

# A Framework for implementing Knowledge Network using Social Network Analysis

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**Abstract** - Recently research interest in Knowledge Management (KM) has grown rapidly. Companies regard intellectual capital as important asset and strive to deploy KM in an organization to gain a competitive edge. Many organizations currently engage in knowledge management in order to leverage knowledge both within the organization and externally to their shareholders and customers. Most of the previous research related to KM are dedicated to investigate the role of information technology in extracting, capturing, sharing, converting organizational knowledge. Knowledge workers, however, are paid less attention though they are the key players in KM activities such as knowledge creation, dissemination, capture and conversion. We regard knowledge workers as a major component of KM and starting point of understanding organizational knowledge activities. Therefore we adopt a method to understand and analyze knowledge workers' social relationships

In this paper we investigate Social Network Analysis (SNA) as a tool for analyzing knowledge network. We introduce the basic concept of SNA and suggest a framework for implementing knowledge network by explaining how SNA can be used for analyzing knowledge network. We also propose a numerical method for identifying knowledge workers using SNA after classifying knowledge workers. The suggested method is expected to help understanding key knowledge players within an organization.

**Keywords:** Knowledge Management, Social Network Analysis, Knowledge Network

## 1 Introduction

Knowledge has become the new strategic imperative of organizations and knowledge management is a central issue to many organizations.

Because knowledge is social in nature and travels through social interactions with other people and cannot be separated from the people who create it, use it, and transform it. Managing knowledge is not a simple issue of managing technology, but it requires managing social relations and interactions in the organization [5]. The key to managing knowledge is through people and knowledge networks are the key to successful Knowledge Management [3].

Therefore, it becomes clear that social networks are at the core of information and knowledge flow. Most people learn through their formal and informal social connections. The real challenge for successful knowledge management is connecting people to people and encouraging knowledge sharing across the organization.

From this perspective, the objective of this paper is to investigate the way of analyzing knowledge network in social context. For this purpose, we illustrate the concept of SNA(Social Network Analysis) as a tool for knowledge network, present a methodology for knowledge network

through SNA, realize the methodology by building knowledge networks applying to military unit.

## 2 Related Works

### 2.1 Social Network Analysis

Social network analysis is the mapping and measuring of relationships and flows between people, groups, organizations, animals, computers or other information/knowledge processing entities [2]. The nodes in the network denoted the people and groups while the links depict relationships between the nodes.

SNA can provide a tool for analyzing social relationship, which can be used to analyze knowledge sharing between knowledge workers [1].

Figure 1 shows social network of 'who likes who' relationship which describes the network of friendship relations among four people.

The data sets that social network analysts develop usually represented as rectangular array or matrix. Mathematical approaches to network analysis tend to treat the data as deterministic. A simple example is shown as table 1.

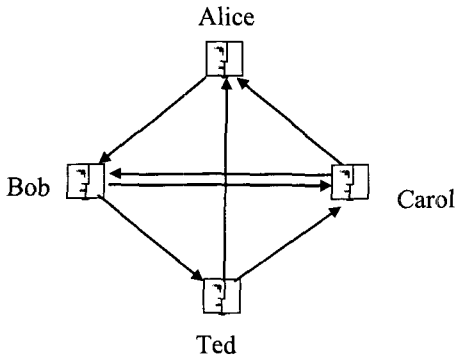


Figure 1. social network of 'who likes who' relationship

Table 1. array form social network

From \ To	Bob	Carol	Ted	Alice
Bob	-	0	1	1
Carol	1	-	0	1
Ted	0	1	-	1
Alice	1	0	0	-

## 2.2 Knowledge Network and CoP

Knowledge network be defined as official or unofficial network voluntarily formed by knowledge workers. People in knowledge network usually build Communities of Practice (CoP) introduced by Lave and Wenger [3][5]. Lave and Wenger saw the acquisition of knowledge as a social process where people can participate in communal learning at different levels depending on their level of authority or seniority in the group, i.e. whether they are a newcomer or have been a member for a long time.

## 2.3 Simple human network vs. Knowledge network

Table 2 show the difference between simple network and knowledge network

Table 2. Simple network vs. Knowledge network

	General Network	Knowledge network
Critical factor	Technical factor	Human factor
Objective	Simple message transfer duing business processes	Mutual learning through knowledge sharing
Satisfaction of participants	Less satisfactory caused by one-way communication	Satisfactory caused by knowledge sharing and synergic effects
Attitude of participants	passive	active

## 3 A Framework for implementing Knowledge Network using SNA

### 3.1 Procedure of implementing knowledge network

There are two perspectives toward organizational knowledge. One is a structured approach toward knowledge creation and sharing through information technology such as Knowledge Management System, Groupware, and Document Management System. The other one is a cultural approach through human communication channels.

Two approaches in KM is depicted in Figure 2.

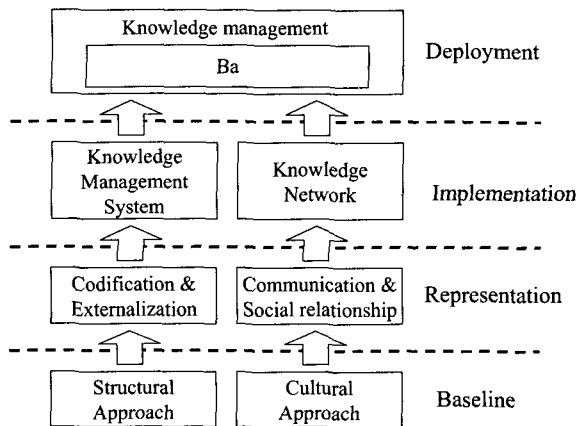


Figure 2. Knowledge network and KM

A framework for implementing knowledge network can be represented by the procedure of implementing knowledge network using SNA. Figure 3 depicts implementation procedure for knowledge network using SNA

### 3.2 Classification of knowledge workers

We suggest four types of knowledge workers; 1) knowledge broker, 2) knowledge evangelist, 3) knowledge consumer, 4) knowledge developer. We can systematically find these types. Suppose that SNA data is represented by  $m \times m$  array -  $m$  denotes the number of knowledge worker. The  $j^{\text{th}}$  row vector represents the  $j^{\text{th}}$  worker's knowledge outflow while the  $k^{\text{th}}$  column vector represents the  $k^{\text{th}}$  worker's knowledge inflow.  $V_{ij}$  is an integer value which has 1 or 0. 1 means the  $i^{\text{th}}$  worker transfers organizational knowledge to the  $j^{\text{th}}$  worker.

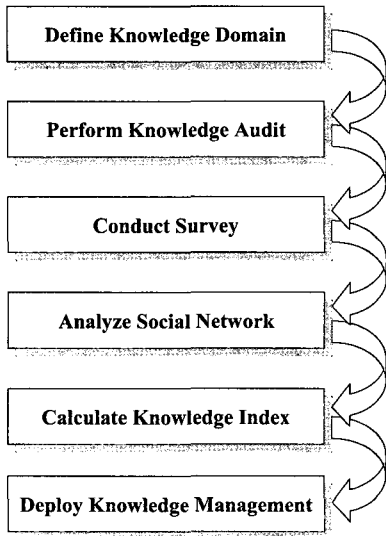


Figure 3. Implementation procedure for knowledge network using SNA

### 3.2.1 Knowledge broker

Knowledge broker receives knowledge and distributes the knowledge to other workers. In SNA context, knowledge broker receives many arrows and at the same time sends many arrows. Knowledge broker can be identified by Knowledge Broker Index (KBI) represented. Equation 1 calculates KCI of the  $i^{\text{th}}$  worker.

$$KBI(i) = \frac{\sum_j V_{ij} + \sum_k V_{ki} - V_{ii}}{\sum_k \sum_j V_{jk}} \quad \dots \quad (1)$$

### 3.2.2 Knowledge evangelist

Knowledge evangelists reinforce and distribute organizational knowledge. In SNA context, they transfer their knowledge rather than consume organizational knowledge. Knowledge Evangelist Index (KEI) represents by the ratio of inflow and outflow of the  $i^{\text{th}}$  worker. Equation 2 shows KEI of the  $i^{\text{th}}$  worker.

$$KEI(i) = \frac{\sum_j V_{ij}}{\sum_j V_{ij} + \sum_k V_{ki}} \quad \dots \quad (2)$$

### 3.2.3 Knowledge consumer

Knowledge consumers mainly consume organizational knowledge rather than produce or distribute the knowledge. They can be identified by calculating the ratio of inflow and outflow of the  $i^{\text{th}}$  worker. Equation 3 shows KCI of the  $i^{\text{th}}$  worker. Equation 3 shows KEI of the  $i^{\text{th}}$  worker.

$$KCI(i) = \frac{\sum_k V_{ki}}{\sum_j V_{ij} + \sum_k V_{ki}} \quad \dots \quad (3)$$

### 3.2.4 Knowledge developer

Knowledge developers usually create organizational knowledge rather than consume the knowledge. Therefore Knowledge Developer Index (KDI) represents the indensity of outflow of the  $i^{\text{th}}$  worker. Equation 4 shows KDI of the  $i^{\text{th}}$  worker.

$$KDI(i) = \frac{1 - e^{-\sum_j V_{ij}}}{1 + e^{\sum_j V_{ij}}}, \text{ where } \sum_k V_{ki} = 0 \quad \dots \quad (4)$$

As  $\sum V_{ij}$  increase, equation 4 converges to 1 that means the  $i^{\text{th}}$  worker only distributes organizational knowledge with no inflow.

## 4 Conclusions

We investigate Social Network Analysis (SNA) as a tool for understanding organizational knowledge by analyzing knowledge workers' social relationship. We also suggest a framework for implementing knowledge network based on SNA and a method for identifying knowledge workers. The contribution of this paper can be summarized as follows: 1) The suggested framework can be used to identify and form CoPs. At the starting point of knowledge dissemination, CoP can facilitate all kind of knowledge activities - knowledge extraction, knowledge evaluation, and knowledge dissemination. 2) The suggested method is expected to help understanding key knowledge players within an organization

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