

Social Network Analysis for Investigating Large Scientific Research Project

Kun Nie

Japan Advanced Institute of Science and Technology, Japan

Euler G. M. de Souza

Japan Advanced Institute of Science and Technology, Japan

Tunç D. Medeni

Japan Advanced Institute of Science and Technology, Japan

INTRODUCTION

Resulting from the development of science and technology, scientific research dedicating to solve economic, social, environmental, and other related complex problems needs team work of research groups with different academic backgrounds. Motivated by this requirement, some established organizations and sponsored projects with the purpose of promoting multidisciplinary or interdisciplinary research have been increasing, the organizations such as SFI (The Santa Fe Institute), IIASA (The International Institute for Applied Systems Analysis), SIS (Society for Interdisciplinary Studies), AIS (The Association for Integrative Studies), ISIS (Institute for Science and Interdisciplinary Studies), and so forth. Some of these attempts achieved the desirable goals, while the majority did not.

One of primary reasons is that the real interdisciplinary collaboration have hardly happened when many scientists with different academic backgrounds get together, since they work or collaborate instinctively with someone who has the similar interests or backgrounds. Moreover, the collaboration among them are informal and invisible which make it more difficult to modify and improve in a targeted way.

This article took a look at a real interdisciplinary project, analyzed the dynamic process of large-scale scientific collaboration with a well-established analytical method called social network analysis (SNA) from both managerial and scientific perspectives.

The remainder of this article was organized as follows. It first introduced the background of the large scientific project in China; then social network, social network analysis, and their unique features were

discussed; furthermore, social network analysis was applied to analyze the large project; some significant conclusions was finally given.

BACKGROUND OF A LARGE PROJECT IN CHINA

From 1999-2004, a large scientific project was sponsored by NSFC (National Natural Science Foundation of China). The mission of this project was to provide a research support to macro economic decision-making problem. Some characteristics of this large project are described in the following:

1. **Large budget:** Approximately millions of Chinese RMB was invested on this large project.
2. **Large amount of participants:** There were about 200 experts coming from 14 different organizations (research institutes or universities).
3. **A fairly long duration:** The project lasted for 5 years from 1999-2004.
4. **Interdisciplinary research:** Scientists came from the fields of mathematics, computer science, systems science, economy, and so forth.
5. **Undertaken by a virtual, networked, and temporary organization:** The organizations included were top universities and research institutes whose locations vary from northern and southern part, eastern and western part of China, physical distances was one of big difficulties that need to overcome, the members of this project assembled together temporarily for fulfilling the large project and dismissed after the project was completed.

Basically, we understand and evaluate a project by the number and quality of published papers or patents which touch only the skin of the project. It is extremely necessary to get into the heart of the project to find out the hidden, invisible, but important phenomena, whether effective or ineffective, for instance, how the members collaborate with each other, how the ideas are transferred, mixed, and created, etc. In order to do so, a well-established SNA was applied.

SOCIAL NETWORK AND SOCIAL NETWORK ANALYSIS

The notion of social network and the method of social network analysis have attracted considerable interest and curiosity from social and behavioral science community in recent decades. A social network refers to a set of people, groups, organizations, and so forth, with some pattern of contacts or interactions between them (Wasserman & Faust, 1994). Social network analysis (SNA) is the mapping and measuring of relationships and flows within the social networks by providing both a visual and a mathematical analysis.

SNA is a more targeted way to investigate what is effective or ineffective inside an organization in depth and details by making invisible things visible, it has been proved successfully in many areas with the ability of tapping into the incentive, hierarchy, leadership, culture, and so forth, of the organizations, for instance: supporting strategic collaboration (Cross et al., 2002), supporting knowledge sharing and knowledge creation (Cross et al., 2001), knowledge flow and knowledge mapping (Chan & Liebowitz, 2006), and many others (Cross et al., 2002, 2004; Wasserman & Faust, 1994), therefore, sometimes it is called as “organizational X-ray”. Normally SNA is used to access the condition of connectivity of social networks, but the visualization and statistical methods provided by SNA is also applicable to other kinds of networks, such as technological networks (e.g., Internet), information network (WWW, Citation network), and biological networks (Metabolic network, Protein interactions network). In this sense, this article extends SNA to analyze citation network and keyword network of the large project, which is an important complementary angle of understanding a large project.

When applying an SNA, there are four steps to follow: namely, accessing, measuring, evaluating,

and promoting which construct a systematic process of doing SNA. More about them are interpreted in the following:

1. **Accessing:** Conduct a questionnaire or survey to touch various meaningful and actionable relationships of strategically important groups within an organization.
2. **Measuring:** Visually and quantitatively analyze the connectivity using SNA tools after obtaining the data.
3. **Evaluating:** Judge the quality of connectivity by the results of measuring, and identify what is effective or ineffective.
4. **Promoting:** Take positive actions to initiate, maintain, correct and develop the right relationships to reach a better network connectivity for an organization.

Besides, the following points should be taken into accounted: (1) two approaches to analyze network structure (Hanneman, 2001): top-down (starting from the whole network) and bottom-up (starting from a specific node); (2) four common role players (Cross & Prusak, 2002): central connectors, boundary spanners, information brokers, peripheral specialists; (3) strong tie and weak tie; (4) dynamic thinking: to observe these networks not only at a certain time, but also their evolution with time; (5) comprehensive method: isolated and combined view of these networks. Furthermore, the results revealed by SNA were not enough to address the problem, the other thing need to do is conducting an appropriate interview or a session again, what make difference is to fully use the results of SNA this time, then finally we get to know what is wrong happening in an organizations and help to find a good solution.

APPLICATION OF SNA INTO A LARGE SCIENTIFIC PROJECT

As mentioned previously, an interdisciplinary large project was undertaken in China from 1999-2004, which provides a good concrete example of conducting a SNA. Meanwhile, it is also good to review the large project from systematic perspective.

Without support of efficient tools and methods, normally, we see a large project only from the level or

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