

The Role of Social Network Analysis in Organizational Knowledge Network System

Sufeng Wang^{1*}, Ziyu Zhao¹, Junkang Feng²

¹Glorious Sun School of Business and Management, Donghua University, Shanghai, China, 200051

²Database Research Group, School of Computing, University of the West of Scotland, UK

*EMAIL: sf_wang@dhu.edu.cn

Abstract: In an organization, the acquisition and conversion of knowledge presents a network structure of knowledge flow. This network is nested in the specific network of organizational relationships. Using the Social Network Analysis, from the 'self-centered social network' and 'whole social network' viewpoints respectively, this paper makes a discriminatory analysis about the nodes, the intensity and the key knowledge points of knowledge exchange in a organizational knowledge network.

Key words: Organizational knowledge management, knowledge conversion, knowledge network, social network, Social Network Analysis

I. Introduction

From the perspective of resource evolution, the focus of competition between enterprises has turned from operand resources to operant resources. The so-called operant resources are no other than knowledge, technology, information etc. Although invisible, these resources could give infinite capacities ^[1]. With knowledge being the most important resource in an enterprise, knowledge management has become a hot topic in the business and theory circles. But how can you transfer the knowledge that hides behind the dominant factors — — such as product, market, technology and the inside of the organization — — into business innovation? That question determines the direction of business development.

Because of the mobility of knowledge, the management of knowledge is not a static process but a dynamic and developing process. Numerous studies from home and abroad have shown that, knowledge management activities are nested in the specific relational network, such as the social networks between company insiders, and the collaborative network between company and external businesses. These networks permeate invisibly in the process of knowledge conversion. The network structure has an effect on the processing of knowledge during the process of knowledge flow ^[2]. With Social Network Analysis, this paper analyzes the states of knowledge flows within enterprise organizations.

II. Introduction to Social Network Theory

The development of social network theory

In the 1930s in the U.S., influenced by Wolfgang Kohler's 'Gestalt' theory, a group of scholars who had emigrated from Germany began to do research on Cognitive Psychology and Social Psychology. This had promoted the research on 'sociogram' and 'Group Dynamics' to emerge in large numbers, which laid the foundation for the development of social network analysis. Then in Britain, especially in University of Manchester, following Alfred Reginald Radcliffe-Brown, who had focused his research on contradictions and conflicts in African tribes, there were breakthroughs that combine mathematics and substantive social theories. Until the 1960s, scholars in Harvard University began to extend research on mathematical foundations of social structure. Those three ideas had finally contributed to the birth of social network analysis structure ^[3].

The content of Social Network Theory

Social network analysis focuses on doers and the relationship between them. By researching and analyzing the relation and connection of doers, it could reveal the social network information of them, even further, observe and understand the social network characteristics of them. Social network could not only show the social network characteristics of individuals, but also grasp much invisible knowledge that hides in these organizational networks. As social network plays a very important and invisible role in the flow of knowledge, when acquiring or transferring knowledge, the enterprise usually follows the internal network of the organization. Therefore, we have to make clear what social network is, and what contents or methods it contains.

The main elements of social network analysis

SNA is use to describe and measure the relationships between actors or any tangible and intangible things moving through those relationships, such as knowledge, information and resources. Since the anthropologist Barnes use the concept of "social networking" to analyze the social structure of a fishing village in Norway for the first time, SNA is considered to be one of the most clear ,simple and convincing perspective of study about social structure. From 1970s, SNA is used to explore some special form of networks such as clique, block, social circle and intra-organizational networks, market networks. Moreover, from a different analytic point, sociologist to make research on the behavioral characteristics, processes and the social structure

which reflect by actors act from the two perspectives of relational orientation and position orientation. These discussions gradually formed the main elements of network analysis.

The research method of SNA

Since the SNA has appeared, the research methods of social network are studied from different perspectives and backgrounds. Two methods which are widely used at present are the 'self-centered social network' and the 'whole social network'. The former discuss the location and the jointing of the actor in the network, and the latter is used to analyze the composition and the form. As the knowledge will be affected by relationship and structure of network when it flows in social network, making use of the self-centered social network research method and the whole social network research method can measure and state what knowledge network is, which is the foundation of evaluating the condition of the flowage of knowledge in organization and improving the existing knowledge network^[4].

III. The management of Knowledge Networks

The researches of the circulation and sharing of knowledge are commonly qualitative analyses, for lacking the quantitative evaluation method. It didn't change until the theory and technology of the Social Networks Analysis grow to maturity. SNA provide rich and systemic methods, tools and techniques to describe and analyze the social relation networks through mapping and analysis the relationship between men in the teams, to change the invisible flow of knowledge into the clear views. Generally speaking, SNA as a quantitative method to be used in knowledge management could offer the concrete means to optimize knowledge networks and improve the members' ability of knowledge sharing.

The management of knowledge networks based on 'self-centered social network'

First of all, we should make it clear that what problems dose the 'self-centered social network' solve? One is who do the individual has a special relationship with? That relationship may vary by the content of research. The other is how intense the relationship (connecting intensity) is. As for the knowledge networks in the organization, we can express the two problems above, if regarding the members as the points in the networks, like this: (1) the relation of knowledge circulation between the, namely, the relations that a certain one have with the other members in the organization. (2)The intensity of connection between the network nodes, namely, how to describe the intensity of knowledge exchange in the members of the organization and what effect it.

As for the first problem, we can quote 'social capital' which brought by the French sociologist Bourdieu to solve it. Bourdieu holds social capital as a kind of capital assets that was showed as social structural resources owned by

individuals^[5]. So, the larger scale the Social Networking Site has, the more social capital we have; the more capital we have, the stronger the ability to collect resource is. In fact, the members' status and role in the net cannot be judged precisely only through the number of the knowledge exchange relationship and the scale of the personal networks. However, the key factor which determines the members' status in the networks is the non-redundant contact. Redundant contact means the relationship of information and knowledge is transferred repetitively in network. The efficiency and effectiveness of the knowledge network inside the organization used to be determined by the numbers of the non-redundant contact in the net, and it is also the second problem we have to solve.

To describe the intensity of the knowledge exchange relationship between members, we should first represent concepts of strong connection and weak connection came up by Granovetter. If a man connects with the social relationship directly and frequently, the relation between him and the social relationship is strong^[6]. Correspondingly, if he doest not connect frequently, the relation is weak. In the organizational knowledge networks, we usually divide the dimensions which show connection intensity of knowledge between members into knowledge exchange frequency, type of relationship, intimacy of relationship and content of knowledge exchange. The larger the frequency is, the stronger the connection is; the more intimate the relationship is, the stronger the connection is. The content also affects the connection. The higher value the knowledge has, the stronger the connection is.

Generally speaking, weak connection is good to create and receive the new non-redundant knowledge, while strong connection is good to deliver the complex, high-quality or invisible knowledge.

The management of knowledge networks based on 'whole social network'

'Self-centered social network' put emphasis on anglicizing the numbers of knowledge exchange relationship and what affect the intensity of connection from the view of relationship, while 'whole social network' focuses on anglicizing what effects do knowledge network feature have on the knowledge flow, finding which net structure can improve the efficiency of knowledge flow in organization, and using SNA to recognize the team and the key point in the knowledge network.

In the organizational knowledge network, if the knowledge communications among a certain group's internal members composed of some nodes are obviously more than the communications with other members outside the group, the group is called the knowledge group in the organization. Knowledge team is an informal organization. One reason is that the efficiency of knowledge's creation and spreading is more prior in the informal team than in the individual, the other reason is that it may lead to communication difficulty and factional dispute with the members outside the team. So

an ideal net structure is that there are several small groups within high density while the groups have relationship with each other in the enterprise. It is useful for the spread of knowledge among groups and the improvement of the knowledge-flow efficiency in the organization^[7].

Recognizing the key knowledge points is analyzing the importance of the members in the knowledge network, namely, centrality analysis. Centrality reflects the status and the affection members have in the net. It can be divided into degree centrality and betweenness centrality. The degree centrality reflects how many nodes have a direct link with which the node we want to calculate and we use the size of node degree as a measure. The betweenness centrality reflects a node's control over the communications among other nodes, which is measured by the number of the shortest paths that go through the node. The knowledge network having an excessively high or low centrality is to the disadvantage of knowledge sharing and dissemination. Centrality analysis based on SNA can help us to identify the crucial role and the knowledge expertise in the knowledge network, and it can also identify the boundary role of network that is able to prevent the losing of knowledge.

IV. Example: Knowledge network analysis of research and development team based on SNA

We intend to set one R&D team of a software company as our research target, By SNA, we could make qualitative and quantitative research on the knowledge network that was formed by knowledge transferring between team members. We can use the form of questionnaires and to put the question as 'From whom the problem get resolved or the knowledge supported which is materially related to the work.' Then, the data of knowledge exchange of the member with other member of the team will be got. According to the result of questionnaires, the team knowledge network structure figure was drawn as Figure 1.

In Figure 1, each node represents a member (to mark the member with initials in the figure), each line represents an exchange of knowledge between two nodes and the arrows indicate the direction of knowledge conversion. In the knowledge network, it is emphasized that the relation of mutual knowledge exchange between nodes. So, the connection between the nodes are bidirectional arrows that means the direction of the knowledge transfer is bidirectional. However, there is no interaction between XXC, ZY, LY, CC, WSF and the other member in knowledge exchange and we call them isolated knowledge nodes.

The knowledge network map to be drawn on the SNA clearly reflects the actual flow of knowledge and the situation of the dissemination within the team. Then, we can use the theory of the 'self-centered social network' and 'whole social network' to discuss the information exchange and knowledge diffusion among the members of the team.

Analysis on the scale of network and strength of

connection

We can see the scale of individual network of each member, that is which members have the relationship of knowledge exchange with this member and it is easy to define the knowledge resource of each member in the network. As show in Figure 1, LY, CC, WSF, XLQ, ZY have the knowledge exchange with CB, so through communication and exchange with this five members, CB is easily to acquire and disseminate knowledge resources in the network.

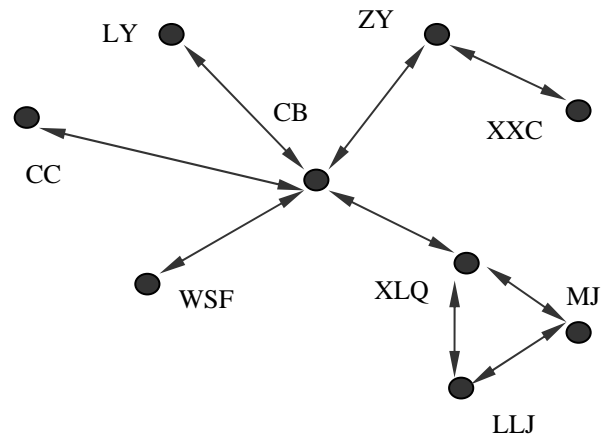


Figure 1. Knowledge network of R&D team

To measure the strength of connection of knowledge, we can use the four dimensions of the way to evaluate the strong connection which was raised by Granovetter: the frequency of interaction, the power of emotion, the degree of intimacy, mutual benefit and exchange^[6]. The data can be obtained through the form of questionnaires or interview. First, according to the features of the intensity of the knowledge exchange, the intensity of the knowledge connection could be divided into three dimensions: the frequency of the knowledge exchange, the relevance of the content of knowledge exchange and work, and the relationship between the members of the team. Then, design the questions as five-point scaling, from 5 to 1 indicates decreasing intensity, the scores will be aggregated to obtain an overall score and then determine the strength of connection among the members by the final total score. We measure the strength of connection between the node CB and other members, to give the frequency of the knowledge exchange and the relevance of the content of knowledge exchange and work 0.4 weight and to give the relationship between the members of the team 0.2 weight. So we can reach a conclusion as Table 1.

From the Table 1, In the contacts who have knowledge with CB, WSF has the highest connection intensity, ZY second, while LY lowest .

Table 1. the strength of connectio between CB and the other members

The intensity of the knowledge exchange	The frequency of the knowledge exchange	The content of the knowledge exchange	Interpersonal intimacy	The strength of connection
CB-LY	2	5	1	3
CB-CC	3	4	4	3.6
CB-WSF	4	5	3	4.2
CB-XLQ	3	3	4	3.2
CB-ZY	4	4	3	3.8

Analysis of key knowledge point

In the above-mentioned knowledge network, we can see that there are two obvious central figure: CB and XQL. In order to confirm the critical nodes in the knowledge network, this paper use the 'local centrality' and the 'global centrality' as metric to calculate all the members in the Figure 1, to get the result as showed in the Table 2.

Table 2. the local centrality and the global centrality of the members

	CB	XLQ	LY,CC,WSF	ZY	XXC	LLJ,MJ
The absolute local centrality	5	3	1	2	1	2
The relative local centrality	0.63	0.38	0.13	0.25	0.13	0.25
Global centrality	11	14	16	16	23	20

The calculation from the Table 2, we can see that CB has the highest local centrality of all, which means that CB has a closest and most frequent direct contact with other members in the entire knowledge network. The computed result of global centrality shows that CB has the lowest global centrality of all. As we know, CB is the closest node between it and other members. So CB at a key position throughout his research team, just like a bridge point. Although G is not as good as CB in the aspect of the local centrality and global centrality, it is obviously better than other points, which proves that XLQ is also such an important role that a small group may be formed around it. Being the typical key points, the two members play an active role in the communicating and disseminating of the knowledge in the entire knowledge network and facilitate the sharing as well.

According to social network theory, the key point and bridge point are quite important in the knowledge network. So we need some ways to increase the key points and the bridge points. My suggestions to deal with the problem are as follows. The meeting should be held regularly by project leaders to discuss and resolve the relevant issues. Project groups should establish regular contacts to maintain

communication, which will expand their knowledge spread in the network.

Summary

The SNA as a method of Sociometry is more and more useful to solve the issues of knowledge management and information technology. Through social networking technology, we could draw a clear picture of the network which includes the flow of knowledge within the organization. Besides, we could also identify the critical knowledge nodes in order to find out effective optimization measures. This research is helpful to explore the root causes that blocks the flow and the sharing of knowledge, provides a reliable basis for improving the efficiency and quality of the flows of knowledge, and objectively establishes institutions and measures which could promote the management of knowledge.

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