Advice, Friendship, Communication, and Cooperative Networks: Growth of University Research Teams

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Abstract

Universities are typical knowledge-intensive organizations, where research teams are considered as important components of technological innovation for a country. This research is based on the perspective of social network analysis because knowledge communication between members from different research teams is in essence the transition process of communicating and cooperating in networks. In this study, we investigate a specific example of UESTC (University of Electronic Science and Technology of China) to analyze the advice network, friendship network, communication network, cooperative network of the research teams, and put forward suggestions to promote the growth of university research teams and enhance team performance.

Key words: Research team; Advice network; Friendship network; Communication network; Cooperative network

1. Introduction

Research teams emerge as innovative and efficient organizations, which has attracted attention from the domestic and foreign researchers. Formal and informal communications are frequent in an effective research team, team members have close relationship with each other, and everyone is open to share knowledge with other team members. Meanwhile, team leaders play important roles to coordinate the whole team, promote open communication, create positive team climate, and strengthen the network structure. It is of great value to capture the current status of research teams from the social network perspective, thus providing practical guidance to promote mutual understanding, enhance collaboration, and improve team performance.

The main contents of the paper are organized as follows: In Section 2, we review the literature regarding research teams, strong ties, weak ties, advice network, friendship network, communication network, and cooperative network. In Section 3, we choose the case of UESTC to analyze the current issues of research teams from the perspective of advice network, friendship network, communication network, and cooperative network based on social network analysis software UCINET6.0. We discuss the challenges facing UESTC and provide practical suggestions for team development in Section 4. Finally, we summarize the study and give a perspective in future in Section 5.

2. Theoretical background

2.1 Research team

Teams are composed of more than two group members who have interdependent relations with one another towards the same goal (Alderfer, 1977；Guzzo & Dickson, 1996). Research teams of universities are made up of researchers from different fields to perform a research task or a group of tasks, the fundamental goal is to engage in academic research and develop talents. Compared to R&D teams of enterprises, university research teams bring forth more theoretical innovation and possess the characteristic of high content of knowledge, and are less affected by authority (Long & McGinnis, 1981). Multidisciplinary and interdisciplinary collaborative work is generally understood to enhance scientific enquiry and improve productivity (Aboelela, Merrill, & Carley, 2007).

Previous research suggests that diversified teams with members of different disciplines and backgrounds help identify new innovative opportunities and improve team performance (Jackson, Joshi, & Ethardt, 2003; Hoever, Van Knippenberg, & Van Ginkel, 2012). Despite of the growing status of research teams in the whole system of innovation, it is an emerging field of research, and there is still a lack of research on research teams of universities. Most of the current research cover the areas of management teams, work teams, and R&D teams of enterprises (Bain, Mami, & Pirola, 2001; Pirola-Merlo, Härtel, & Mann, 2002; Sarin & McDermott, 2003). Domestic and international research on research teams mainly discuss from the perspectives of teambuilding and role analysis, some international researchers use case studies and empirical studies to analyze (Long & McGinnis, 1981; Rey-Rocha, Martín-Sempere & Garzón, 2004).

2.2 Social network

Social network can be very powerful, networks of relatives and close friends could provide access for you to find a job in a new place. A "social network" can be defined as a set of nodes or actors (persons or organizations) linked by social relationships or ties of a specified type. A tie or relation between two actors has both strength and content. The content might include information, advice, or friendship, shared interest or membership, and typically some level of trust (Castilla et al., 2000). Granovetter differentiated between strong and weak ties that the strength of the tie is usually indexed as being either weak (acquaintances and indirect ties) or strong (relatives and friends) (Granovetter, 1973). Close friends know the same people you do, whereas acquaintances are better bridges to provide new contacts and information, so new job opportunities could often occur from weak ties rather than from close friends. Firms could also benefit from employees' social networks, and employers are thus willing to pay monetary bonuses to them for successful referrals (Fernandez and Weinberg, 1997; Fernandez, Castilla, and Moore, 2000). Lin (2002) defined social capital as the diversity of resources that can be accessed through network ties.

It was presumed that the influence, advice, and communication networks, on the one hand, and the friendship network, on the other, represent instrumental and expressive relations, respectively (Krackhardt, 1990). Friendship and advice networks perform distinct functions. Advice networks are closely related to organizational power (Brass, 1992; Ibarra and Andrews, 1993). They influence work-related knowledge (Morrison, 2002), and job performance (Sparrowe et al., 2001). In contrast, friendship has been linked with organizational commitment (Morrison, 2002), resource sharing during crisis (Krackhardt and Stern, 1988), and career-related decision making (Kilduff, 1990; Krackhardt, 1992). It enables coworkers to discuss sensitive issues that they would not share with non-friends (Sias and Cahill, 1998).We could also see some examples regarding trust networks under conditions of risk and uncertainty. Heimer (2001) provides an example of trust network as positive social capital called "Jane" organization, which is a secret network of trusted women and physicians to protect those in need and provide services. But only under certain conditions then do trust networks serve to provide social capital to members of the network, the networks may undermine processes of social change, lead to ossification of the networks and some degree of limitation in the social capital such relations typically provide under other conditions (Cook, 2005). Social network analysis can be an effective tool for promoting collaboration and performance improvement within research teams of universities. The research on the current issues of university research teams from the social network perspective is of great theoretical and practical significance, and thus boosting more innovative research results with far-reaching implications.

3. Advice, friendship, communication, and cooperative network: the case of UESTC

Founded in 1956, UESTC (University of Electronic Science and Technology of China) became one of the nation's key universities in 1960 as one of the seven earliest key universities in national defense. It was then included as one of the first universities into "Project 211" and was admitted into the nation's Project 985, receiving special support for developing world-class universities and world-famous research-oriented universities. As a research-oriented university with electronic science and technology as its nucleus, engineering as its major field and featured the harmonious integration of science, engineering, management and liberal arts, UESTC now face more chances and challenges in the new century to pursue high-tech development. The research teams of such a research-oriented university could be considered as one typical example of knowledge-intensive organization in our study. 86 team leaders from 16 schools of UESTC participated in this study. A total of 57 effective questionnaires were returned.

At the same time, interviews are conducted among team leaders and junior faculties regarding capacity building of research teams and the implementation of strategies, and in-depth interviews with eminent team leaders spend about three hours respectively.

According to the theory of "the strength of weak ties" (Granovetter, 1973), we call it strong tie to describe the stronger linkages of research team members from the dimensions of contact hours, emotional investment, the degree of trust, and mutual help; and we call it weak tie to illustrate the weaker linkages from the above four aspects. Team leaders have strong relationships with other team members, so they are called the core layer; the close layer, the virtual layer, and the service layer gradually go away from the core layer, indicating a tendency of downward relationship between team members and leader (see Figure 1). The supports provided by the members from the core layer outweigh the supports from peripheral members. For instance, communication messages sent from the core members to link to the external members are more than that of the opposite direction, reflecting that the core members are more adept at making good use of resources to keep in touch with other people.
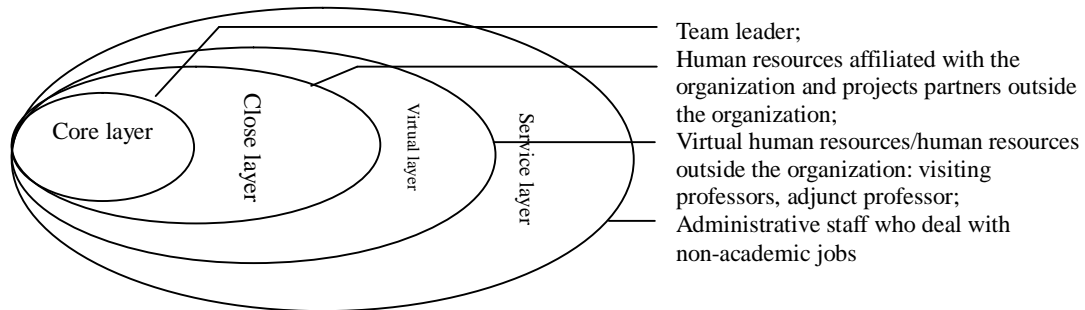

Figure 1:   The hierarchical relationship of research teams

Questionnaires of social network consist of four components: advice network (e.g., "Who support you most in your present job/studies?"), friendship network (e.g., "Among your colleagues at school, who are your good friends to have lunch, play ball games, fall in upon for a chat, share heart-to-heart conversations, and pour out your troubles?"), cooperative network (e.g., "Whom did you collaborate with on a project? Who would you like to collaborate with currently?"), and communication network (e.g., "Choose the means of communication you frequently use to contact with colleagues: face-to-face communication dominates daily contact, and they also contact via telephone and email; team members see each other once in a while, and they could contact via telephone and email; seldom contact; others"). We use social network analysis software UCINET6.0 to draw advice network, friendship network, communication network, and cooperative network based on the data collected. In the network diagrams, A-Q stand for 16 schools, A1，A2…，An stand for the team leader from each school. U stand for the division of science and technology of the university, HZ represent scientific institutions outside the university and other universities.
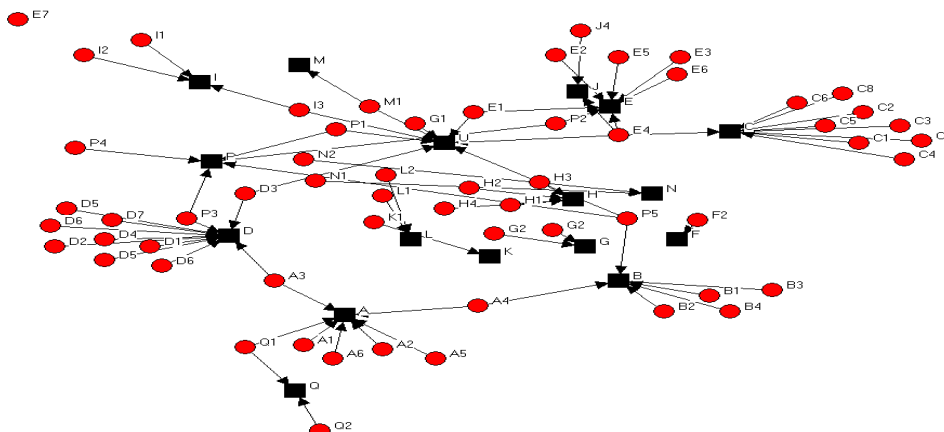
3.1 Advice network

Figure 2: Advice network of the team leaders of the university

A=School of Communication & Information Engineering；B=School of Electronic Engineering；C=School of Microelectronics and Solid-State Electronics；D=School of Physical Electronics；E=School of Computer Science &Engineering；F=School of Automation Engineering；G=School of Mechatronics Engineering；H=School of Optoelectronic Information；I=School of Life Science and Technology；J=School of Mathematical Sciences；K=School of Management and Economics；L=School of Political Science and Public Administration；M=School of Foreign Languages；N= School of Aerospace；P=School of Electronic Science and Technology；Q=National Key Laboratory of Science and Technology on Communications；U=The division of science and technology of the university；HZ=Scientific institutions outside the university and other universities. A1 represent the team leader of the first research team from the school of Communication & Information Engineering, A2 stand for the team leader of the second research team from the school of Communication & Information Engineering, An represent the team leader of the nth research team from the school of Communication & Information Engineering, and so on. The letters of the following four network diagrams stand for the same meanings.

Figure 2 represent the advice network of the 57 team leaders, 16 different schools, and the division of science and technology of the university. According to the statistical result of the network, 56 team leaders mainly consult with people from their own schools on research problems, and only 9 team leaders have interdisciplinary cooperation with people from other schools. Different subgroups are apparently formed in the advice network. The graphic results show that the links among team leaders are tenuous, and the feature of small groups based on individual school is rather obvious. Communications are limited primarily to members within the school, but there is still a lack of connection with other schools and the division of science and technology of the university.
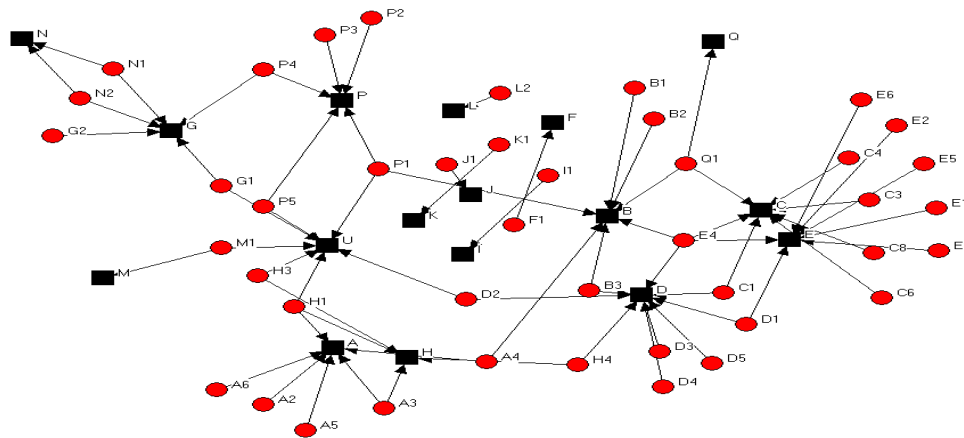
3.2 Friendship network

Figure 3: Friendship network

Figure 3 represent the friendship network of 44 team leaders (44 out of 57 team leaders returned the questionnaires). The data analysis results indicate that 40 team leaders develop friendships within the school, and 15 team leaders build associations with colleagues from other schools. The diagram clearly shows that the friendship network of team leaders is very sparse, the friendship connections of team leaders focus on the internal members of the school, and the association across-subjects and across-schools is little. Team leaders seldom build friendship with people from the division of science and technology of the university.
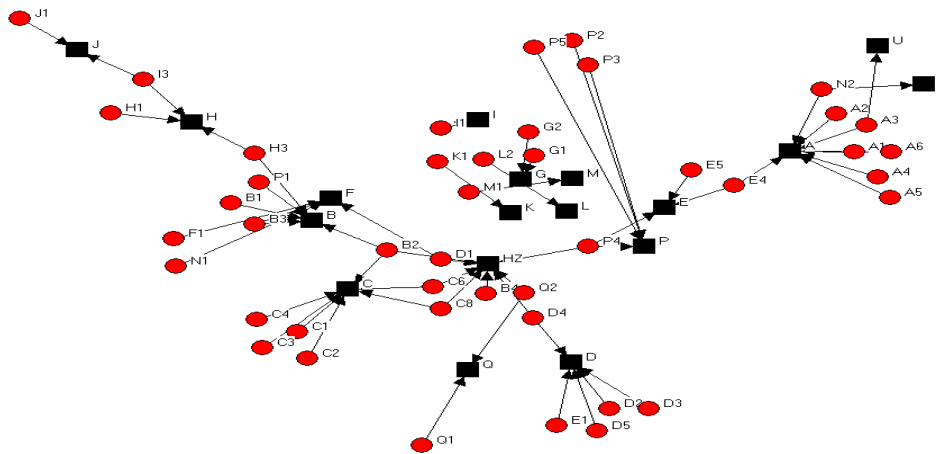
3.3 Collaboration network

Figure 4: Collaboration network

Figure 4 stand for the collaboration network of 45 team leaders (45 out of 57 team leaders returned the questionnaires). 37 team leaders collaborate with people inside the school on research projects, 14 team leaders collaborate with colleagues from other schools of the university, and 8 team leaders build durable strategic partnership with scientific institutions outside the university and other universities. The collaboration network reflects the characteristic of small groups. Team leaders mainly collaborate with members in the school, the intercollege collaborations are continuously developing.

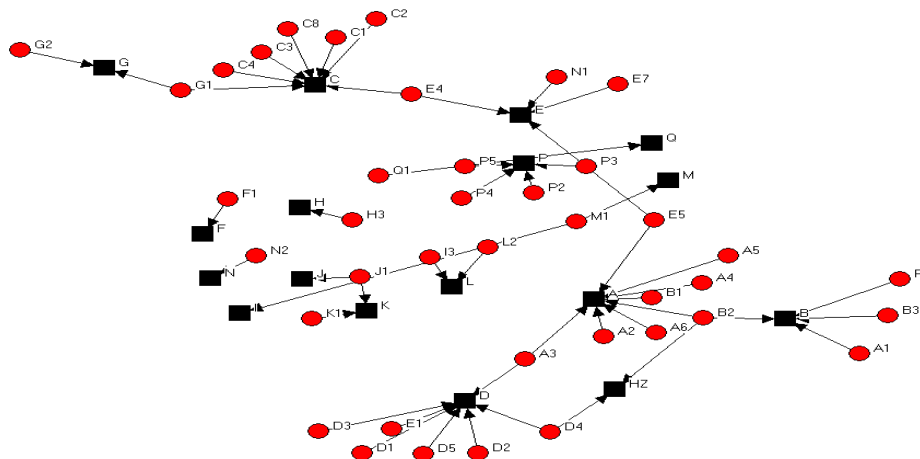### 3.4 Communication network

Figure 5: Communication network

Figure 5 represent the communication network of 40 team leaders (40 out of 57 team leaders returned the questionnaires). According to the data analysis result, 30 team leaders have good communication with members inside the school, 10 team leaders communicate with people of different schools, and 2 team leaders establish good communication and cooperative relationship with scientific institutions outside the university and other universities. The communication network is not so dense, small group communication dominates the situation. Team leaders frequently communicate with members within the school, and there is a lack of communication between people from different schools. Regarding collaboration with scientific institutions outside the university and other universities, there is still room for improvement in terms of the communication skills.

According to survey results, the communication frequency of team leaders is shown below: 77.12% team leaders often have face-to-face communication with researchers and also contact via telephone and email; 20.67% team leaders see team members once in a while, and contact via telephone and email; 2.2% team leaders seldom contact researchers. In some schools, the members from the core layer rely 100% on face-to-face communication and also contact via telephone and email, and 42.87% of the members from the core layer from other schools see each other once in a while, and contact via telephone and email.

Table1: Communication frequency of different schools

Schools	Face-to-face communication dominates daily contact, also contact via telephone and email	See each other once in a while, and contact via telephone and email	Seldom contact
Communication	80%	20%	0%
Electronic Engineering	75%	25%	0%
Microelectronics	67%	33%	0%
Physical Electronics	67%	33%	0%
Computer Science	75%	25%	0%
Automation Engineering	100%	0%	0%
Mechatronics Engineering	33%	34%	33%
Optoelectronic Information	67%	33%	0%
Life Science	100%	0%	0%
Mathematical Science	100%	0%	0%
Public Administration	100%	0%	0%
Foreign Languages	50%	50%	0%
Aerospace	100%	0%	0%
Electronic Science	43%	57%	0%
National Key Lab	100%	0%	0%

4. Challenges and suggestions

There are a lot of challenges facing UESTC based on the data analysis and the interviews, the problems regarding organizational patterns are: single-subject teams dominate the university, and there are few interdisciplinary teams; teams from single department dominate the whole situation, whereas there are few teams from multi-departments; there are a lot of research teams formed by people with the same academic interest, teams regarding important research projects are few; teams from the bottom up are much more than teams from the top down.

According to the analysis above, we propose the following practical suggestions for team development:

(1)   Renew old friendships and establish new contacts. More teambuilding activities could be organized between different colleges to enhance collaboration. People will have more opportunities to get to know their co-workers better through teambuilding activities. Collaboration enlarges the pie and allows more options for team members. The establishment of friendship network could help team members to get touch with other person's feeling on happiness and sadness, thus improving team performance.

(2) Performance management for excellence. Managing for excellence supports developing and maintaining strong team leader-member relationships through three key competencies: communicate, motivate, and develop. Team leaders should set clear expectations, provide feedback that helps improve performance, listen to concerns and suggestions, and provide the support needed to get the task done. Team leaders should also motivate team members to enhance team performance.

Team leaders should recognize achievements of team members, provide challenging tasks that make good use of member strengths, and encourage innovative thinking. It's important for leaders to make rewards and recognition effective: money is not the best incentive, and the delay between behavior and rewards must be bridged. Finally, team leaders could help the members develop technological skills and knowledge needed to develop team members.

(3) Establish effective communications among team members and leaders. Create an open environment. Open communication is of vital importance in research teams. Team leaders and members should communicate face to face, and avoid solving conflicts via the mail. Face-to-face communication is preferred, as messages are expressed through a combination of body language, tone and words to receivers, whereas relying heavily on non face-to-face communication limits the main sources for message understanding and can give rise to a lot of communication problems with a quick escalation of conflict. Team leaders should also establish good communication and cooperative relationship with members from other schools, scientific institutions outside the university, and other universities.

5. Conclusions and prospects

This paper discuss the advice network, friendship network, communication network, cooperative network of research teams, and find solutions to improve team performance from the perspective of social network analysis. The relationship between social network and trust will also be worthy of further study. Trust could be divided into the different dimensions of organizational trust, cognitive trust and emotional trust in future research. We could also calculate the density of advice work and emotional network, analyze network strength and network degrees to extend the research. Besides, it is worthy of further research on social network to find the key person in the interpersonal network of enterprises or universities to avoid collective turnover or provide suggestions for promotion, which is also an interesting topic to study.

Acknowledgements

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