Study of Network Public Opinion Structure Based on Social Network Analysis

-- Scientific Research Funds in Chinese as an Example

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Abstract—This paper is a case study on scientific research funds in colleges and universities in China and it introduces social network analysis to explore the structure of scientific research funds network. It analyses network's degree, core-periphery structure and cohesive subgroups, based on the data from <http://www.people.com.cn>. The analysis reveals that the scientific research funds network is in the stage of the formation, although there have been some influential members, but generally speaking, the network is more dispersed, with less subgroups. And the communication between the actors in the network is not frequent, even if in the subgroups.

Keywords- network public opinion; network structure; social network analysis; cohesive subgroup

I. INTRODUCTION

Social network generally refers to a collection of social actors and their interactions. A social network is composed of a plurality of nodes (social actors) and edges (relationship between actors), consists of a set of points and lines. Social network analysis (SNA) is a kind of sociological research methods, is the mapping and measuring of relationships and flows between people, groups, organizations, computers or other information/knowledge processing entities, explores the attribute character of the network by analyzing the relationship between the network members, and reveals the characteristics of network structure through graph theory, mathematical model and statistical software with the relationship data.

From the perspective of internet public opinion, the actors (cyber citizen) constitutes the social network, and the interactive relationships in the Internet replace traditional social relations, gradually become major pattern linking all the actors. Therefore, social network analysis can be used to explore the network public opinion. It is in line with objective discipline that the actors are both independent and different from each other in the network. It's feasible and necessary to study the actors' role and power in the whole network by exploring the reactions between them.

There are two major research methods in the research of network public opinion, one is traditional research mode, and the other one is social network analysis. The biggest differences between the two methods is that the traditional research mode is dominated by content analysis, which is focus on contents and records, with the purpose of

understanding the tendency in the network, figuring out who is the leader in the network and what is his main intention, attitude or emotion. The social network analysis provides a variety of indexes and methods to explore the network properties, structure and node role, can be applied to the internal connection of network public opinion. Social network analysis can not only measure quantitative indexes, draw the relationship map and other basic calculation, but also can display a complete structure of the network by data mining. We can determine the propagation path of information transmission, according to the degree of density of network public opinion structure. Based on the interactive relationship among the members, we can also figure out subgroups that guiding public opinion, etc..

II. RESEARCH DESIGN

A. Node degree analysis

In public opinion network, actors(nodes) generate interactive contact via reply message posted by other one. Degree is the number of other nodes with which a given node is directly connected. The number of nodes flowing into a given node is called "in-degree", and the number flowing from a given node is similarly called "out-degree". Degree is a main index measuring how important the nodes is in the network. If a given actor posting a message can attract attention of most actors, and receive a large number of feedback, or if he actively replies to others' messages, then the actor become an important nodes of the network, in other words, he is in the center of the network with great powers.

B. Core-periphery structure analysis

Core-periphery structure is a common concept in social network analysis, it is the notion of a two-class partition of nodes (one class is the core and the other is the periphery). In the terminology of block modeling, the core is seen as a 1-block, and the periphery is seen as a 0-block. The blocks representing ties between the core and periphery can be either 1-blocks or 0-blocks. The nodes in the network are divided into the core region and a periphery region according to degree of power. Actors in the core region have more power than those in the periphery region.

C. Cohesive subgroups analysis

We can find relevant actors by finding cohesive subgroups, that is, subgroups of actors that have intense interactions within the group than outside the group. Cohesive subgroup analysis can simplify the public opinion network structure, figure out cliques in the network and their relationship. We analyze public opinion network, using cohesive subgroups method, in order to reveal the actual and potential relationship between the actors, and identify whether they have already constituted a strong, direct and tight subgroups? Will these subgroups strongly promote the development of the public opinion?

III. EMPIRICAL ANALYSIS

People have paid more and more attention to the scientific research fund abuse and corruption. We can find out what's the actors' attitude towards scientific research fund abuse and the information communication mode in the public opinion network. Results are conducive to help universities and government grasp the public opinion, design emergency plan, and finally solve the problem. Data needed in our research comes from the People Forum

(<http://bbs1.people.com.cn/>) , we gather all the messages, with title "scientific research fund", posted in the forum from January 1, 2013 to October 31, 2014, record who posts and who replies, calculate the data and establish a relationship matrix. We use ucinet and pajek, which is popular statistical software, to analyze the matrix.

A. Relationship Matrix and Mapping the Public Opinion Network

By the data already collected, there are 239 members participated in the related topics "scientific research fund", then we get a relationship matrix of 239×239 . For privacy protection, we use the first letter of the actors Chinese name instead of their actual name, and the length is not more than six. This relationship matrix is a directed network, Figure 1 is a map we draw according to the matrix, the arrows indicates the replies direction, the thickness of the lines representative frequency of communication happened between the two nodes, the more the interactions happen, the thicker the line is. Additionally, the size of node represents the frequency of communication happened to the given node, the more the actor communicate with others, the bigger the node is.

Figure 1 Public opinion network map

B. Degree Analysis

Table 1, Table 2 and Table 3 shows the list of top 10 actors by in-degree, out-degree and total degree. Table 1 shows that, kjpd attracts the most people's attention , a total of 81 actors participated in the interaction, and the degree number of him is 2.3 times bigger than the second actor, with in-degree number 34, and 13.5 times than the tenth actor. As can be seen from Table 2, the degree number of the top 10 actors are small, the numbers that top 1 and top 2 actor gets

are both nine , which means they have carried out nine times interaction with others. Observed in Table 3, we can conclude that kjpd gets the largest number, his total degree is 81, the top six actors are kjpd, jpyp, jjpd, szpd, sx and ssljx, the same as table 1, but zykjgx rises from top ten to top seven.

Table 1 top 10 in-degree actors

rank	name	in-degree
1	kjpd	81
2	jypd	34
3	jjpg	30
4	szpd	28
5	sx	26
6	ssljxx	18
7	smt	10
8	ykykcd	10
9	lym258	7
10	zygykj	6

Table 2 top 10 out-degree actors

nk	name	out-degree
1	xtsany	9
2	wgfd59	9
3	zygykj	6
4	xz3775	5
5	jiangF	4
6	staint	4
7	nmfm	4
8	orc	4
9	wsljxxq	4
10	117.13	3

Table 3 top 10 total degree actors

rank	name	degree
1	kjpd	81
2	jypd	34
3	jjpg	30
4	szpd	28
5	sx	26
6	ssljxx	22
7	zygykj	12
8	smt	10
9	ykykcd	10
10	xtsany	9

From the analysis results, different actors gets different in-degree number, out-degree number and total degree, it means different actors have different power and play different role in the network. Members like kjpd, jypd, jjpg, szpd, sx, ssljxx are more actives in the virtual community, they can get a lot of attention from the others, and some of them also actively participate in the discussion posted by other one, they make a great contribution to the public opinion network, they are the activists in the network. And all of them have a much bigger in-degree number than out-degree number, which suggests that they are populate in the network, easily get other actors attention, but they paid less attention to others. Actor xtsany has a far greater out-degree number than in-degree number, which indicates that he is interest in the messages posted by other actors, but less likely to be concerned by others. On the contrary, actorskjpd has greater in-degree number than out-degree number, shows that he has strong influence, gets more people's attention, but little attention by others.

C. Core -periphery structure analysis

This section will divide actors in the public opinion network into core and periphery region, using CORR algorithm to determine the position of each actor. The results show that the Final fitness is 0.186, the core - periphery structure is quite obvious. Actors in core region are 123456,135357, xtsany, kjpd, szpd and wgfd59500 and the rest actors are at the periphery region. Actors in core region have only 2.5 % of all members.

D. Cohesive subgroups analysis

In order to make clear of the structure of the public opinion network, this paper make cohesive subgroups analysis. The result show that there are five subgroups in the network, each subgroups has 2-4 members. Compare with other network having the same nodes, the public opinion network has less subgroups and each subgroup has less members. The result also means small group phenomenon is not obvious in the network, there also doesn't exist any group with strong influence. Additionally, the majority of actors are in stragglers state. Overall, we can conclude that the public opinion network of scientific research funds is in the formation stage, without a stable communication with each other.

Table 4 subgroups of the network

subgroups	members
1	49.116 cnys
2	staint dfpd
3	xtsany kjpd szpd wgfd59
4	jjpg xz3775
5	nmfm zscqpd

IV. CONCLUSION

This paper applies models and methods in social network analysis to the study of public opinion. Through the empirical analysis of Chinese public opinion about scientific research funds in China, we can draw a conclusion that actors in the network play a different role because of the different position they have in the public opinion network. The one with the biggest number of degree, has enough power to control others, he is the center of the network, what he say will easily draw a widely public attention, and he can promote the dissemination of public opinion effectively.

Management of scientific research funds is an important task of the education administration department and universities, but hasn't caused the extensive concern yet. Only since 2013, with the rapid development of the anti-corruption in all organizations across all walks of life in China, corruption phenomenon in scientific research funds gradually attracted media attention, a lot of reports began to emerge. This study shows that the public opinion network of scientific research funds is in the formation stage, although there have been some influential actors, but generally speaking, the network is more dispersed, with less subgroups. And the communication between the actors in the network is not frequent, even if in the subgroups.

The significance of this study for the government lies on the following areas: The result reveals the public opinion network of scientific research funds is in the formation stage, and the network is lack of enough subgroups, there are a few of actors that have power to control others. Government sectors can make use of these messages to grasp the latest development in the public opinion, to know what happen in the network, and how to deal with the public opinion correctly. Specifically, the research can help government improve their decision making, take control and guide public

opinion effectively, make sure that the public opinion is in favor of the government's work.

The inadequacies of this article is mainly in the following areas:

Firstly, we carry out the research base on the data collected from only one single forum, the people website forum, although it is the most famous and influential in China, so the result may not describe all the aspect of internet public opinion about scientific research funds in China. Secondly, the data used in the paper is only a short term data, from the year 2006 to now. Finally, it is not a dynamic analysis of the network, because there is lack of a long-term observation. All these problems require further study.

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