

MAPPING KNOWLEDGE FLOWS THROUGH NETWORK ANALYSIS : A CASE STUDY OF A PHARMACEUTICAL COMPANY IN INDIA

V. Murale*, G. Prageetha Raju**

*Assistant Professor, Amrita School of Business, Amrita Vishwa Vidyapeetham University, AIMS Campus, Ponekkara, Kerala, India. Email: v_murale@asb.kochi.amrita.edu

**Associate Professor, HR Area, ICFAI Business School, IBS Hyderabad, Donatanapally, Andhra Pradesh, India. Email: dr.prageetha@gmail.com

Abstract *The present paper aims at studying that the knowledge flows through the social networks and thus knowledge maps are developed to illustrate the actual knowledge flow for better performance in a pharmaceutical company in India which has a global presence. It first, provides a review of literature on the recent research and application of knowledge mapping and SNA, followed by a discussion of the concepts of SNA and KNA.*

Keywords: *Social Network Analysis (SNA), Knowledge Networks, Knowledge Network Analysis (KNA)*

1. INTRODUCTION

Competition has turned out to be the nomenclature for most of the organisations in the present boundary-less business environment. Further, it is a reality that these firms should have to improve their performance through continuous innovation of new products, process and productivity enhancement measures to attain sustainability (Pfeffer, 1998). An organisation's value creation efficiency has undergone a radical redefinition in a knowledge economy. The value creation efficiency of a firm depends on its (Sheikh, 2008) intellectual capital that can be transformed into value, or its intellectual material (knowledge, information, products and patents, and experience) that can be utilized for generating wealth. This shift of focus from product to knowledge has resulted in a new set of Knowledge Intensive Firms where every member's innovative potential, abilities of self-organisation and creativity play a cardinal role. The term, "Knowledge Intensive Firm" (KIF) is used to denote firms that achieve competitive advantage through generating knowledge from the data and information that it receives from the internal and external environment it exists", for the purpose of the study. To elaborate further, a KIF distinguishes itself by projecting knowledge as its core product and source of competitive advantage, (A. Gianola *et al.*, 2003). Thus, Organisational knowledge can be defined as a meaningful data incorporated within a set of rules, laws, and procedures, deducted or learned from experiences and

organisational practices.(O'leary, 1998; Bhatt, 2002; Li and Gao, 2003). Further, organisational knowledge evolves out of specific and exclusive kind of interactions between people, technologies, techniques, and contexts which cannot be replicated by any other organisation.

This metamorphosis from a machine oriented economy to knowledge oriented economy has given rise to a novel concept called Knowledge Management. The focus of knowledge management is on "identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers." (Duhon, 1998). Bhatt (2001), author of *Knowledge Management*, has broadly categorised knowledge into two levels, namely, individual knowledge and organisational knowledge. It is important for a firm to understand how ideas and knowledge of a person can become knowledge of a firm (O'leary, 1998; Bhatt, 2002; Li and Gao, 2003). The process of creation of knowledge can be summed up in the following phases:

- Creation of knowledge at the individual level (from tacit into explicit knowledge)
- Codify knowledge (formalize the experience, explicating best practice)
- Communication of this knowledge (newsgroup, team work)

- Access and use of knowledge generated by other people within the organisation

Knowledge management literature lays emphasis on the fact that a major chunk of knowledge dissemination occurs through the various forms of relationship networks that exist within the organisations. Krackhard D. and Hanson J.R (1993), have proposed that practicing managers should have a pictorial representation of three kinds of network existing in a firm.

- The Advice Network: comprises of the prominent players in an organisation on whom others depend to solve problem and who provides technical information.
- The Trust Network: indicates the channel where employees share delicate
- political information and back each another in crisis.
- The Communication Network: a depiction of the regular communication channel in which employees share information on work - related matters on a regular basis.

Advice network helps managers uncover the source of political conflicts and failures to achieve strategic objectives. Trust network reveals the cause of non-routine problems such as poor performance by temporary teams. The communication network helps to identify gaps in information flow, the inefficient use of resources and failure to generate ideas.

The mapping of these informal networks will be a rich and systematic means for identification of casual relationships among people, teams, departments or even the entire organisation. Further, it would be of help to map a knowledge perspective of the actors in a system, sources of knowledge, flows, constraints and sinks of knowledge flow within an organisation (Grey, 1999; Speel *et al.*, 2000; White, 2002; Driessen *et al.*, 2007). The knowledge maps facilitate knowledge scripting and profiling in large knowledge intensive organisations (White, 2002). Secondly, knowledge maps will lead to dialogues and discussions that will help in development of structured and procedural knowledge which can be deployed for exploring and solving problems (Wright, 1993). The utility of knowledge maps are thoroughly studied by Grey (1999), Meso and Smith (2000), White (2002), Liu and Hsu (2004) and is summarized in Table 1.

This study aims to map knowledge flows that happens through social network that exists in a pharmaceutical organisation in India. Further, motivation for the study is the fact that majority of the available literature on knowledge management depicts organisational 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. Our study shall add and enrich the existing literature on the role of informal networks in

organisational learning and knowledge sharing.

We organised this paper as follows: A section of review of literature focused on knowledge flows that happens through Intra-organisational networks; a section on summary of application of social network analysis as a tool for mapping knowledge networks. The next section provides a detailed description of the methods used and about the organisation where study is carried out. The last section presents the observations and recommendations. The paper ends with a discussion on the results, and some implications vis-à-vis areas for future research.

2. REVIEW OF LITERATURE

Organisation researchers such as Katz and Kahn, 1966; Weick, 1969, describe organisations as “social groupings with relatively stable patterns of interaction over time”. This approach views organisations as social systems comprising of objects such as people, groups, organisations connected by a multiplicity of relationships (networks). contemporary organisation theorists have extensively researched on organisational network models. Morgan (1997) and described organisation as a political system consisting of loose networks of people who congregate for achieving a common goal. These objectives may vary from creation of wealth to upliftment of the weaker section of a society.

Aforementioned studies point into the multiplicity of relationships and perspectives that exist among various entities in an organisations. These multiplicities of relationships are those that exist between set of objects in a system defined as networks for the purpose of this study. Kadushin (2004) defines a network, as a set of relationship 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 systems. 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 helps in dissemination of information, rumors and gossips within an organisations (Pathak *et al.*, 2010). These informal networks also facilitate the lateral sharing of knowledge among various members in the network (Wenger, 1998; Davenport and Prusak, 1998). Hence, they play a pivotal role in effective knowledge management which contribute to an improved organisational performance (Cross and Parker, 2004; Epple, Argote and Murphy, 1996). Cross *et al.*, (2001) on role of social knowledge creation in organisation decipher that people do not learn from impersonal sources but from interactions that occur at various levels in their work place. Tsai and Ghoshal (1998) view social networks as something that add value to organisational performance as it facilitates opportune contact to right source of information. In several studies, the

Table 1: Purposes and principles of knowledge mapping

Utility of Knowledge Maps	<ul style="list-style-type: none"> • To inbreed knowledge and ideas in an organisation. • To envisage complex structure (long text, hypermedia, large web sites). • To facilitate exchange of complex knowledge and ideas among various actors and subunits in the organisational system. • To aid individual and organisational wisdom by clearly integrating new and old knowledge. • Helps in evaluating understanding or diagnose misunderstanding. • To have a mechanism that facilitates an easy access to relevant knowledge.
Key Principles of Knowledge Mapping	<ul style="list-style-type: none"> • Understand that knowledge is transient. • Explain the sanction, establish boundaries and respect personal disclosures. • Identify and locate knowledge in a wide variety of forms; tacit and explicit, formal and informal, codified and personalized, internal and external and short life cycle and permanent. • Helps to trace knowledge that underlies in processes, relationships, policies, people, documents, conversations, links, context, suppliers, competitors and customers. • To have an awareness of organisational levels and aggregation, cultural issues and reward systems, timeliness, sharing and value, legal process and protection associated with knowledge management

Source: The table was adopted from research work of Gang Cheol Yun (2008) on utility of knowledge mapping.

network structures are considered to be a contextual aspect that facilitates collaborative relationship. Networks in any form and structure disseminate knowledge and information among its members. This collaboration among the members results in higher level of learning and cooperation among members of a network which ultimately results in enhanced performance (Cross and Cummings, 2004; Ng and Chow, 2005).

Tsai and Goshal, (1998) has recognised the innovation happening through social networks and its impact on performance. The study will help to provide empirical evidence for learning that happens through social network. A path breaking study conducted by Hansen (2002) on 120 new product development projects in a multinational electronics corporation revealed that teams that had easier access (shorter network path) to units that possessed related knowledge completed their projects ahead of other teams. Organisations are also increasingly becoming aware about the knowledge transfer and collaboration that occurs through these informal networks. An understanding of these knowledge networks that exist within the organisations, will help in identifying the knowledge sources, sinks, and constraints. Organisations will be highly benefitted if these knowledge networks are mapped as it helps managers to examine the knowledge flows and streamline knowledge exchange process in the overall networks Krackhardt and Hanson (1993). However, organisations lack the mechanism or 'know-how' of mapping and managing these networks as they are unobservable (Chan *et al.*, 2006). Contemporary literature on Knowledge Management suggests the application of social network analysis as a technique for mapping the knowledge networks in organisations (Faust and Wasserman, 1994; Cross *et al.*, 2004). Originally, social network analysis is employed to study the social interaction

between members of a particular group of people in social science research, in which networks are mathematically represented using a graph (or a multi-graph); 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 person, organisations, or groups, i.e., any set of related participants.

3. APPLICATION OF SOCIAL NETWORK ANALYSIS FOR MAPPING KNOWLEDGE NETWORKS

Krackhardt and Hanson (1993) proved that informal networks helped managers to work with the informal organisation and are able to improve the knowledge exchange. Further, corporate employs social network analysis for process improvement and organisational engineering. "A social network is a simple structure comprising of set of actors or nodes (Hanneman, 2001, Kelvin Chan *et al.*, 2006) that may have relationships ties with one another". Some of the firms that had applied Social network analysis for knowledge network analysis (hereinafter called as KNA) includes include Rubbermaid, TRW, IBM, Lucent Technologies (Krebs, 1998), J.P. Morgan Chase, Steelcase Inc, and Hewlett-Packard (Kleiner, 2002) .

Knowledge network analysis is an extension of social network analysis (Helms and Buijsrogge, 2005). In knowledge network analysis, the emphasis is given to the lateral sharing of knowledge involving the members in a network. The application of social network analysis (hereinafter called as SNA) in mapping knowledge networks will help in identifying the strengths and inefficiencies that are present in existing knowledge sharing networks. SNA helps in

mapping and measuring formal and informal relationships to understand what facilitates or impedes the knowledge flows that bind interacting units, viz., who knows whom, and who shares what information and knowledge with whom by what communication media (e.g., data and information, voice, or video communications). These relationships are not usually readily discernible, social network analysis is somewhat akin to an “organisational x-ray” and thus gives priceless inputs to decision makers to adopt strategies that can improve performance of their organisation (Krackhardt and Hanson, 1993; Cross *et al.*, 2003).

Cross *et al.* (2001) conducted a pioneering study on knowledge sharing that takes place in informal networks in an organisation by applying using social network analysis techniques. The objective of the study was to create a sociogram of information flow in an informal network. They were able to identify a number of dimensions which may influence information flow in the network such as knowledge, access and engagement. In another study which deployed SNA to map knowledge networks on more than fifty organisations, Cross and Prusak (2002) recognised four categories of players in organisational setting, that could be categorised as: central connectors, boundary spanners, information brokers, and peripheral specialists who play predominant role in a network and are critical for organisational productivity. The boundary spanners connect their division with similar networks or other divisions of the organisation. The brokers keep different subgroups in a network together, any in action from these brokers will results in the disintegration of networks. Central connectors are the linking pins as they possess information on expertise level of most members in the network, which help them to get the tasks executed at a much faster pace. Peripheral specialists are the real experts who deliver valuable knowledge in a network. The major fact highlighted in the study is that all these players were not formal leaders in the organisation, but still they contributed to organisation at a greater level of intensity.

In 2004, Mueller-Prothmann and Finke, propounded SELaKT method, (Sustainable Expert Localisation and Knowledge Transfer), rooted in SNA. The study was carried out with an intent of understanding social relations on a organisational network. The SELaKT method adopted SNA Concepts such as degree, structural holes, bridges and hubs for identifying knowledge communities and the structure of intra- and inter-organisational knowledge flows

has deployed a questionnaire to understand a study on knowledge sharing pattern of global leaders. The respondents were thirty prominent leaders across the globe who were asked to participate in the survey. Questions like “whom they share information, such as documents and plans,” and with” whom they have informal discussions about work”, “the frequency of contacts” etc were asked and the data was

collected . Sociograms were generated on this information and was discussed with managers to identify the strength and weakness that are inherent in these networks. Helms (2006) has carried out a study that highlights the results of knowledge network analysis done in an engineering firm to understand the bottlenecks in an organisation which caused a block in smooth knowledge transfer among all the members of a network. The paper defines that there are two kinds of knowledge network which exist namely, knowledge pull network and knowledge push network. In this study, the author had elaborated about the application KNA technique by employing social network analysis measures. The analysis of the study depicts absence of learning relationships among people in an organisation, further it highlights the concept of clustering, centrality and brokerage roles. The paper concluded with the recommendations made by the authors to the firm regarding improvement in velocity of knowledge for people in different groups. They brought to light the importance of location in knowledge transfer. The paper also identified the vulnerable points of expertise which posed attrition risks. Recommendations were also made at level of individual actors.

In a study conducted by LNX Research (2007), social network analysis was deployed to find key opinion leaders who shares their opinion and information on the network. The study emphasises on various centrality measures like betweenness, centrality, closeness centrality and eigen vector centrality. The study concludes by stressing that the existence of key opinion leaders is pivotal in creation and sustenance of ideas in knowledge based communities. It also underlines that SNA is a unique tool which can evaluate such communities in total, their collaborative patterns and the key individuals in it, that neither surveys nor literature searches can reveal.

Many more recent studies which had exploited the potential of SNA for identifying knowledge flows in an organisation can be listed, but, as the former part of our study we had highlighted the fruitfulness and validity of SNA for mapping informal knowledge networks which has a huge influence on the success of a knowledge based organisation, the authors would like to move into the basic technicalities of social network analysis. In social network analysis networks are represented as graphs. These graphs are of two types: simple and directed. A directed graph indicates in a network indicates the relationships of people who are in quest of advice. A directed graph with two actors X and Y depicts a relationship, where the actor X will be looking for advice from the actor Y. In this case, Y does not approach X for an advice or solution. Hence, graphs representing these kind relations are directed and the arrows used indicate the direction of the relation. Simple graphs are used to represent relations that are of casual nature. A detailed analysis of these networks reveals that they are predominantly centered

around two concepts; knowledge actors and knowledge flows (Helms *et al.*, 2006). Similarly, knowledge area, concept proposed by Helms (2006) on his study is also considered. A knowledge area denotes a cluster of knowledge embedded in an organisation (Schreiber, Akkermans *et al.*, 2002) which it has accumulated from insights, experiences, theories, and heuristics over a period of time. A typical knowledge area in a pharmacy firm could be the quality control mechanism. It is worthwhile to mention that each knowledge area has a knowledge management mechanism of its own, which may influence the knowledge flow within it. The term 'Knowledge Actor', refers to individuals involved in exchange of knowledge on a particular knowledge area. The exchange of knowledge or any kind of value added information between two actors is referred to as knowledge flows (Hansen and Kautz, 2005). These concepts shall be revisited at a later stage in the study. The knowledge network analysis can be carried out through visual representations as well as by applying quantitative measures which we will be discussing in the subsequently part of our study .

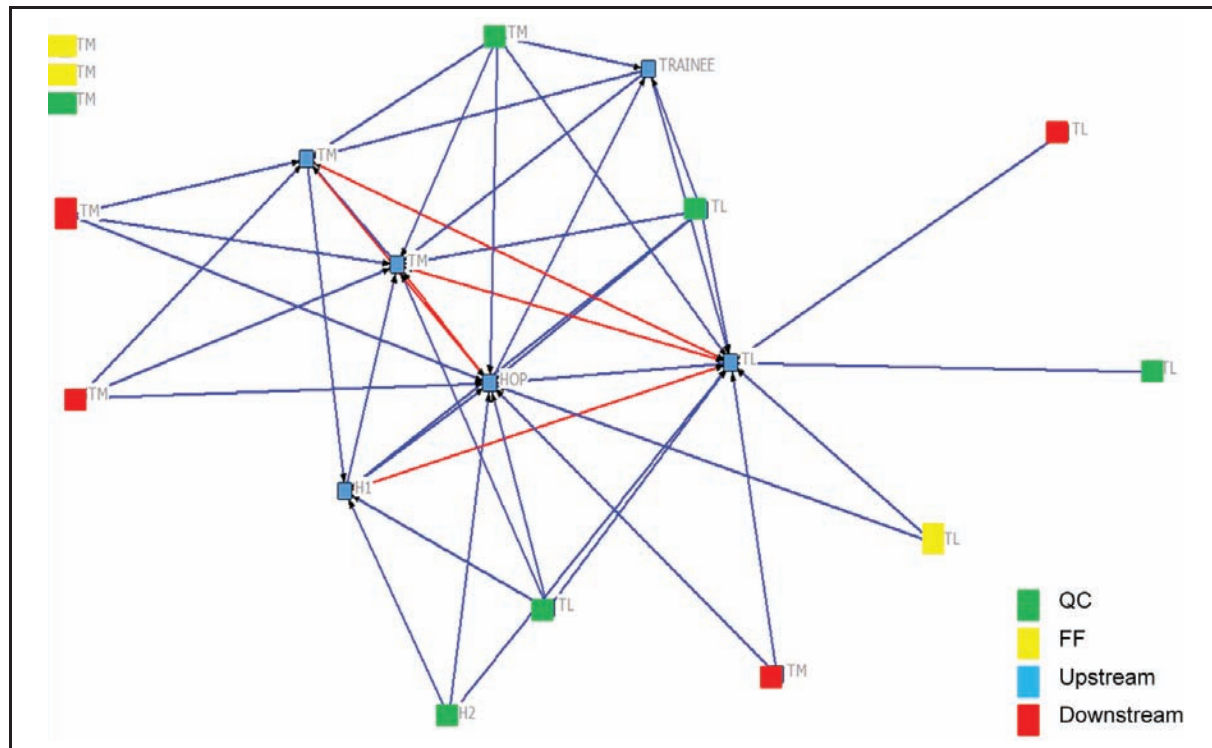
4. SNA FOR MAPPING KNOWLEDGE NETWORKS: A CASE STUDY FROM INDIA

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 particular 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 studied 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 is located at Hyderabad where the study conducted had 141 employees. In biologics, MGOF is one of the most important functions. It handles procurement, production, quality and packaging of the products. In biologics, there is a high level of interdependency present among the constituent functions. The dynamic and complex environment in which this pharma company is operating 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 of MGOF, it should take measures 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 an individual to accomplish anything of substance on their own. Hence, departing employees take away with them not only technical expertise but 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 main objective of this project is to recognize the key knowledge sharing actors in a particular function which would help in transfer and sustainable conservation of tacit knowledge and discoveries of opportunities to improve the communication network and efficiency. It would also help to strengthen boundary spanning knowledge exchange and to increase the informal inter organisational relationships. This in turn will result in better knowledge sharing and facilitates the improvement of organisational knowledge development aspects in an organisation.

The period of the study was from 27th April 2012 to 27th 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 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 (Spek *et al.*, 2002). These knowledge areas for mapping and gauging Knowledge creation and flow among the employees in MGOF were identified as - Upstream, Downstream, Fill Finish, and Quality Control. The employees associated with these knowledge areas are 110 in total.

The second phase was to identify knowledge actors who facilitate exchange of knowledge. Becerra-Fernandez *et al.* (2004) highlight various properties associated with knowledge actors such as knowledge role, expertise level, function. We had added one more set of attribute that is tenure of actor in the organisation (Reagans *et al.*, 2004). The knowledge actor's role can be as diverse as that of a

Figure 1: A demonstrative knowledge flow diagram

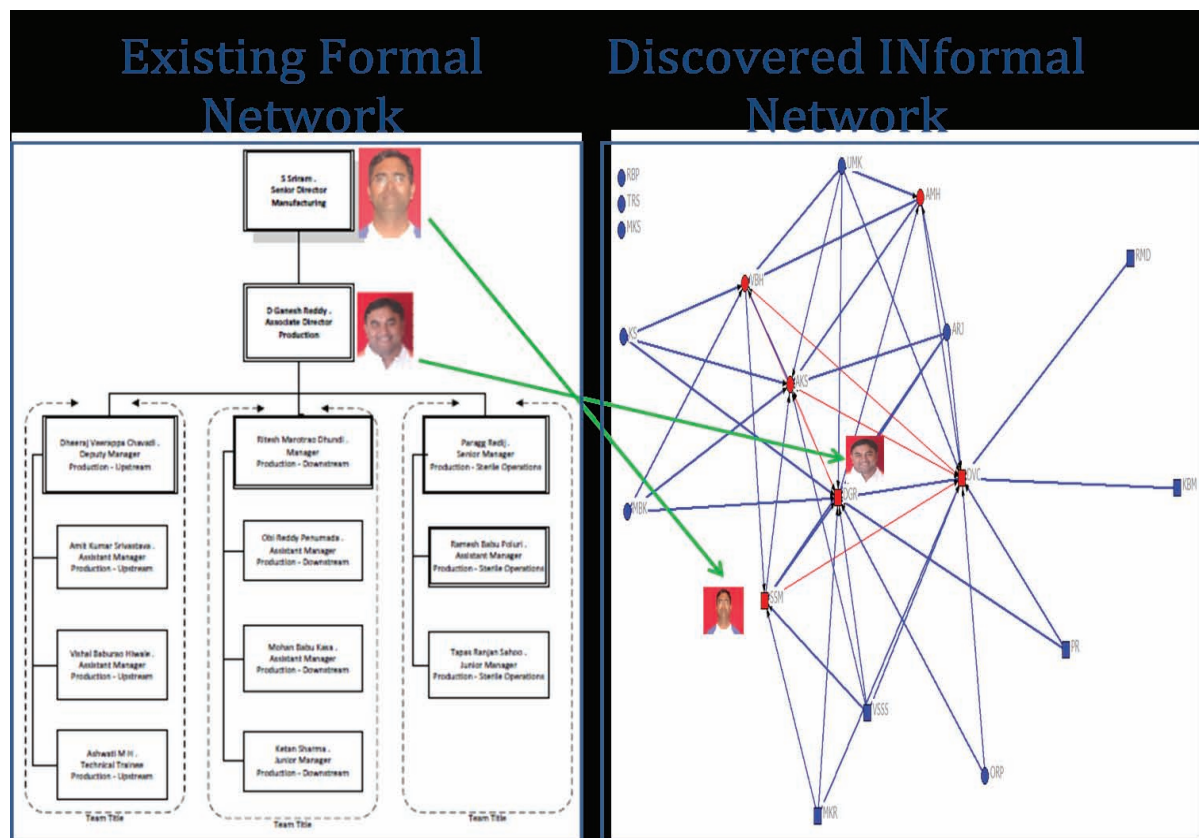
knowledge creator who contributes towards the construction of knowledge in a group; of a knowledge broker who facilitates sharing of knowledge, and of end user who applies the gained knowledge for solving/ improving his/ her work related process. The expertise attribute refers to the level or quality of knowledge possessed by an actor, empirical studies and past observations implies 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 *et al.*, 1996, Wasko and Faraj, 2005). For the sake of study, the actors were broadly classified as 'Expert' and 'Trainee', based on the level of knowledge they possess. The functional level of actors connotes the role or responsibility of an individual actor in the organisation. 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 are 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 one-on-one personal interview with each of the sample member, selected by 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 helps to understand how willing people are to share their ideas and how much is the organisation supporting them to voice their opinion. The interview revealed the gaps and the issues employee face due to delay in information flow or due to unavailability of appropriate information. By examining the response, authors were able to analyze the responses 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 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 one shown in Figure 1.

As it can be seen in Figure 1, the nodes represent the actors and the edges represent the knowledge flows. In the map,

Figure 2: Parallel knowledge network



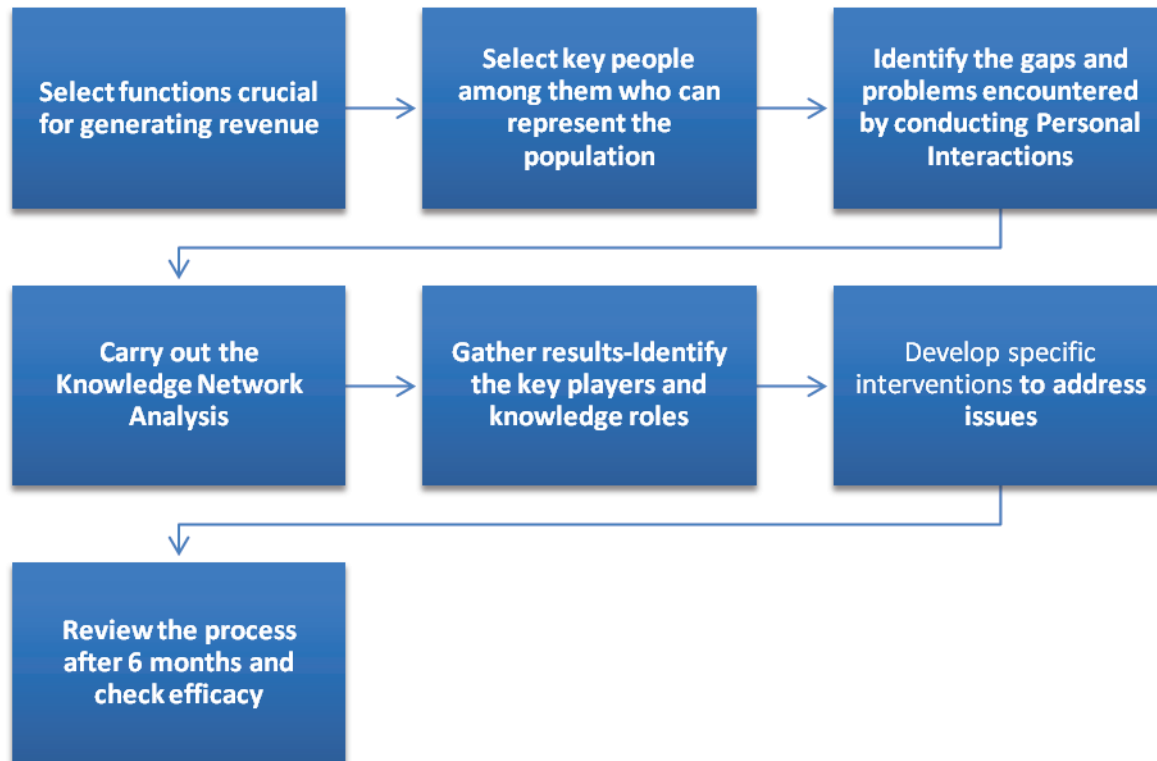
the nodes are colored according to the area they belong to. Also, the shapes of nodes are specified based on the attribute of expertise. While the actors who are currently in the higher role bands and are leaders are represented as boxes, the individual contributors and team members are represented as 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- in knowledge area level and in nodal level. The density was used as a measure the level of interactions on Knowledge area level (Wasserman *et al.*, 1994). The interaction levels will be higher on a high density network structures., also called as closure networks structures. Moreover, in a dense network structure within, the group members are more likely to demonstrate willingness to invest time, energy, and efforts in sharing knowledge (Reagans and McEvily, 2003) among the members, which results in enhancement of knowledge sharing efforts among the area members. At the nodal level, the measures such

as in/out-degree (Helms, 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/steward and 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, 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 organisation ,

Figure 3: Cycle suggested for Improvement in Knowledge management

as concluded from the literature which can be depicted in Figure 2.

Figure 4.1. Existing Formal Network Vs Discovered Parallel Knowledge network

The pattern of networks mapped on the basis of knowledge indicated a group of bridged networks existing in the organisation 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 and Van Buren, 1999, Reagans *et al.*, 2004).

Results of further analysis helped us to understand that there are few key players like in the case of Team Leader of Fill Finish, and 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 they will make sure that uniform distribution of information flow and network connections. It was also observed that there are three team managers from Upstream area who have limited interaction with other colleagues. An analysis of the in/out-degree data shows that neither they go to anyone to get information regarding upstream, nor they are approached by anyone regarding it. This implicates 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 takes 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 department. People are unaware about her knowledge skills. It was recommended that she has to 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 are mutual ties existing among the leaders of downstream, and share a very strong communication bond. This means that they are 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.

A copy of report and the slide presentation have been 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 QC. Further, a resource has been dedicated, each from the Human Resource Department and from Business Planning and Systems Department (Project Management Office). They have been given a copy of report of project, 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 cycle as shown in Figure 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 study helped us to identify and visualize the flow of tacit knowledge through informal networks in an organisation. The main objective of study to identify knowledge network using social network analysis and our study had proved that SNA is a very powerful tool that can be deployed for developing knowledge maps for an organisation. Further our study highlights the need for recognizing the role informal networks in organisational performance. The analyses helped in identifying the various levels of knowledge actors, such as knowledge creators, brokers and users, in different knowledge areas. The study enabled us to depict the pattern of knowledge flows and detect various bottlenecks in knowledge sharing. The analysis helped us in deriving pragmatic solutions for improving the effectiveness knowledge management practices of the organisation.

Although the case study provided valuable information about the application of knowledge network analysis, our study is also prone to some shortcomings that we will summarily discuss. The project has not considered personality types. Hence, solely providing recommendation based on the analysis may not be the right step. Secondly, the technique itself is consuming very much of time and hence the analysis was carried only on representative samples selected from the knowledge areas that contributes heavily to the business goals. Thirdly, the in/out-degree may not be

a suitable measure to classify the knowledge actors such as creators, brokers, and users. Even though this indicates that the person is having a certain degree of knowledge that may be of worth for many others, it does not ensure that these people are creating new knowledge. Hence it invites further research is needed on how to precisely classify the knowledge actors. Finally, respondents were allowed to indicate only about the people whom they approach for information. Other type of knowledge transfer which may happen in the organisation is not considered for our survey. Hence, further research is required in order to validate the Knowledge Network Analysis techniques.

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