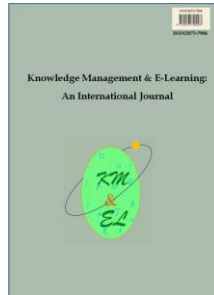


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### **Analyzing the role of social networks in mapping knowledge flows: A case of a pharmaceutical company in India**

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## **Analyzing the role of social networks in mapping knowledge flows: A case of a pharmaceutical company in India**

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**Abstract:** Knowledge Management literature lays emphasis on the fact that a major chunk of knowledge dissemination occurs through the various forms of social networks that exist within the organizations. A social network is a simple structure comprising of set of actors or nodes that may have relationships ties with one another. The social network analysis (SNA) will help in mapping and measuring formal and informal relationships to understand what facilitates or impedes the knowledge flows that bind interacting units. This paper aims at studying the knowledge flows that happen through the social networks. It first, provides a conceptual framework and review of literature on the recent research and application of knowledge mapping and SNA, followed by a discussion on application of SNA for mapping knowledge flows in a pharmaceutical firm. In the last part, Knowledge maps are presented to illustrate the actual knowledge flow in firm.

**Keywords:** Social network analysis; Knowledge networks; Knowledge network analysis

**Biographical notes:** Dr. V. Murale has completed his MBA and M. Phil from Bharathiar University and PhD from Anna University Chennai. He has in Nine years of experience in Academics, Research and in corporate training. He was a resource person for many of the MDP programs organized at IBS Hyderabad and conducted training sessions for executives of ICICI, HSBC and GE Capital on the topic 'Understanding Employee Behaviour'. He has extensively published articles in National and International journals. His areas of interest include Human Capital, Intellectual Capital, Knowledge Network Analysis, Qualitative research with a special emphasis on application of Case Study in Management.

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## 1. Introduction

People have always passed their accumulated knowledge and wisdom on to future generations by telling stories about their thoughts, works, and experiences. Throughout recorded history some form of written language has been used to document their 'know-what' or explicit knowledge. When it comes to organization, the information they need would almost likely be stored in a database, previous record files and all other possible concrete resources. However, it is to be understood that people seek information from other people around them through networks. Organizational knowledge evolves out of specific and exclusive kind of interactions between people, technologies, techniques, and contexts, which cannot be replicated by any other organization (Chen, 2009). Organizations believe that work is increasingly accomplished collaboratively through these networks. It is to be apprehended that explicit information can be codified and saved in databases, but the real edge lies in the grey matter of each person which is not tapped. The context-sensitive knowledge which is not written down anywhere, resides in a competent person's mind and it is timeless, endless, and relentless. Knowledge Management literature lays emphasizes on the fact that a major chunk of knowledge dissemination occurs through various forms of relationship networks that exist within the organizations. Informal networks are important for organizations because they promote the lateral sharing of knowledge within the organization (Wenger, 1998; Davenport & Prusak, 1998). These so-called knowledge networks make employees more effective in dealing with knowledge (Kanter, 2001).

Organizations manage their knowledge to incite innovation at all organizational levels and stay ahead of their competitors. Organizations also began to realize that the gap in technology in product offerings of different firms offering same product lines are narrowing with the advent of internet and other modes of speedier communication channels thus, compelling them to continuously innovate for value generation and sustainability. An organization's value creation efficiency depends on its (Sheikh, 2008) intellectual capital that can be transformed into value, or its intellectual material (knowledge, information, products & patents and experience) that can be utilized for generating wealth. This metamorphosis from a product oriented economy to knowledge oriented economy has given rise to a new set of 'Knowledge Intensive Firms' (KIF), where every member's innovative potential, abilities of self organization and creativity plays a cardinal role. KIF distinguishes itself by projecting knowledge as its core product and source of competitive advantage, (Fiocca & Gianola, 2003).

The formal structures underpinning organisational charts do not really reflect the actual knowledge flows within the organisations. Most corporations, however, do not know how to manage these informal networks as they find them unobservable and ungovernable (Cross & Prusak, 2002). Informal networks help to map a knowledge perspective of the actors in a system, sources of knowledge, flows, constraints and sinks of knowledge flow within an organization (Grey, 1999; Speel, Shadbolt, Vries, Dam, & O'Hara, 2000; White, 2002; Driessen, Huijsen, & Grootveld, 2007) and lead to dialogues and discussions that will help in development of structured and procedural knowledge which can be deployed for exploring and solving problems and facilitate knowledge scripting and profiling (Wright, 1993; White, 2002).

In a nutshell, in every organization, there is a formal hierarchical system in place which provides answers to questions such as, "who works where"? and "who reports to whom"? On the other hand, knowledge networks present answers to questions such as, "who knows who"? and "who shares information and knowledge with whom"? It therefore gives a picture of the many visible or tacit relationships that can either aid or

hinder knowledge creation and sharing. Many people refer to knowledge networks as an 'organizational X-ray' which illustrates the real network that exists under the veneer of formal system.

In a knowledge intensive firm like a Pharmaceutical company, every member's innovative potential, abilities of self organizational and creativity plays a cardinal role. Therefore, it becomes imperative to preserve the knowledge which each distinguished person here possesses. When organizations merge, downsize, reorganize, or changes organizational culture, priceless individual and organizational knowledge is lost or buried under new information. Employees, who quit, take their valuable knowledge, resources, skills and experiences along with them. Those who stay back would be assigned new jobs and they never use their wealth of accumulated knowledge.

For companies, it is important to know whether the knowledge networks in their organization function properly. A useful technique to study these knowledge networks has been developed in the field of social sciences: Social Network Analysis (Wasserman & Faust, 1994; Cross & Cummings, 2004); technique to study the social interaction between members of a particular group of people. It models the people in the group as nodes and the interaction between these people as arcs between the nodes, hence resulting in a social network. The interaction between co-workers and the transfer of knowledge internally was shown to be more important than elsewhere (Collins & Smith 2006; Reed, Lubaktin, & Srinivasan, 2006).

## **2. Purpose of the research**

This study adopted the social network perspective to develop a conceptual model joining actor based and relational levels of analysis, collected social network data, and performed social network analysis. The study was conducted with a pharmaceutical company. Innovations in a pharmaceutical company is quite challenging because of long product development cycles and a highly regulatory environment. Only a small fraction of all drugs developed is eventually approved by the health authorities. The present study aims to find out the role of knowledge networks in mapping knowledge flows in a pharmaceutical organization in India. In this paper, the authors develop a formal framework to analyze the flow of information and/or knowledge through social networks.

In a casual chat over the week-end, between the authors and the divisional head of the biologics division of the said pharmaceutical company, the divisional head expressed his anguish about threats to product portfolio and erosion of knowledge when people leave and the inevitable necessity of knowledge within organizations to foster organizational growth vis-à-vis initiation of knowledge sharing practices and ways and means of building knowledge within the division for continuous innovation and performance that generates value to individuals and the organization.

The topic on networks surfaced, and the authors happened to mention about knowledge networks, social networks and various favorable outcomes associated with it. The company head patiently listened to the authors and invited the authors to examine the network dynamics in his division. Thus, the present study began.

Most of the available literature on knowledge management depicts organizational knowledge management systems focused on efforts to capture, screen, store, and codify knowledge and not on the knowledge that is rooted in existing human networks. Also, to manage the growing manpower in the most effective manner, there should be awareness about each individual's relationship networks and knowledge. Knowledge Network

Analysis would help to identify the key knowledge vulnerabilities in a network by virtue of both what they know and who they know.

After discussions with the Divisional Head and Functional Heads, the authors and the Heads concluded that there is a need to recognize the key knowledge sharing actors in a particular function who would help in transfer and sustainable conservation of tacit knowledge and discovery opportunities to improve the communication network and efficiency and would also help to strengthen boundary spanning knowledge exchange and increase the informal inter organizational relationships.

Thus, the main objective of the study is to examine the role of social networks in mapping knowledge flows in a Pharma company. To accomplish the main objective, the following sub-objectives are formulated:

- To identify the actors and the roles played by individuals in a given network for knowledge sharing;
- To observe the interactions between individuals for information during work hours and observe the preferences of individuals in approaching a particular individual for knowledge exchange;
- To identify the culture with respect to knowledge sharing practices prevailing in the company; and
- To develop knowledge maps using social network analysis; for instance, who knows whom and who shares knowledge with whom.
- Based on the above objectives, the following research questions are generated:
- Whom does an employee approach when there is a need for information/knowledge to perform a task?
- How willing are people to share their ideas? What barriers do knowledge seekers face from supposedly knowledgeable employees?
- Whom do people prefer to approach to receive information and how much of organizational support is available for knowledge sharing between coworkers/colleagues?

### **3. Review of the literature**

Innovation is a learning-by-doing process that starts from an awareness that grows within the firm and aims to improving the business. In a subsequent stage, support is sought from outside the company. Internal experience is considered to be the main source of new knowledge generation. Historically, capital, raw materials and labour have been considered more valuable than creating and applying knowledge, but, the emergence of information age and knowledge revolution have caused problems for people and organizations because of heavy demands for imaginative, intuitive, and inspirational leaders who can manage human intellect and convert it into useful products and services continue to grow (Goffee & Jones, 2000). People are expected to do more work in less time and struggle to keep up with adequate education, training and explicit knowledge. Thus, common sense, intuition, tacit knowledge began becoming the order of the day to remain competitive and organizations are using this tacit knowledge to augment the academic learning and experience. Thus, the last decade of the 20<sup>th</sup> century began portraying and emphasizing the continuous and significant emergence of knowledge.

Moreover, the declining importance of labour and capital intensive activities led to emergence of knowledge based activities, knowledge intensive organizations, and specially, knowledge intensive services.

### *3.1. Knowledge*

There has been a great deal of debate in the literature about the meaning of the term “knowledge management”. Most of the debate revolves around the differences between ‘information’ and ‘knowledge.’ Knowledge itself is a much more all encompassing term which incorporates the concepts of beliefs that are based on information. There are many definitions and forms of knowledge. For instance, knowledge is structured and organized information that has developed inside of a cognitive system or is part of the cognitive heritage of an individual (Zins, 2007). Based on cognitive science theories, knowledge can be defined as an abstract concept that is consciously or unconsciously built by the interpretation of a set of information acquired through both experience and meditation on the experience itself, and that is able to give its owner a mental and/or physical ability (Polanyi, 1962, 1966; Kim, 1993; Kolb, 1984; Johnson-Laird, 1990). This definition highlights that knowledge has three characteristics: structural, process and functional, that are tightly interconnected. Albert and Bradley (1997) defined knowledge as information combined with experience, context, interpretation, and reflection and it is a high value form of information that is ready to apply to decisions and actions.

### *3.2. Forms of knowledge*

Knowledge that surfaces out of interconnected data and information is viewed through different perspectives. It is generally divided into explicit and tacit forms. The former is systematic knowledge stored in hard form while the latter is based on intuition, rule of thumb, experiences, judgment and is not written (Daft, 2000).

Nonaka and Takeuchi’s (1995) classification of knowledge into tacit and explicit based on Polanyi (1966) is not well grounded because it is not relevant to management context because of philosophical assumptions (Nonaka, von Krogh, & Voelpel, 2006). According to Polanyi (1966), “explicit” or codified knowledge refers to knowledge that is transmittable in formal, systematic language, whereas “tacit” knowledge has a personalized quality which makes it hard to formalize and communicate. The latter deeply rooted in action, commitment, and involvement in a specific context, or as Polanyi has stated, it “in-dwells” in a comprehensive cognizance of the human mind and body. Tsoukas and Vladimirous (2001) argued that tacit and explicit knowledge are personal in character while organizational knowledge is collective in orientation. Gourlay (2006) asserted that tacit and explicit knowledge dimensions are radically subjective and devoid of consistent and valid referential. Therefore, another definition of knowledge is needed.

From the perspective of who holds a particular form of knowledge, there comes a duality between individual and organizational knowledge and this demands different sets of strategies in knowledge management (Bhatt, 2002). Organizational knowledge is the capability members of an organization have developed to draw distinctions in the process of carrying out their work, in particular concrete contexts, by enacting sets of generalizations whose application depends on historically evolved collective understandings (Tsoukas & Vladimirous, 2001). It is important for a firm to understand the process in which ideas and knowledge of a person gets transformed in to organizational knowledge (O’Leary, 1998; Bhatt, 2002; Li & Gao, 2003). This process includes:

- Creation of knowledge at the individual level (from tacit into explicit knowledge);
- Codifying knowledge (formalizing the experience, explicating best practice);
- Communication of the knowledge (via newsgroup, team work); and access and use of knowledge generated within the organization.

### 3.3. *Knowledge intensive firm (KIF)*

In recent years, an organization's value creation efficiency has undergone a radical change in the knowledge economy. The value creation efficiency depends on its intellectual capital that can be transformed into value, or its intellectual material that can be utilized for generating wealth (Sheikh, 2008). This shift of focus from product to knowledge has resulted in a set of knowledge intensive firms, i.e., organizations began realizing that knowledge is to be captured, stored and used for organizational growth. Therefore, knowledge management is defined as a process of capturing and making an organization's collective expertise anywhere in the business – on paper, documents and databases, or in people's heads. Simply speaking knowledge management is concerned with managing both recorded (i.e. explicit) and tacit knowledge.

There is difficulty in defining knowledge intensive firms or knowledge intensive business. Miles (2005) claimed that the key indicator of KIF is formal education of employees. It does not include non-formal education and work experience of employees, which is crucial in a knowledge intensive activity. Also, this indicator doesn't take into account the tacit knowledge and the organization's ability to learn. Another disadvantage of this indicator is underestimation of the performance of KIF companies, such as service innovation. Another approach is to define knowledge-intensity as the ability to integrate different sources of information and knowledge in innovation processes within the company. According to this definition, KIF is characterized by an ability to retrieve information from outside the company and transform this information, combined with knowledge about the company, into a service useful to their clients.

KIFs are largely based on professional knowledge (expertise) associated with a specialized field or discipline, and provide intermediate products (Hertog, 2000). Due to the fact that KIF companies offer intangible services with a high degree of adaptation to the needs of individual customers, the "production" of such services requires close and intensive collaboration between the given company and its customers.

Koch and Strotmann (2008) defined KIF as highly application-oriented services, in which tacit knowledge plays an important role and specialized knowledge and cumulative learning processes are required. Consoli and Elche-Hortelano (2010) defined KIF as intermediary firms which specialize in knowledge screening, assessment and evaluation, and trade professional consultancy services." Knowledge intensive services are also provided in those sectors which are not defined as knowledge intensive businesses. Despite the many disadvantages of classifying KIFSS on the basis of official statistical classifications, many scientists apply them in their research. According to Baláz (2004), typical examples of KIFS are: accounting, management consultancy, technical engineering, R&D activities, design, services related to computer and information technology, and financial services.

### 3.4. *Knowledge sharing*

Knowledge sharing is a means of accelerating the process of mobilization of pieces of knowledge and integrating them into the knowledge creation process. The development of drug products requires specific knowledge within several scientific fields, but given the limitations of human cognition, it is impossible for any individual to be an expert in all of them (Berends, van der Bij, Debackere, & Weggeman, 2006). The expertise of R&D professionals and the knowledge stock available within the pharmaceutical company therefore holds great potential if shared. Knowledge sharing practices are defined as the engagement of an individual or a group in a knowledge sharing activity. Knowledge management is a discipline believed to enhance organizations' innovative capability through the sharing and creation of new knowledge (Davenport & Prusak, 1998). To improve knowledge management in an organization, it is therefore vital to understand its knowledge sharing practices (Birkinshaw, 2001). Nonaka and Takeuchi conceptualized knowledge creation processes as a theoretical framework. They made an essential distinction between tacit and explicit knowledge and proposed that the key to knowledge creation lies in the mobilization and conversion of tacit knowledge to explicit knowledge (Nonaka & Takeuchi, 1995). According to Nonaka and Takeuchi (1995), knowledge creation in an organization happens through the sharing of tacit and explicit knowledge, which turns into a knowledge creation spiral.

Knowledge sharing has also become an important focus in the strategic management field, where knowledge is seen as “the most strategically-important resource which [organizations] possess,” (Grant, 1996, p. 376) and a principal source of value creation, (Nonaka, 1991; Spender & Grant, 1996; Teece, Pisano, & Shuen, 1997). Indeed, “in many industries, the importance of developing abilities to better utilize the knowledge contained in the firm’s network has become apparent. Lilleoere and Hansen (2011) found that three types of context specific knowledge sharing practices namely, routine, reactive and transfer sharing practices. The routine and transfer practices took place as part of daily work, whereas the reactive practices were initiated by the occurrence of a “critical” episode. Tacit knowledge was the underlying source.

### 3.5. *Social networks*

In this study, knowledge sharing is examined from a social network perspective prevailing within the organization in a routine context. Moreno (1953), one of the earliest advocates of social network, investigated the psychological state of individuals within a group. Further, empirical studies conducted by social science researchers on areas such as on diffusion of innovation and voting behavior demonstrated the existence of networks and its role in social interactions (Katz & Lazarsfeld, 1955; Coleman, Katz, & Menzel, 1957; Rogers & Shoemaker, 1971). Tichy (1973) is of the view that the concept of networks in organization has its origins from various disciplines such as sociology (Park, 1924; Cooley, 1956; Simmel, 1950), anthropology (Levi-strauss, 1969; Malinowski, 1959) and role theory (Kadushin 1968; Katz & Kahn, 1966). Capra (2002) advocated the concept of living network – a metaphor that exists in highly successful organizations. He compares these human networks to ecological networks that can function as a self-generating network of communications which makes these organizations similar to life systems. Kadushin (2004) defines a network as a set of relationships that exists between two or more objects. It is worthwhile to recall that conventional network structures are also based on relationships in which the structures are non-hierarchical dispersed system.



Similarly, a social network refers to a group of collaborating (and/or competing) entities that are related to each other. Social networks are informal in nature and are powerful channels which help in dissemination of information, rumors, gossips, within an organization. These informal networks also facilitate the lateral sharing of knowledge among various members in the network (Wenger, 1998; Davenport & Prusak, 1998), hence plays a pivotal role in effective knowledge management which contributes to an improved organizational performance. An understanding of these networks by the organizations help in identifying knowledge sources, sinks, and constraints. Organizations shall be highly benefitted if these knowledge networks are mapped as it helps managers to examine the knowledge flows and thus streamline knowledge exchange process in the overall networks (Krackhardt & Hanson, 1993). However, organizations are not aware of mapping and managing these networks as they are unobservable.

Contemporary literature on knowledge management suggests the application of social network analysis as a technique for mapping knowledge networks in organizations (Wasserman & Faust, 1994; Cross & Parker, 2004). Networks are mathematically represented using a graph or multi-graphs and each entity in the collaboration is called an actor and depicted as a node in the graph. The relations between actors are shown as links between the analogous nodes. Actors can be people, organizations, or groups or any set of related participants. The diagrammatic representation of networks is a knowledge map. Chan and Liebowitz (2006) opined that knowledge map portrays the sources, flows, constraints and sinks of knowledge within an organization. Knowledge maps are used to increase the visibility of knowledge sources and thus facilitate and accelerate the process of locating relevant expertise or experience in an organization. However, they do not provide a systematic ways to access the efficiency of a knowledge flow. Social network analysis (SNA) complements such weaknesses by providing an important means of analyzing knowledge flows systematically. SNA makes the invisible network of relationships between people seem more visible and thus gives valuable inputs to the managers to make decisions for improving the performance of their organization (Krackhardt & Hanson, 1993; Cross, Parker, & Sasson, 2003).

### *3.6. Application of social network analysis for mapping knowledge networks*

The present study applies SNA technique to knowledge mapping and uses the concepts of centrality, in-degree and out-degree, closeness and betweenness. Knowledge network analysis is an extension of social network analysis (Helms & Buijsrogge, 2005). In knowledge network analysis, the emphasis is given to the lateral sharing of knowledge involving the members in a network. Pugh and Prusak (2013) assert knowledge networks “are collections of individuals and teams who come together across organizational, spatial and disciplinary boundaries to invent and share a body of knowledge”. The focus of such networks is usually on developing, distributing and applying knowledge. The knowledge network has been trumpeted as a model for innovation and scale — one that capitalizes on the agility and reach of human connections while integrating practical insight into the day-to-day work of network members. Networks can be 10 people across a handful of organizations or 1,000 people across continents and industries. Knowledge network members come together around a common goal and share social and operational norms. Most researchers agree that network members participate out of common interest and shared purpose rather than because of contract, quid pro quo or hierarchy. However, researchers don’t agree about the importance of formal structure, organization and leadership. Some emphasize that members are simply “linked together by interdependent

exchange relationships” while others call for formalized roles, routines and metrics (Stein, Stren, Fitzgibbon, & MacLean, 2001).

Cross, Parker, Prusak, and Borgatti (2001) studied knowledge sharing that takes places in informal networks and developed sociograms of information flow. Cross and Prusak (2002) studied 50 organizations and recognized four roles in a network, viz., boundary spanners, connectors, information brokers and peripheral specialists. Mueller-Prothmann and Finke (2004) propounded SELaKT (sustainable expert localization and knowledge transfer) rooted in SNA with an intention to understand social relations in an organizational network. Concepts like degree, structural holes, bridges and hubs were identified. Helms and Buijsrogge (2006) highlighted KNA in an engineering firm to understand bottlenecks in an organization with respect to knowledge transfer among all members in a network. He identified pull network and push network. LNX research in 2007, found various centrality measures and concluded that SNA is a unique tool as it can evaluate such communities in total, their collaborative patterns and key individuals, which neither surveys nor literature can reveal.

#### **4. Method and result**

This study aims to find out the knowledge networks that exist across and within the Manufacturing Group Function (MGoF) in the large biologics division of a leading pharmacy group in the country. This firm employs an approximate manpower of 15000 people globally and is a significant global player in Generic drugs category. The biologics division deals with a new class of drugs that have been used since 1998 and have been established for almost 10 years. Biologics, or large molecule pharmaceuticals are complex, highly targeted and generally expensive therapies that are a growing contributor to overall global healthcare spend. The MGoF department of Biologic division, located at Hyderabad has 141 employees. In biologics, MGoF is one of the most important functions. It handles procurement, production, quality and packaging of the products. The reason for selecting the biologics division is that there exists a high level of interdependence among the various constituent functions. The dynamic and complex environment of this Pharma Company demands proper preservation of knowledge and informal networks of the employees which are central to getting work done.

With the anticipated increase in the manpower in MGoF, it is critical to understand how the knowledge and information transfer takes place among the employees. MGoF consists of functions which have high dependency on each other. To dispatch a product in the market there is a chain reaction of operations going on among the functions. This creates a need to monitor the necessary interactions among the employees and ensure timely flow of relevant information. There is a need to ensure that the knowledge of every person is preserved and utilized. In this knowledge driven system, it is rare for individual to accomplish anything of substance on their own. Hence, departing employees take away with them not only technical expertise but also the relationships with internal employees and external partners and customers. Knowledge network analysis would help to manage these growing intricacies about each individual’s relationship networks and knowledge. Further, it helps in detecting the key knowledge vulnerabilities in a network by virtue of both what they know and who they know.

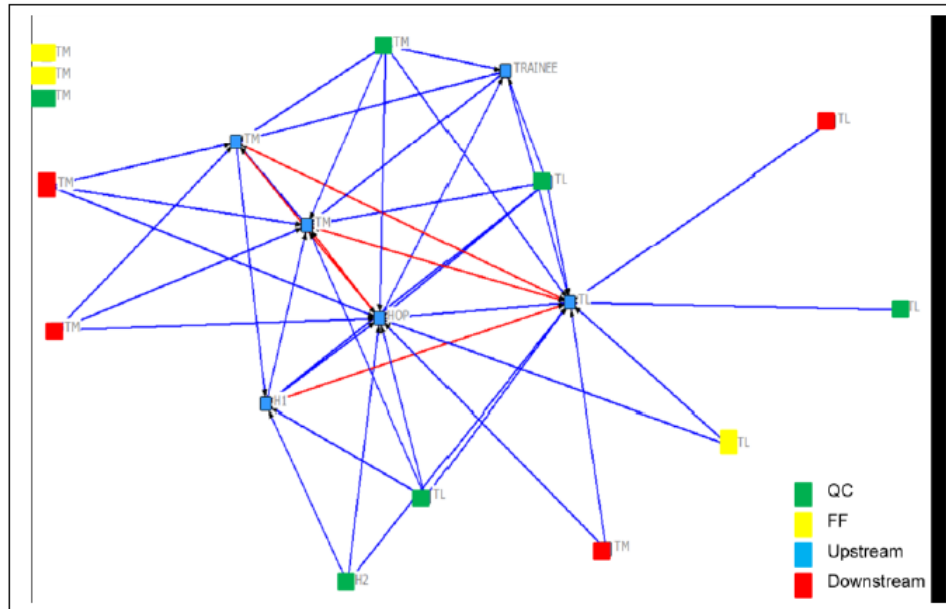
The study was conducted from the 27<sup>th</sup> April 2012 to 27<sup>th</sup> May 2012. It was understood that the effectiveness of the study depends on the inputs received, time and responses of the concerned head of departments, senior managers, the line managers, the employees and the peers working in the identified areas. Hence, a presentation was made

to the respected heads of manufacturing Department, the agenda of which was to familiarize them with the knowledge network analysis concept and get their cooperation for carrying out the project. For better understanding, certain assumptions were made and knowledge in this project was defined as new ideas and any information which can aid a person in delivering their work faster and improve the efficiency. The knowledge which is supposed to be shared among people does not include any confidential data. Four knowledge areas were decided on the basis of interactions done with the Managers following the presentations. These Knowledge areas were chosen by means of knowledge strategy process, which selects the knowledge area that yields the highest contribution to the business goals (Van der Spek, Hofer-Alfeis, & Kingma, 2002). These knowledge areas for mapping and gauging knowledge creation and flow among the employees in MGOF were identified as - Upstream, Downstream, Fill Finish, Quality Control. The employees associated with these knowledge areas were 110 in total.

The second phase was to identify knowledge actors, knowledge actors facilitate exchange of knowledge., Becerra-Fernandez, Gonzalez, and Sabherwal (2004) highlight about various properties associated with knowledge actors such as knowledge role, expertise level and function, We had added one more set of attributes, that is tenure of actor in the organization (Reagans, Zuckerman, & McEvily, 2004). The knowledge actor role can be as diverse as that of a knowledge creator who contributes towards the construction of knowledge in a group, a knowledge broker who facilitates sharing of knowledge and that of an end user, who applies the gained knowledge for solving/improving his/her work related process. The expertise attribute refers to the level or quality of knowledge possessed by an actor. Empirical studies and past observations imply that actors having higher level of expertise are more likely to share useful advice to others in their jobs when compared to actors with a lower level of expertise (Constant, Sproull, & Kiesler, 1996; Wasko & Faraj, 2005). For the sake of study, the actors were broadly classified as 'Expert' and 'Trainee', based on the level of knowledge they possessed. The functional level of actors connotes the role or responsibility of individual actors in the organization. For the present study, the respective functional roles are head of production, team leaders, team managers and technical trainees of MGOF. A sample of 19 people was selected for the analysis based on judgment of productions and quality Control Heads. These people were selected on the basis of their past records of experience, knowledge contribution, interaction level and their networking abilities with other employees in their strata of population.

As the knowledge areas and knowledge actors were identified, it was decided to conduct a personal interview with each member, selected as per the judgment of the Heads of MGoF. The main motive of the interview was to understand precisely what knowledge each person requires, in order to meet their objectives and the barriers they face in work due to improper information flow. Further it was also aimed at understanding the current culture practices such as knowledge sharing attitude, collaboration, team spirit and staff relationship with their superiors, peers and subordinates. This process also helped to understand how willing people are to share their ideas and how much is the organization supporting them to voice their opinion. The interview revealed the gaps and the issues faced by the employee due to delay in information flow or due to unavailability of appropriate information; By examining the response, the authors were able to analyze the responses which indicated the need for a proper information flow and also bring out the willingness of people in the department to share knowledge. This was followed by a survey in which the questionnaire focused mainly on the preference of people one approaches to receive information from. The respondents were made aware about the meaning of the term "Knowledge", with respect to the study. As stated earlier, knowledge here was defined as "information which can

help to make faster and can add to the efficiency of the work processes”. They were asked to mark the people in each knowledge area they approach for information. The responses received were then arranged into 19x19 matrices and fed into KNA software called UCINET. The Net Draw element of the software was used to create the visual map of the knowledge flow and 4 visual maps were created each for Upstream, Downstream, Fill- Finish and Quality- Control. The basic diagram looks like the one shown below in Fig. 1.



**Fig. 1.** A knowledge flow diagram

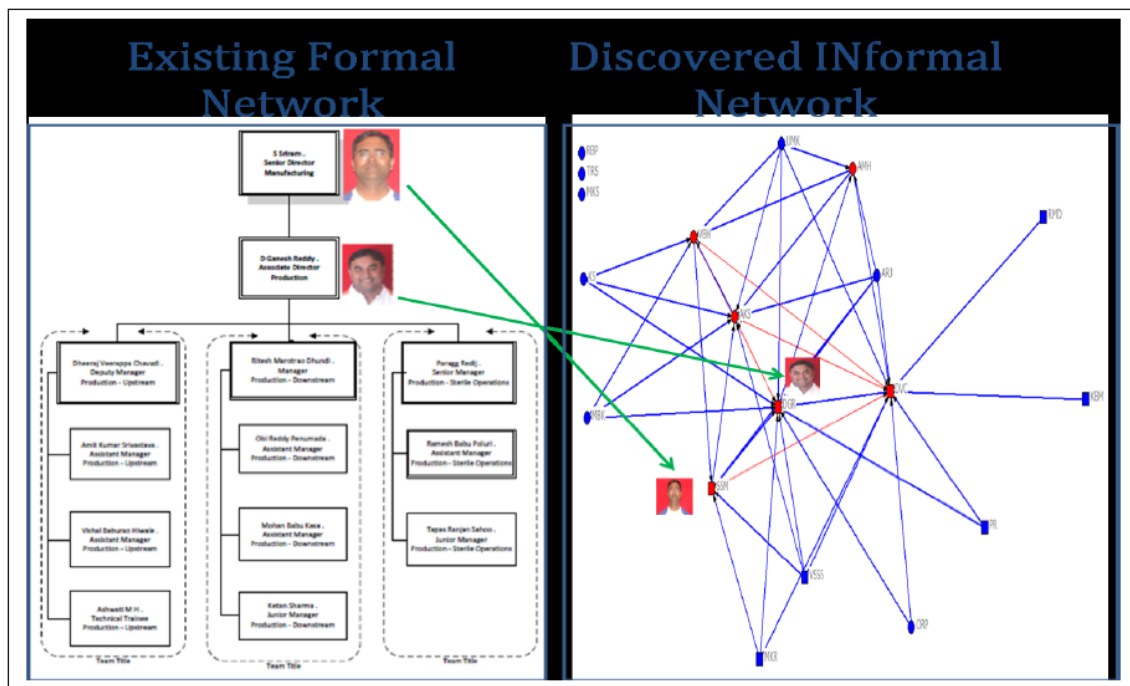
As it can be seen in the Fig. 1 the nodes represent the actors and the edges represent the knowledge flows. In the maps, the nodes are colored according to the area they belong to. Also, the shapes of nodes are specified based on the attribute of expertise. While the actors who are currently in the higher role bands and are leaders are represented as boxes, the individual contributors and team members are represented as circles. The red lines or edges represent the mutual flow of knowledge between two actors, i.e. they both approach each other while the blue lines represent one way flow with arrows pointing in direction of the actor being approached by the other.

Statistical measures were also deployed to interpret the data. Two types of statistical measures were used to interpret the statistical results- at the knowledge area level and in-node level. The density was used as a measure the level of interactions on Knowledge area level (Angela, Yannerell, Rusak, Tripett, & McMahon, 2007; Wasserman & Faust, 1994). The interaction levels will be higher on a high density network structure, also called closure networks structures. Moreover, in a dense network structure, the group members are more likely to demonstrate willingness to invest time, energy, and efforts in sharing knowledge (Reagans & McEvily, 2003) among their group members, which results in enhancement of knowledge sharing efforts among the area members. At the node level, the measures such as in/out degree (Helms & Buijsrogge, 2006) and Out-degree centrality were adopted for interpreting results. The in-degree denotes the number of incoming knowledge flows and out-degree represents the total

number of knowledge outflows of an actor. The in and out degree is applied for deciding the role of an actor. An actor is considered to be a knowledge creator if the in-out degree ratio is smaller than 0.5, a knowledge broker/sharer if it lies in between 0.5 and 2.5 and knowledge user if the degree is higher than 2.5. In practice the role of knowledge sharer and creator can be overlapping many times hence a distinction between these cannot be drawn upon all the times. The Out-degree centrality is the representative sign of the central position of actors in a network. A higher degree of out degree centrality (Hanneman & Riddle, 2005), indicates that the particular actor has an influential role in the network as he can get in touch with infinite number of actors with his expertise.

## 5. Observations and recommendations

The analysis highlighted helped us to conclude that there exists a parallel knowledge network in the organization, as concluded from the literature which can be depicted in the Fig. 2.



**Fig. 2.** A comparison of existing formal network with informal network in the organization

The pattern of networks mapped on the basis of knowledge indicated a group of bridged networks existing in the organization with many structural holes as indicated by the low measures of density. It is implied that an intra-group network rich with structure holes, represents a fractured group, which can restrain internal coordination and hamper the team's ability for taking collective decisions (Leana & Van Buren, 1999; Reagans, Zuckerman, & McEvily, 2004).

Results of further analysis helped us to understand that there are few key ( Ref. Fig. 2) players like the team Leader of Fill Finish, and a high dependency on them can

cause a serious network crunch on the occasion of their departure. It was suggested that new recruits can be assigned into this level who can share the responsibility and ensure that uniform distribution of information flow and network connections. It was also observed that it was found that there were three team managers from upstream area who had limited interaction with other colleagues. An analysis of the in-out degree data shows that neither they did go to anyone to get information regarding upstream, nor they were approached by anyone regarding it. This implies that they are isolated and they do not gain knowledge about the developments in the area. The team leader of Upstream was surprised to know that the relationship network of this person was not strong and this could result in ambiguity and dissonance when replacement took place. Thus, team leader has started delegating duties which involves forming networks and will also help others to recognize him as the next right person to depend on regarding upstream information. In one of the areas, a Technical trainee is at the periphery. She is not connected to anyone from other departments. People are unaware about her knowledge skills. It was recommended that she be assigned to a broker who can guide her to channelize her knowledge in a proper direction and make her work visible.

However, the network structures were not totally weak as there were mutual ties existing among the leaders of downstream, and share a very strong communication bond. This means that they were forming a clique. Hence, they have common approach towards problems; have a good understanding, a good level of agreement in decision and simply stating, a similar thought process. Together, they form a good team can be clubbed together for better decision analysis. We had also suggested that the key people identified can also be mapped into the talent management board and included as a criterion in the career management and initiatives can be taken to reallocate information access and decision rights to ensure one point do not become too vulnerable. Further it is recommended to assign brokers in areas where information gap exists and reward employees for bringing external ideas.

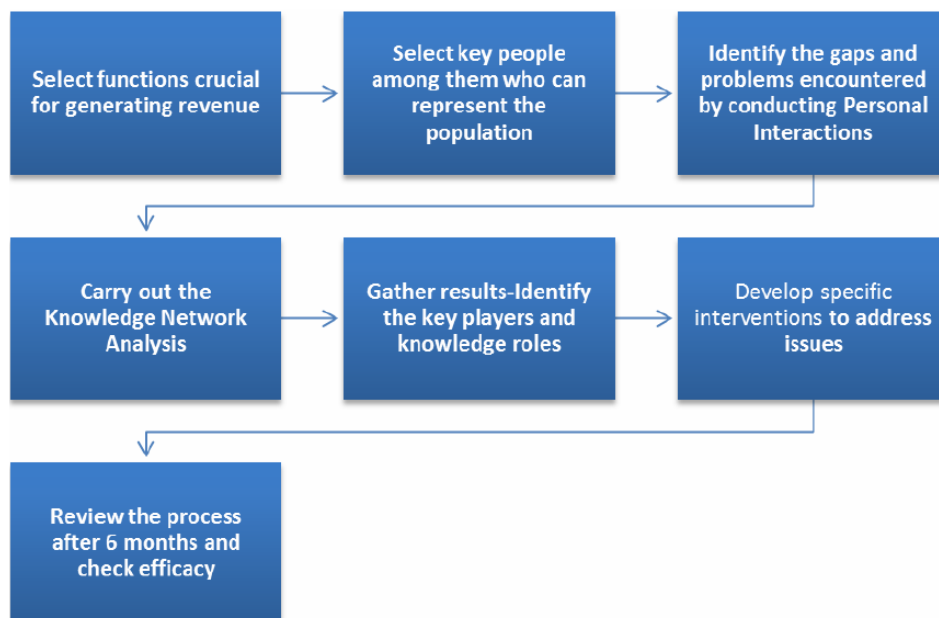


Fig. 3. Suggested cycle for improvement

A copy of the report and the slide presentation were given to each Head of MGoF. As discussed above few of the recommendations have come into effect while other long term actions will be included in the review period. The various initiatives include that of “Quality Control Department” counting the junior members too in their functional meetings to increase their visibility. People equipped with domain knowledge and good communication skills have been identified in knowledge areas. These people have been informally assigned as the point of contact for quality control. Further, a resource has been dedicated, each from the human resource department and from business planning and systems department (Project Management Office) for implementing the recommendations. They have been given a copy of the report; the documents and manuals used and have been trained on the concepts involved. Proper information have also been provided to them about the software used- UCINET and the necessary manual. The following cycle outlined in Fig. 3 was suggested to them for further improvement.

## 6. Discussion and conclusion

In our study, Knowledge Network Analysis, a technique based on Social Network Analysis, was used for mapping knowledge networks, and the results were interpreted using visual as well as quantitative analysis techniques. The analyses helped to identify and visualize the flow of tacit knowledge through informal networks in the selected organization. Moreover, the analyses helped in identifying the various levels of knowledge actors, such as knowledge creators, brokers and users, in different knowledge area; depicting the pattern of knowledge flows, and detecting various bottlenecks in knowledge sharing. These analyses will help in deriving pragmatic solutions for improving the effectiveness knowledge management practices of the organization.

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