

Research on the Knowledge-sharing Dilemmas of DSRT and Countermeasures from the Perspective of Social Networks

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Abstract—The issue of knowledge-sharing was an important factor affecting research performance of Distribution Scientific Research Team (DSRT). Analysis its knowledge-sharing dilemma and put forward countermeasures. Practical problems could be abstracted as the scientific model of Social networks, and could be solved from the view of theoretical point. The research tried to draw on the problem of Knowledge-sharing of DSRT with the research method of social networks theory. In the first place, to construct the general research structural model of DSRT and research on the density of its network, the network location of nodes, the key nodes and small groups. What could be found as follows: There were barriers of DSRT tacit knowledge-sharing in the research process; Individual knowledge sharing incentives was imperfect; Knowledge transfer process of point to point could easily lead to knowledge sharing bottlenecks; and the congenital phenomenon of cohesion subgroup would lead to negative impact on the knowledge-sharing of DSRT. In this paper, the research on the knowledge-sharing dilemma of DSRT using the social network theory and specific recommendations targeted measures had theoretical and practical significance. In theory, the social network theory has been applied more in-depth study, and in practice, analyzed and solved the practical research work on knowledge-sharing of DSRT.

Index Terms—DSRT, social networks, knowledge-sharing, dilemmas

I. INTRODUCTION

The development of Knowledge Economy would be inhibited without the management and the use of knowledge which was the most important resource. Knowledge has become the necessary weapons for personal, team, organizational and national survival and development. First, the use of knowledge requires access to knowledge; the most effective ways and means to access to knowledge were knowledge-sharing for research-based teams. In recent

years, the problem of knowledge-sharing has been the hot research topic in academic world. The research perspective, research methods and theories have been well developed. From 1996 to 2005 the literature of knowledge-sharing was mainly from the economy of knowledge-sharing, objects of knowledge-sharing, subject of knowledge-sharing and means of knowledge-sharing the four aspects to do in-depth study. Qiu Qian and others researched on the review of domestic and international literature on knowledge-sharing from 2005 to 2009. What could be finding that the current researches were mainly concentrate on the factors of knowledge-sharing and means of knowledge-sharing? And factors which influenced knowledge-sharing were the current research focus. The factors of knowledge-sharing included the factors that promote knowledge-sharing and the factors that hinder knowledge sharing. The factors impeded the knowledge-sharing were divided into objective and subjective factors. In the past, objective factors and subjective factors would be studied separately in many scholars' researches on the barriers of knowledge-sharing. In fact, the objective and subjective factors were combining the effect on the result of knowledge-sharing during the process of knowledge-sharing.

Virtual R & D team is a collaborative team formed by scattered "individual", which was to complete common research goal through the information technology. The development of modern information technology, cross of discipline knowledge, raise of the complexity of scientific research and the progressive emphasis on research of the organizations such as universities and business, this style team who broke the boundaries of traditional research team is playing an increasingly important role in research projects. DSRT is a specific form of virtual research team and an important form of research team. The main difference showed that it is a co-operation network between teams from the different spatial and temporal in structure

with the general virtual research team. Although modern information technology brought conveniences for DSRT, could not insure the collaboration among team members. Knowledge-sharing among members is still the one of the most serious problems. Social network analysis is an important tool in the field of sociology. Currently, it has been applied to many other disciplines which provide supports to resolve many practical issues. With the help of social network analysis and from the view of sociological, this paper researched on the issue of DSRT knowledge-sharing. This article analyzed the defects of the social networks structure of DSRT, explored the impact factors of individual knowledge sharing in the research team. And hope that, through using concrete measures to overcome the difficulties of knowledge-sharing.

II. CHARACTERISTIC OF DSRT AND THE CONSTRUCTION OF SOCIAL NETWORK MODELE

DSRT was a cross-regional alliance style of the research teams; it is the space and time separation of different forms of cooperation between research teams. Interdisciplinary and resource scarcity of research projects had put forward the real demand for the distributed team cooperation. The development of information technology promoted the knowledge exchange and cooperation among the teams from different regions, thus to promote the formation of DSRT.

DSRT had the general characteristics of the common virtual research teams also had its own unique characteristics:

It was a temporary organization, and the research teams would dissolve after the completion of research projects itself;

The task was usually interdisciplinary research project, team members' knowledge structure with high heterogeneity;

The cooperation between research teams with spatial isolation, mainly use the information communication technology between members of different groups;

It was a virtual research team formed by a core research

team and a number of external research teams, each team had its leader and the leader of the core team was the commander of DSRT.

From the perspective of five characteristics as team structure, complexity of research projects, team stability, the trust among members and the means of communication, the comparisons about the DSRT, traditional research team and General Virtual Research Team could be shown in Table 1.

Social network theory is an important tool for analyzing and studying the real social problems, by studying the network density, centrality and relationship strength of the social groups' network model to solve problems which were found. DSRT knowledge-sharing behavior was a group behavior, in order to facilitate the analysis of this article, its necessary to construct the general network model for DSRT. Distributed research teams in different areas have different organizational structure. According to the analysis of past research data, and refer to a real structure of the DSRT, the general network structural model of DSRT could be constructed. Before, we should do the following assumptions:

A DSRT was led by a core research team and four external research teams, a total of 23 researchers;

Each research group has a responsible person to do foreign exchange of knowledge; the one of the core research team was the coordinate bridge for the exchange of knowledge between external groups;

According to the characteristics of DSRT and some basic assumptions, this paper built a common distributed research network model for DSRT as follows:

Node: Each researchers of DSRT as a node, to distinguish responsible researchers and general researchers by the size of the node. Research team including core research group A (contained nodes: 1, 6, 7, 8, 9, 10 and 11), external research group B (contained nodes: 2, 12, 13 and 14), external research group C (contained nodes: 3, 15, 16 and 17), external research group D (contained nodes: 4, 18, 19 and 20) and external research group E (contained nodes: 5, 21, 22 and 23).

Line: The lines in the research network model of DSRT represented the specified working relationship. Links between nodes had been established with the scientific research assignments. Knowledge exchange between the research group leaders implemented through the information platform, shown with the black line in the model; Knowledge exchange within the group implemented through face to face, shown with the red line in the model.

The set of nodes in the research network of DSRT was $N = (n_1, n_2 \dots n_N)$, and the number of members in the core research group A was N_A , the number of members in the four external groups were N_B , N_C , N_D and N_E . so $N = N_A + N_B + N_C + N_D + N_E$. $L(l_1, l_2 \dots l_M)$ was on behalf of the set of individual relations in research work.

TABLE I. COMPARISONS BETWEEN DSRT AND OTHER TYPES OF RESEARCH TEAMS

characteristics research teams	team structure	complexity of research projects	team stability	trust among members	means of communication
traditional research team	Individual cooperation in same region	Single knowledge, low complexity	Long-standing	High degree of trust between members	Face to face communication mainly
General Virtual Research Team	Individual cooperation of spatial isolation	Knowledge cross, high complexity	Temporary formation	Low degree of trust between members	Information technology
DSRT	Teams cooperation of spatial isolation	Knowledge cross, high complexity	Temporary formation	High within the groups but low between	Face to face within but information technology between

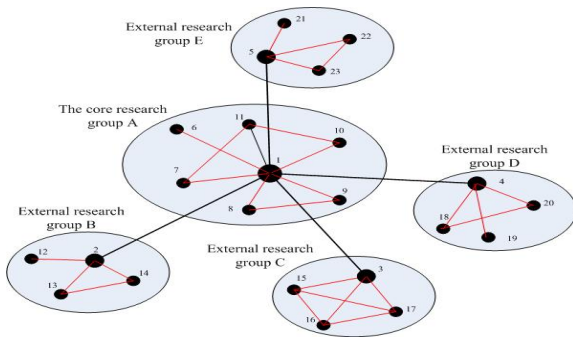


Figure 1. Common research network structural model of DSRT

If $l_{ij} = 1$ then there was working relationship has been designated between node i and node j . If $l_{ij} = 0$ then there was not working relationship has been designated between node i and node j . Then the network structural model for DSRT could be constituted.

III. ANALYSIS OF THE DSRT KNOWLEDGE-SHARING DILEMMA

The research work of DSRT was usually the research projects that need multidisciplinary knowledge and with high significance. Knowledge-sharing among the members had a major influence on the development and the completion of research projects. From the analysis of the network structural model for DSRT what could be find was as the network density of the research network model was too low, there were too sparse knowledge exchange among the various research groups of DSRT, what implied there was a problem of tacit knowledge-sharing between research groups. From the analysis of the node location in the research network model, real incentive system could not fully reflect the value of the individual distribution, individual research and knowledge sharing would be difficult to motivate. As the centralities of some nodes were too high, excessive load on the task of knowledge sharing, further because the various knowledge heterogeneity between research sub-networks, what would easily lead to knowledge sharing bottlenecks. Cohesion subgroup was congenital defect of DSRT, in the network model it showed as many small groups divided by the border. Too frequent interaction within the Subgroup would have a negative impact on the process of knowledge-sharing for the whole research team.

A. Network density and the team's tacit knowledge-sharing

Network density is a measure of the scope of interaction between team members, which is used to describe the relationship between the network nodes. High-density network model means that most of its internal nodes can generate the process of interaction. Low-density network model means that only a few internal nodes can generate the

TABLE II.
COMPARISONS OF NETWORK DENSITY WITHIN THE DSRT

	Core research group A	External research group B	External research group C	External research group D	External research group E	DSRT
The number of node	7	4	4	4	4	23
The number of line	9	4	6	4	4	31
density	0.43	0.67	1	0.67	0.67	0.12

process of interaction. The size of the network density can be measured by the ratio of the number of actual connections with the possible number of the maximum connections in the model. Expression is:

$$\rho = \frac{l}{n(n-1)/2} \tag{1}$$

Where ρ represents the density of the network model, n represents the number of nodes in the model and l represents the actual number of connections in the network model. According to formula (1) could calculate the density of DSRT network model, the density of core research group network and density of other external research group networks, as table 2 shown. By comparison, the density of DSRT network model was far smaller than that of its internal research group networks. Which reflected the interaction between the team members was too sparse. If the interaction between members too low, the operation of the team and the results would have a negative impact and it's not conducive to knowledge-sharing among team members, particularly the sharing of tacit knowledge. Knowledge-sharing included the sharing of explicit knowledge and the sharing of tacit knowledge, in which the exchange and sharing of tacit knowledge was the foundation of knowledge creation. Tacit knowledge was difficult to spread through formal channels, team members can better interact only through participation in the sharing of tacit knowledge. Generally speaking, tacit knowledge-sharing was the result of long-term communication adjustments and mutual perception among the members.

Sharing of tacit knowledge would achieve a better result within various research groups as the face to face communication of the members was more familiar and frequent. But there was no direct link among the external groups and the link between external groups and core group only by single person in charge. The research team's network was less dense, the interaction of members in different groups was limited and with poor communication, the sharing of tacit knowledge among groups would be difficult to achieve.

B. Difference of Network location and Incentives for knowledge-sharing

In the social network has several important concepts used to describe the location of the node. Such as: network centrality, structural holes and bridge. Network centrality is an important pointer of personal structure position, which reflects the superiority of the individual's social status in the network. Network centrality mainly contains degree centrality and between ness centrality. Degree centrality is mainly used to measure the status of the individual in the team, which can be obtained by direct sum the number of the relationship linked to the node (as formula 2 shown). It also can be standardized, which can be used to do comparison of nodes' degree centrality from different networks (as formula 3 shown). Between ness centrality is used to measure the capacity as the media of nodes. If a node is the only media connected to other two nodes, then the node has high between ness centrality. The node with between ness centrality is the one we usually called bridge, whose role is to connect nodes or small groups with structural holes. Ronald Burt defined the concept of structural holes in his book *Structural holes: The social structure of competition*, the so-called structural holes is: one or some nodes have no direct link with other nodes in a network, the phenomenon of no direct relationship or disconnection would appears a cave in the whole network.

$$C(n_i) = \sum X_{ij} \tag{2}$$

$$C'(n_i) = \frac{C(n_i)}{n-1} \tag{3}$$

Where $C(n_i)$ represents the absolute value of the degree centrality of the node i , the value of X_{ij} could be 0 or 1, 0 on behalf of there was no relationship between the two nodes, and 1 on behalf of there was relationship between the two nodes. And n represents the number of nodes in the network, $C'(n_i)$ represents the standard value of the degree centrality of the node i .

In the research network of DSRT, the degree centrality of members should be measured from two perspectives. The one is the degree centrality within the research groups, which reflected its intensity of knowledge control in its research group. The other one is the degree centrality in the DSRT, which reflected its intensity of knowledge control in the whole research team. For example from the results of degree centrality in table 3, we can find that the standard value of the degree centrality within group A of the node 11 is 0.5, the standard value of the degree centrality within group D of the node 18 is 0.67. We can say that node 18 is more important than node 11 in their research groups. But if compared their standard value of the degree centrality in the DSRT, we would get a different judge. From this we can get that the comparison of the degree centrality of different nodes is a complex process in DSRT. The importance of a node is not simply based on his position in his research

TABLE III.
COMPARISONS OF DEGREE CENTRALITY

nodes	degree centrality			
	degree centrality within group network		degree centrality in the DSRT	
	absolute value	standard value	absolute value	standard value
1	6	1	10	0.454545455
2	3	1	4	0.181818182
3	3	1	4	0.181818182
4	3	1	4	0.181818182
5	3	1	4	0.181818182
6	1	0.166666667	1	0.045454545
7	2	0.333333333	2	0.090909091
8	2	0.333333333	2	0.090909091
9	2	0.333333333	2	0.090909091
10	2	0.333333333	2	0.090909091
11	3	0.5	3	0.136363636
12	1	0.333333333	1	0.045454545
13	2	0.666666667	2	0.090909091
14	2	0.666666667	2	0.090909091
15	3	1	3	0.136363636
16	3	1	3	0.136363636
17	3	1	3	0.136363636
18	2	0.666666667	2	0.090909091
19	1	0.333333333	1	0.045454545
20	2	0.666666667	2	0.090909091
21	1	0.333333333	1	0.045454545
22	2	0.666666667	2	0.090909091
23	2	0.666666667	2	0.090909091

group or the status in the whole research team. Both of them should be taken into account.

In addition, the between ness centrality is an indicator which reflects the ability of the node's bridging, and it is a manifestation of the coordinating role of researchers. By calculating the between ness centrality of each node we would find their different ability to coordinate. Not discussed in detail here.

However, during the actual process of research incentives, the distribution of incentives often only in accordance with the size of the personnel specified positions and the implementation performance of subproject. Could not or did not accurately take into account the researchers' "hidden contribution" throughout the research project. If only the use of traditional incentives would cause a serious imbalance in the amount of contributions and the amount of incentives. This is bound to discourage the enthusiasm for work of some key members, and the operation of research system would abnormal. Under such circumstances, knowledgeable members would not to share knowledge, members who lack of knowledge is difficult to obtain new knowledge, so the knowledge-sharing craving of team members would be severely inhibited.

C. Key nodes, network heterogeneity and knowledge sharing bottlenecks

The so-called key nodes in the network model are the nodes that have a high degree of centrality. They are important central figures with higher status in the network. From the data of table 3 we could find that node 1 is the most important key nodes in the DSRT network. In addition, the nodes 2, 3, 4 and 5 are also important key nodes in the network. Centrality on the one hand reflects the status of

network nodes, on the other hand also shows that the size of its work load level, the higher the centrality, the greater the load. Take node 1 as a case study: node 1 has the maximum of centrality which reflects he own the core knowledge resources of the entire research team. During the process of knowledge-sharing, he needs to receive knowledge from the external research teams and researchers within the core research team, also needs to pass the knowledge and information which must be with appropriate treatment to the target audience. This kind process of knowledge-sharing with node 1 as the center would format a joint topology as figure 2(the left one) shown. The workload of node 1 not only contained the absolute amount of knowledge, but also the difficulty of knowledge integration during the process of knowledge-sharing. DSRT was a combination of high heterogeneous groups; knowledge structure of each research group was quite different, the transfer of heterogeneous knowledge would face barriers from the excessive distance of knowledge or organization between the main transfer bodies. The high mobility of knowledge and the high heterogeneity of knowledge structure had very high demand of the characteristics of the key nodes, and also exerted great pressure on the research work of key nodes. If the key nodes can not be timely processing and transmission of knowledge, a lot of knowledge would overstock at node 1 as figure 2(the right one) shown. The poor circulation of knowledge would cause obstruction of knowledge-sharing.

In addition, because of the excessive concentration of centrality, only a few of the key nodes play dynamic role and control the research team's core knowledge during the process of knowledge-sharing. If a key node interrupt or limit the sharing of knowledge (only to receive knowledge but limited to transfer knowledge), other groups was difficult to receive its internal knowledge. Then the trust problem would happen during the process of knowledge-sharing. If the problem was not promptly identified and dealt with, other key nodes would also interrupt or limit the sharing of knowledge. Besides being costly, centralization of knowledge also risks its distortion as knowledge passes through the hierarchy. Furthermore, samll research groups may lose their intrinsic motivation to share knowledge directly with other groups and, consequently, will only provide knowledge to other groups when a higher authority

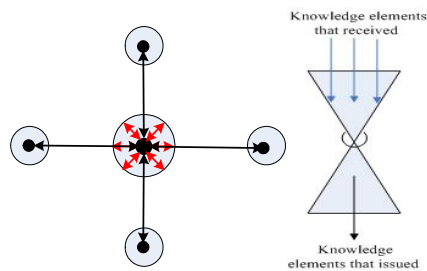


Figure 2. Knowledge-sharing joint topology maps with node 1 as the center and schematic diagram of knowledge-sharing dilemma

demands it.(Dana B. Minbaeva and Snejjina Michailova, 2004)

In a word, once the amount of knowledge-sharing over the load carrying capacity of key nodes, or abnormal behavior of key nodes, knowledge-sharing bottlenecks of DSRT easily occur.

D. Cohesion subgroup and negative effects of knowledge-sharing

The manifestations of cohesion subgroup are small groups, which mean a small group of people who are particularly close to each other and format a sub-group. Members within small groups generally know each other; have common interests and exchange knowledge frequently. DSRT was a union body beyond the organizational boundaries, but it does not breakthrough the border form a full sense. Cohesion subgroup was "innate" exists in the DSRT, in the research network model of DSRT there were five cohesion subgroups which include core research group A, external research group B, external research group C, external research group D and external research group E. And within these groups had high node interaction and the exchange of knowledge was frequent. Of course, there would be many small groups in a large-scale research group; however, in the most research work the number of members in the research group was not enough to form several small groups actually. So, this paper just took each research group as a small group to study.

The traditional view was that the more closely the relationship among the members of the team was the more favorable the knowledge-sharing was. However, if interaction within the small group was too frequent, most knowledge has repeated currency then it would waste many times of members, which was not conducive to team knowledge-sharing.

In addition, related research pointed out that small group members can maintain a strong relationship and to strengthen knowledge-sharing, but if a small group too self-closing and on their own way, then knowledge-sharing within the entire team would be difficult to complete. Adler and Kwon in their study pointed out that too high interaction between team members would reduce their contacts with external entities and they would reject the new knowledge and limit the transformation of their own knowledge, the knowledge-sharing among groups was difficult to achieve.

Each research group had become a closed state; the phenomenon of condensation subgroup was too serious, the knowledge-sharing tended to occur within the research group, not familiar and distrust with other research teams would hinder the knowledge sharing of DSRT. Therefore, cohesion subgroup although could help knowledge-sharing in group network to some extent, but too high cohesion of subgroups would have a negative impact on knowledge sharing of DSRT.

IV. SOLUTIONS TO THE DSRT KNOWLEDGE-SHARING DILEMMA

Above, analyzed the DSRT knowledge-sharing dilemma using social network theories, here were some solutions and suggestions to solve these problems.

A. Set up an informal network of human emotions, promote Tacit knowledge-sharing, and INHIBIT the negative effects of knowledge-sharing

Martinez and Jarillo (1989) assert that formal and informal control mechanisms invariably operate in conjunction with each other in dealing with the complexities of multinational organizations. Tacit knowledge-sharing had greater emphasis on the informal private communication and interaction among members. Informal relationship network was the main channel for tacit knowledge-sharing, and also an important means to break through the traditional closed organizational boundaries in the true sense.

Establish an interactive online community for members. The online community could be defined as a group of people with a common interest, experience, purpose and plight format a community through various forms of network technology. Members who participate in the community could communicate with each other to take in information, experience-sharing, teamwork and knowledge-sharing. Eliminates the reality boundaries of groups, perfected the research network limitations, and strengthen the different opportunities for informal communication between groups. It is particularly important to establish the online community for the DSRT with isolation of space and time.

The tacit knowledge-sharing requires not only frequent informal exchanges, but also needs create touching opportunities for members to enhance the tacit knowledge-sharing. Because there are physical constraints, members of DSRT are difficult or impossible to achieve conscious contact with each other. Through the organization of group activities from time to time, can enhance the feelings among the members, so members can discuss issues face to face and learn from each other in contact process. Although the organization of group activities will cause many problems on cost, it is necessary from the perspective of the long-term interests of the

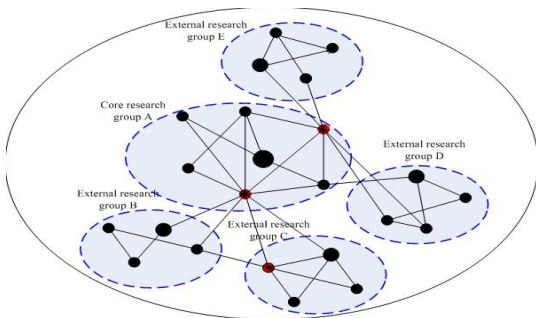


Figure 3. Interpersonal feelings network model of DSRT

scientific research work.

B. The establishment of selective incentives to improve the will for knowledge-sharing

Recent contributions had been made by Husted and Michailova (2002) and Michailova and Husted (2003). They argued that knowledge senders' behavior depends on their willingness to share knowledge with other organizational members on request. The results show a striking effect of organizational commitment and individual attitudes on knowledge transfer performance in the multinational corporations. Organizational commitment was reflected in a reasonable incentive system, reasonable incentive system would enhance the individual research work motivation to promote knowledge-sharing. The famous economist Mancur Lloyd Olson found that selective incentive system was an important condition for the realization of collective action. The so-called selective incentives are stimulation that to distribute different amount of incentives encouraging according to their different volume of contributions for the collective action. Structural differences in the location of personnel of DSRT required establishing a sound mechanism for selective incentive to improve the knowledge-sharing. This article will by evaluating personal research contribution coefficient in the total project to guide how to implement selective incentives.

The evaluation of the personal contribution coefficient must take two indicators into consider. On the one hand, we must evaluate the contribution coefficient of the subproject which the member' research group researched on in the total project. On the other hand, we must evaluate the personal contribution coefficient for his personal characteristics.

The issues of selective incentives for members related to quantitative factors and qualitative factors, so AHP method can be used to establish Analytic Hierarchy model framework for personal contribution, as figure 4 shown.

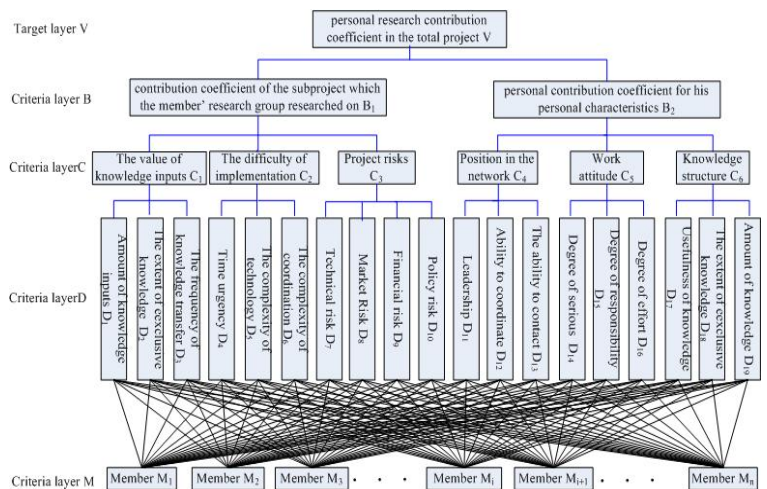


Figure 4. Analytic Hierarchy model framework for personal contribution

C. Improve the quality of group leaders to reduce the knowledge sharing barriers between groups

Focus on leaders' personal ability to avoid knowledge-sharing bottlenecks. The single interface was the main reason that caused knowledge-sharing bottlenecks, but multi-interface would lead to management chaos, reconcile difficulties and other issues. Knowledge-sharing bottlenecks had objective reasons for team structure of DSRT, but through the focus on the ability of group leaders could improve knowledge-sharing bottlenecks. When each group appointed person in charge should do the comprehensive assessment of various indicators, such as personal internal and external communication skills, ability to receive and transfer knowledge, capabilities of extraction and analysis, capabilities of coordination and integration and so on. To develop a comprehensive selection mechanism for project leaders use these indicators and to develop leadership development programs. Avoid or eliminate the knowledge-sharing bottleneck during the process of distributed research.

Strengthen the moral constraints of leadership to reduce the risk of knowledge-sharing. Under the constraint conditions of knowledge transfer methods in DSRT, risks of knowledge-sharing had become one major research difficulty. Reduce the knowledge-sharing risk not only need their moral qualities of leaders, but also need ethics to control their behavior. The over-protection of knowledge or artificially improper transfer of knowledge would cause the lack of knowledge-sharing among groups directly. Over time would lead to a crisis of confidence among groups and then knowledge-sharing risks would emerge. By strengthening the moral constraint of leadership, could regulate the behavior of their knowledge-sharing to some extent, thus reduce the risk of knowledge.

V. DISCUSSION

The main work of this study was to analyze the knowledge-sharing dilemmas of DSRT and countermeasures from social networks perspective. And it is necessary to have some discussions and explanations.

A. Theoretical implications

Several theoretical implications can be drawn from the study. In this study, social network theory was applied to knowledge-sharing of DSRT, what was a inheritance and development of the past research on knowledge-sharing. On the one hand, the analysis of the knowledge-sharing dilemmas of DSRT was based the mature theories of the past research, what was an inheritance. On the other hand, social network theory was taken into practice, what was a development of the past research on knowledge-sharing. Application of scientific theory into practice is the ultimate goal to do research. Using theoretical knowledge to guide practice and improving the theory in practice, thereby promoting the development of scientific research.

B. Practical implications

From a view of practical point meaning, this study took the DSRT who have been playing a greater role in reality. Such as the scientific research cooperation between universities and companies. Research team is a knowledge-intensive organizational form; scientific research was directly dependent on the efficiency of knowledge-sharing. Knowledge-sharing was a key limiting factor during the process of research for the characteristics of distributed of DSRT. Knowledge-sharing was difficult to achieve simply rely on a strict system in the real cooperation among the research team for reasons as follows: The scarcity of the Knowledge resource itself, the heterogeneity of the structure of knowledge resources, the awareness on the protection of knowledge resources and Sense of competition between teams. We found the knowledge-sharing dilemmas of DSRT through the theoretical study. Practical guidance could facilitate knowledge-sharing to enhance the research performance of DSRT.

C. Limitations and future research

This article conducted the network model of DSRT based on previous research. Model was relatively simple, but there would be contradiction to the actual structure of DSRT inevitably. In this study, the general network model but not a specific example of a real DSRT was the research object. This paper was an article of exploratory application, which was a basic article for the research of the knowledge-sharing problem of DSRT. In the future research, it is need to use actual data to study, in order to obtain research results with more practical value.

VI. CONCLUSIONS

What we could find from the analysis of DSRT from the perspective of social networks contained: Team's network density was far below the network density within each group, group interaction skills and opportunities for interaction were weak, so tacit knowledge-sharing of DSRT was a problem during the process of knowledge-sharing; DSRT had features with multiple network, what was different with other research teams. So each node had a cross-role in its group and the DSRT, Unreasonable incentives will reduce or inhibit the wishes of knowledge-sharing of members; There were a special kind of key nodes in the DSRT network, they were the transfer hub of internal knowledge and external knowledge, and a high degree of heterogeneity between teams' knowledge. If the task of knowledge transfer overweight or those in the location of a critical node had abnormal behavior in the DSRT, the knowledge-sharing bottlenecks would arise. Spatial isolation and the sense of competition of groups within the DSRT easily lead to "fragmentation" phenomenon.

This paper proposed to build informal networks of human emotions of DSRT for the tacit knowledge-sharing; the establishment of selective incentives to enhance members' will for knowledge-sharing; focusing on the improvement of

the capacity of research group leaders or moral constraints and other measures to enhance the effectiveness of knowledge-sharing of DSRT.

There was little research on knowledge-sharing of DSRT currently, and this paper just analyzed the problems and gave countermeasures from the perspective of social network preliminary. There are many other issues on DSRT worth studying and discussing. For example, the establishment of trust mechanism, the establishment of knowledge-sharing platform and the impact on research performance of leadership styles, which are need in-depth study next step about the DSRT.

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