiles Pires belongs to the PT – Workers' Party, the most representative of the City Council with 04 councilors, we not considered, because even though two other Councilors, members of the bench, are among the most prominent nodes, they are not relevant in the analyzed metric.

We noted that even if this node is more peripheral in the graph, it does not influence its measure of mathematical Closeness. Another point that we highlighted is that the node with a lower degree, in this case, the director of the legislative house, is much more influenced than the second and third nodes, for example, since the average difference between the first and last is .029 degrees.

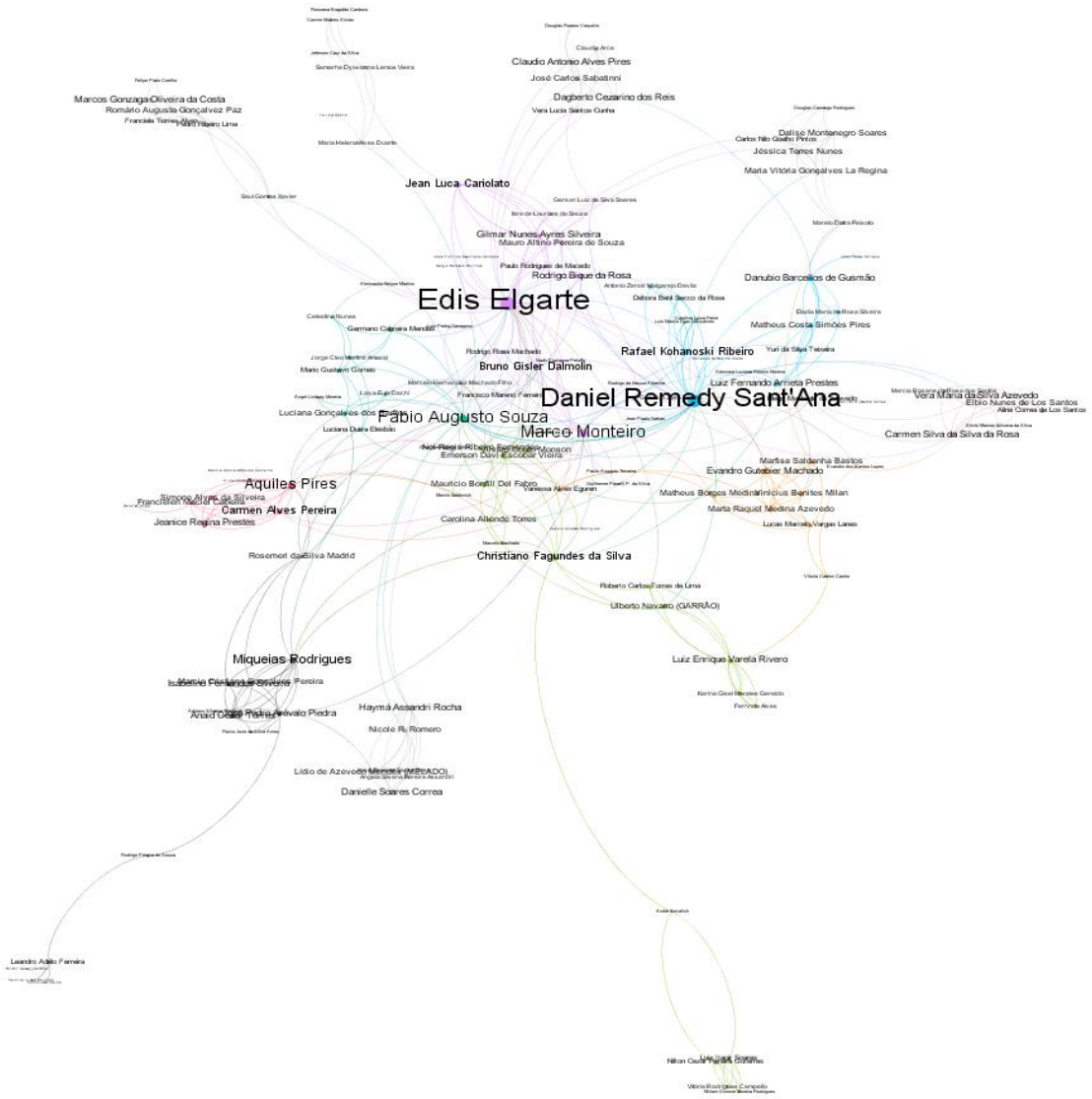
About the eigenvector centrality, we identified the director of the Legislative House Fábio Augusto Souza with degree 1 (cluster nº 4), parliamentary advisor Nei Regis Ribeiro Fernandes, with a degree of 0.66 (cluster nº 4), and Alderman Antonio Zenoir Melgarejo with a degree of 0.39 (cluster No. 4), as the most prominent nodes of the same cluster. That is, considering the direct and indirect connections, these civil servants have an influence and prestige over other civil servants within the grouping of nodes to which they belong (Bonacich, 1972).

We understood that the most representative nodes of each cluster, according to Degree Centrality, belong to the same cluster, number 4. However, none has an institutional connection as they operate in different sectors and offices, demonstrating the variability of actors within the same cluster.

Regarding the interpersonal trusted social network of public servants of the Municipal Council of Sant'Ana do Livramento, we said that we made up 135 public servants. Thus it can be seen that there are 135 nodes or actors in the network. Interconnected by 422 edges, that is, connections between nodes, signaling a directed graph.

When analyzing the density metric (Borgatti et al., 2009), we noticed that it resulted in a value equal to 0.023, being able to say that it is a 2.3% dense or cohesive network, that is, of the possible connections between the network actors 2.3% are adequate. The modularity metric (Blondel et al., 2008) resulted in a value equal to 0.609 and distinguished 14 different communities. These communities we determined by the colors blue, lilac, orange, pink, lime green, pool blue, purple, gray, brown and the other 05, less representative groups, in a decreasing grayscale in the graph. We understood that these 14 large groups determine the behavior of the network. That is, they reflect the form of organization and grouping of actors. The nodes belonging to each of these modules are not very densely connected and are even more fragile or null with the other actors belonging to the other clusters in the network. The graphical representation of the social network we mapped in Figure 3.

Figure 3 - Trusted social network and the 15 most central nodes from the perspective of degree Centrality Metrics



	CENTRALITY DEGREE		CLOSENESS CENTRALITY		BETWEENNES CENTRALITY		EIGENVECTOR CENTRALITY	
	0 20 40		0 0,40 0,80		0 1000 2000		0 0,75 1,50	
Evandro Gutebier Machado	10	14º	0,44	11º	97	12º	0,34 1	6º
Dagberto Cezarino dos Reis	10	12º	0,35	7º	148	10º	0,25 8	11º
Danúbio Barcellos de Gusmão	10	13º	0,44	10º	256	8º	0,27 8	9º
José Pedro Arévalo Piedra	10	15º	0,52	13º	334	7º	0,35 2	5º
Carmen Alves Pereira	11	9º	0,48	12º	118	11º	0,64 4	3º
Rafael Kohanoski Ribeiro	11	11º	0,29	5º	621	6º	0,27 1	10º
Bruno Gisler Dalmolin	11	8º	0,17	3º	747	4º	0,17 12	13º
Jean Luca Cariolato	11	10º	0,23	4º	1135	2º	0,31 12	8º
Christiano Fagundes da Silva	12	7º	0,00	1º	0	14º	0,68 0	2º
Miqueias Rodrigues	14	6º	0,52	14º	54	13º	0,32 6	7º
Aquiles Pires	17	5º	0,73	15º	206	9º	0,6 4	4º
Fábio Augusto Souza	20	4º	0,00	2º	0	15º	1 5	1º
Marco Monteiro	21	3º	0,32	6º	695	5º	0,1 12	14º
Daniel Remedy Sant'Ana	33	2º	0,40	8º	836	3º	0,2 1	12º
Edis Elgarte	38	1º	0,40	9º	1640	1º	0,08 12	15º

Source: Prepared by the author with the help of Gephi Software 0.9.1.

According to the results shown in Figure 3, according to the centrality metric of degree, the public servant (political agent) that connects more public servants in the interpersonal relationship of

trust of the Sant'Ana do Livramento City Council is the press officer Edis Elgarte with 38 connections, followed by parliamentary advisor Daniel Remedy Sant'Ana with 33 links and Councilor Marco Monteiro with 21 links in the network. These public servants play an essential role in the network, having the most significant number of direct connections with other actors in the network.

It appears that Councilor Marco Monteiro occupies 3rd place in the friendship and trust networks, which confirms the analysis carried out in the friendship network and confirms that the personal image of the Councilor, who has the profession of Federal Police, is the friendliest and trustworthy among the councilors who currently occupy the seats of the Municipality of Sant'Ana do Livramento.

Regarding the degree of Betweennes of the network, the press officer Edis Elgarte appears in 1st place, with 1640 degrees, the IT sector intern Jean Luca Cariolatto in 2nd place, with 1135 degrees and the parliamentary adviser Daniel Remedy Sant'Ana in 3rd place, with 836 degrees of Betweennes, this means that the more these public servants (network actors) find themselves in a situation where public servants (other network actors) have to go through them to reach other actors, the greater it is the ability to coordinate, control and circulate information on the network (Lemieux & Ouimet, 2004), as shown in Figure 3.

It is understood from this analysis that the Betweennes capacity of public servants Edis Elgarte and Jean Luca Cariolato is due to their respective roles in the press and information technology sector, in which they communicate compulsorily with everyone in the Chamber Municipal, in what concerns the civil servant Daniel Remedy Sant'Ana, who belongs to the Office of Councilor Antonio Zenoir, we observed that in the 6th position of this metric, is his cabinet colleague, the civil servant Rafael Kohanoski Ribeiro, which shows that not only the servers act in isolation in the network of trust, but that the cabinet has a reference regarding the interpersonal relationship of trust within the City Council of Sant'Ana do Livramento, a fact that we confirmed in the network of authority /constant confidence in the next item of this analysis of results since the Councilor himself, as well as his parliamentary advisors, occupy the 13th and 14th position.

As for the Degree of Closeness, that is, how close a specific node is to the others in the network, we have seen that, in this case, the legal attorney Christiano Fagundes da Silva and the director Fábio Augusto de Souza occupy the first place, with a degree of Closeness 0, followed by the legislative assistant Bruno Gisler Dalmolin with a degree of 0.17, we understood that these countries are more subject to influence because they have a smaller average distance measure from the most central nodes. This classification is justified because the servers work in the Legal Attorney, General Directorate and Personnel Department sectors, which provides the obligation to establish

interpersonal relationships with all public servants of the City Council. However, it appears that these concentrate high credibility and trust of the other actors in the network.

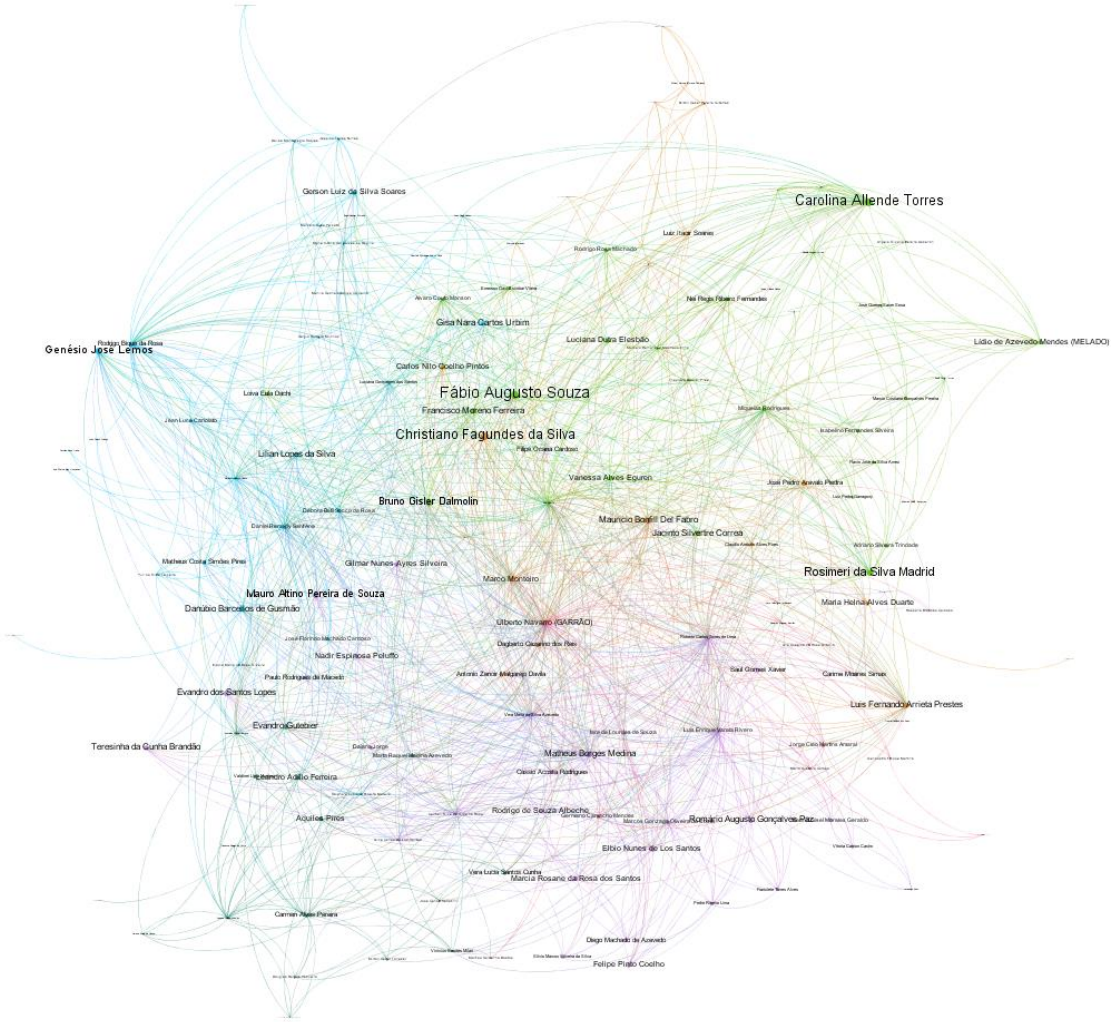
About the centrality of the eigenvector, we identified that the director Fábio Augusto Souza with degree 1 (cluster No. 5), followed by the legal attorney Christiano Fagundes da Silva with a degree of 0.68 (cluster No. 0), and the coordinator Carmen Alves Pereira cabinet with a degree of 0.64 (cluster No. 4), is the most prominent primary nodes of their respective clusters, that is, considering the direct and indirect connections, these public servants have an influence on the others in each group of public servants within the network (clusters), thus increasing its prestige and power of influence (Bonacich, 1972).

Regarding networks, when analyzed from the perspective of authority metrics, a new configuration can be seen, which shows practically the same actors in the three analyzed networks, unlike the result obtained in the previous analysis. This result is because the authority metric (Kleinberg, 1998) represents the sum of the hub with which each node has linked, that is, when a specific node transmits or broadcasts certain information to the receivers simultaneously.

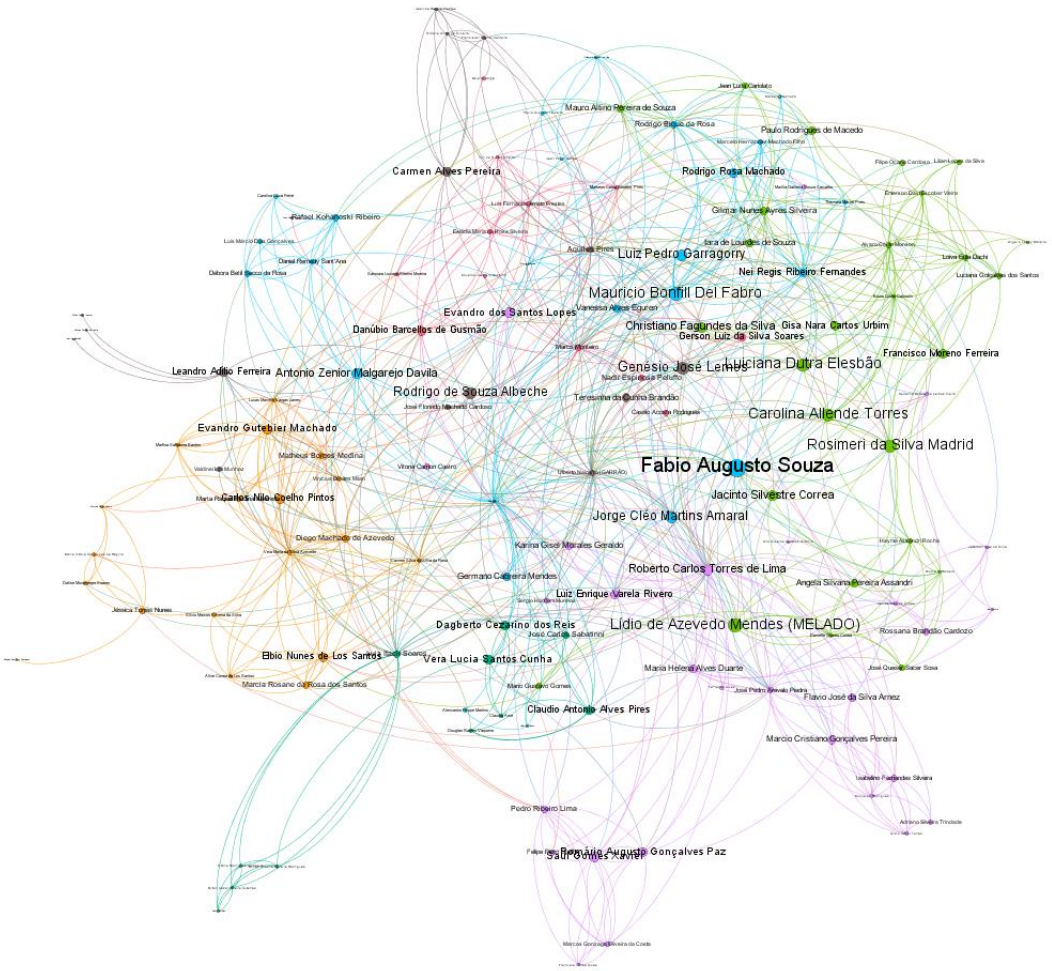
In this context, there is the differentiation of the power of the information flow that a node with a high degree of Betweennes has since it acts as a “bridge” or gatekeeper. That, in its position, decides which information should circulate between clusters or between a pair of actors. For example, in authority, the node transmits the same information without reservations or filters.

It can be seen visually, in Figure 4, that the most prominent nodes are permanent civil servants, in non-political positions, such as legislative assistants who work in different sectors such as the secretariat and human resources department, legal attorney, and directors.

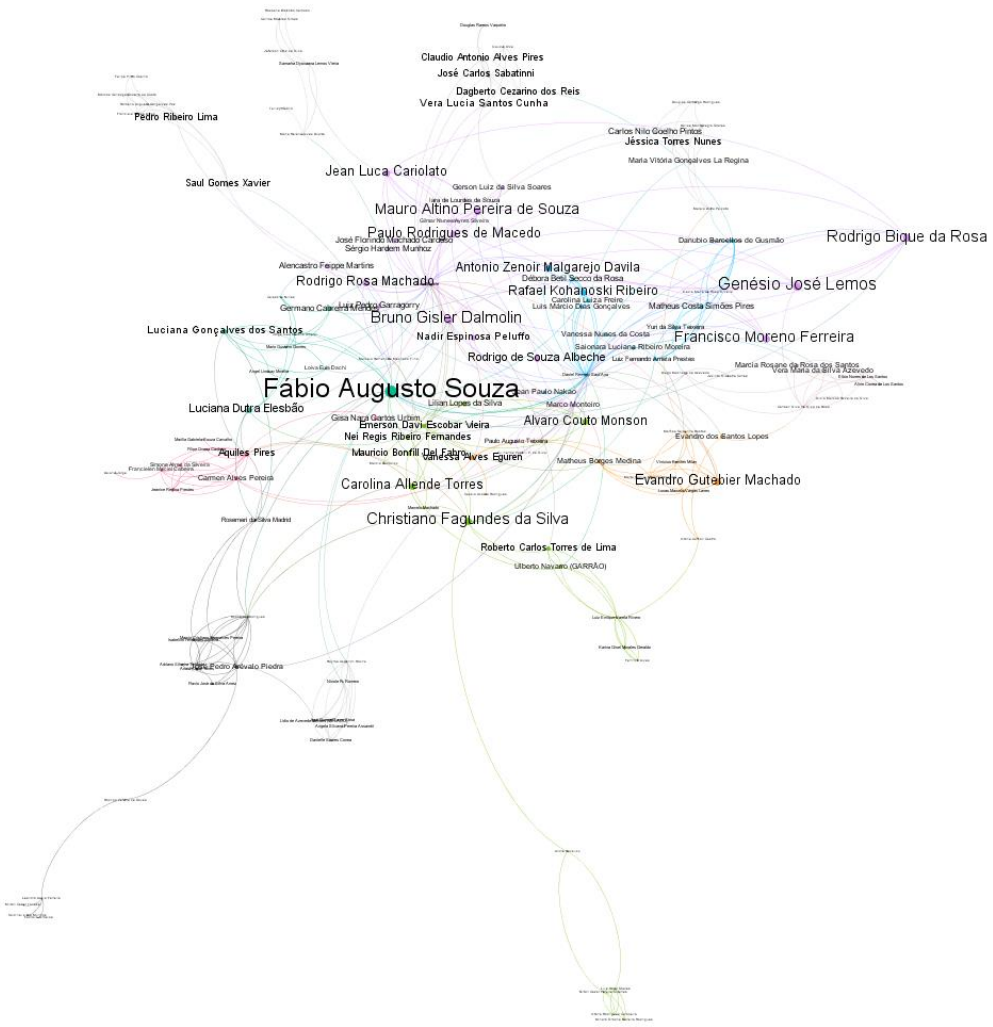
Figure 4 - The 15 most central nodes in the information exchange network (A), friendship (B) and trust (C) about authority metrics



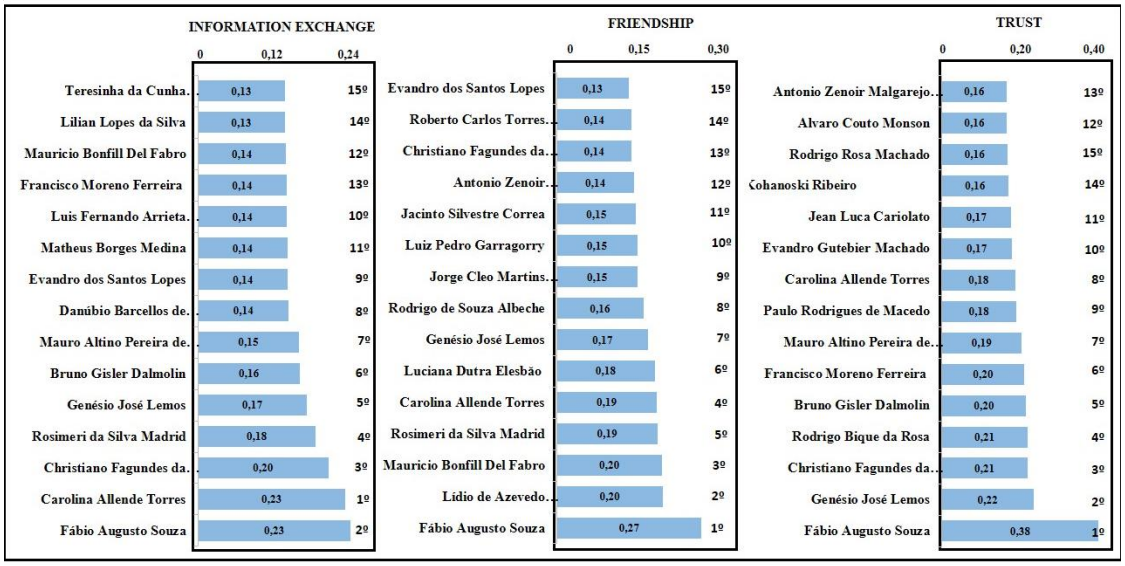
(A)


Mauro Assis Pereira de Souza
Rodrigo Rosa da Rosa
Paulo Rodrigues de Macedo
Carmen Alves Pereira
Rodrigo Rosa Machado
Rafael Kohanoski Ribeiro
Gilmar Nunes Ayres Silveira
Luiz Pedro Carragorry
Nei Regis Ribeiro Fernandes
Mauricio Bonfill Del Fabro
Evandro dos Santos Lopes
Danúbio Barcellos de Gusmão
Christiano Fagundes da Silva
Gisa Nara Cartos Urbim
Gerson Luiz da Silva Soares
Francisco Moreno Ferreira
Leandro Adão Ferreira
Antonio Zenior Malgarejo Davila
Genésio José Lemos
Luciana Dutra Elesbão
Rodrigo de Souza Albeche
Carolina Allende Torres
Evandro Gutebier Machado
Rosimeri da Silva Madrid
Fabio Augusto Souza
Carlos Nilo Coelho Pintos
Jacinto Silvestre Correa
Jorge Cléo Martins Amaral
Diogo Machado de Azevedo
Roberto Carlos Torres de Lima
Germano Cabeira Mendes
Angela Silvana Pereira Assandri
Luiz Enrique Varela Rivero
Dagberto Cezarino dos Reis
Lídio de Azevedo Mendes (MELADO)
Rossana Brandão Cardozo
Elbio Nunes de Los Santos
Vera Lucia Santos Cunha
Maria Helena Alves Duarte
Marcia Rosane da Rosa dos Santos
Flavio José da Silva Arnez
Claudio Antonio Alves Pires
Marcio Cristiano Gonçalves Pereira
Pedro Ribeiro Lima
Saul Gomes Xavier
Benário Augusto Gonçalves Paz

(B)



(C)



Source: Prepared by the author based on metrics calculated by the Gephi Software 0.9.1.

According to the results indicated, according to the authority metric. This public servant receives, transmits or disseminates the same information to the other actors (receivers) of the network at the same time in the interpersonal relationship of information exchange, friendship and trust are

the legislative official Carolina Allende Torres and director Fábio Augusto Souza, both tied for 1st and 2nd place with 0.23 degrees, and legal attorney Christiano Fagundes da Silva in 3rd place, with 0.20 degrees. We noted that the servers Carolina Allende and Christiano Fagundes did not respond to the social media measurement questionnaire since the first refused and the second was on vacation during the collection period, which highlights the importance of these actors in the network since they are integrating it because other actors have mentioned them.

CONSIDERATIONS

Thus, we learned from this analysis of social networks that the mathematical measures used (metrics) for the processing of information from the networks are of fundamental importance to highlight the formal and informal interpersonal relationships established within the City Council, as well as, from any other personal and professional environment, as it, elucidates them, as in the case of informal social networks for the exchange of information, friendship and trust in which the most prominent actors are heterogeneous, from different offices and sectors, and occupy different positions in commission, interns or staff, we noticed that these elements do not influence the establishment of a relationship between the actors.

However, when observing the authority network, a homogeneous configuration was noticed, which shows positions related to the general direction of the institution, secretariat and legal attorney. In the case of the analyzed actors, the legislative official Carolina Allende Torres and the Director Fábio Augusto Souza, it is understood that the role they play within the Legislative House requires strict compliance with specific rules and protocols inherent to their functions, which do not require given autonomy, but the fulfillment of specific, protocol, institutional and politically disinterested regulations. We believed that the factors mentioned above ensure that these actors have their information heard and considered by many networks.

We noted a board of directors formed by councilors and that the mayor at the time, councilor Maurício Bonfill Del Fabro, was the 12th most central node in the authority networks, which shows that the metric does not necessarily link to relations of hierarchy and power.

In this way, we expected to contribute theoretically to the academy, in particular to the Analysis of Social Networks, by demonstrating that, regardless of the position held by public servants of the City Council, whether they are effective, in commission or interns, the importance of each actor in the network it will be due to their involvement in the formal and informal networks.

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