Mapping the Knowledge Environment – Processes, Social Networks and Knowledge

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Abstract

Deciding on a strategy for knowledge management initiatives requires a detailed understanding of the knowledge environment of the organisation. Knowledge maps can provide a picture of what currently exists but must include what happens in the informal social networks. This research in progress describes the development of a methodology to elicit processes, social networks and knowledge types (codified, common, social and embedded) as a preliminary to any research or consulting project.

Keywords

Knowledge management, social network analysis, knowledge elicitation, action research.

INTRODUCTION

The interdisciplinary nature of knowledge management (KM) has spawned a bewildering array of approaches to both research practice and business application. The variations in research practice can be attributed to the diverse orientations towards the central concept of knowledge (Polanyi 1974; Berger and Luckmann 1967; Alavi and Leidner 2001), and the theories from many different disciplines that are used to explore and understand the implications of knowledge within organisations. Practitioners can choose to adopt implementation strategies that range across technology-based and human-centred approaches (Alavi and Leidner 2001; Earl 2001). However, the complexity of the core concept of knowledge and how it is embedded within organisational contexts can lead organisations to follow oversimplified prescriptions of the "how to" style without a strategy built on understanding either their unique knowledge environment or the theories that could guide them. Organisations are aware of the concept of KM and can see the benefits of undertaking KM initiatives, but they are unsure how to incorporate these ideas into their overall strategic plan (Earl 2001).

Such uncertainty is illustrated in the experience of a company with whom we spoke recently. The company had identified initiatives already in place that fitted the KM paradigm. Further, they had categorised them as explicit (intranet, document management systems, databases) and tacit (user groups, teleconferencing, staff rotation, social clubs). The next stage is to coalesce this patchwork of activities into a coherent KM strategy that can form the basis of the next round of initiatives. What they have already implemented 'seems' successful and sensible but does not guide them into the future because the choice of initiatives was not based on analysis of their particular knowledge environment. Choosing KM initiatives using a 'best practice' approach has worked so far but now they want a longer term KM strategy.

The design of KM strategies is greatly influenced by how existing organisational knowledge is conceived. While knowledge is long regarded as an exclusive domain of the experts, it can be argued that reservoirs of knowledge exist outside recognised experts (Wenger 1998). Such knowledge is embedded within the activities of everyday processes of the organisation, involving informal networks of roles, rules, relationships and communication. While most management would acknowledge the existence of such networks, few attempt to address them in their strategic planning. The reasons for this can be attributed to the difficulties in the identification of such networks and the embedded knowledge.

In this research, we believe that an effective KM strategy requires an evaluation of what employees know, who knows it, which knowledge can be leveraged, and what knowledge is missing or leaking. To achieve that, the whole knowledge environment of an organisation needs to be taken into account. This means taking into consideration knowledge that resides in both the formal and informal aspects of the organisation. In this paper we describe the development of a methodology for exploring the whole knowledge environment of an organisations using an action research framework. Our research team is particularly interested in devising ways

of unlocking knowledge that is embedded in social activities and the relationships of people involved in business processes.

This paper represents research in progress with the aim of developing a methodological approach to preliminary assessment of the knowledge environment of any organisational. The deliverables of our proposed methodology will provide the foundation for research studies into detailed theories and strategic planning activities for management.

FORMAL AND INFORMAL ORGANISATION NETWORKS

Organisations often adopt standard procedures to guide the behaviour of their members. These procedures typify the a priori structure that is set in place to effectuate organisational goals and objectives. They are formulated on the basis that organisational members should be guided by a same set of roles and principles that identifyan organisation as a single-purposed, single-minded social ecology (Drucker 1993). In other words, they represent the organisational espoused theories (Argyris and Schon 1978), interpretive scheme (Ranson, Hinings and Greenwood 1980); and organisational frame of reference (Shrivastava and Schneider 1984), and in essence, they form a formal network of hierarchies, relationships and roles containing mental and structural artefacts that have consequential effects on performance and activities of organisational members.

When codified, the espoused theories, interpretive schema and frames of reference represent the organisational knowledge or justified true beliefs of the organisation; and the knowledge that is embedded generally goes through a justification process that is essentially influenced by the dominant general management logic of the organisation (Prahalad and Bettis, 1986; von Krogh and Roos, 1995). Consequently, while organisational memory contains knowledge that is supposed to be relevant to a broader range of organisational members, it is nonetheless, formulated by a narrow range of people. If organisations are viewed as a collection of differing motives and interests (Corbett and Scarbrough 1992) derived from individually perceived meanings (Thompson and Walsham 2001), the effects of organisational memory within the formal network may not be as far reaching as the management would want.

In reality, the actual behaviour found within an organisation may or may not be congruent with the espoused theories of the organisation. Organisational members are often guided by a different set of principles from those are constituted through their engagement with their daily activities, which Argyris and Schon (1978) termed as the theories-in-practice. Bartlett (1932:21), for example, introduced the concept of the schema to encapsulate these principles as the cognitive heuristic of individuals that is grounded in their historical experiences. While this set of guiding principles and their subsequent actions are not inculcated into organisational formal network as such, they are considered to be pervasive and emerge as an important ingredient within the formation of a unrevealed informal network that is considered by many researchers as more influential than the formal network (Crampton et al. 1998; Davis 1953). Wenger (1998) refers to an informal network as a community-of-practice, that represents the sources of knowing within organisations (Pan and Leidner 2003). Thus, the acknowledgement and examination of informal networks has huge implication to the design of KM strategy and implementation.

KNOWLEDGE ACTIVITIES WITHIN INFORMAL NETWORKS

The ‘grapevine’ or ‘rumour’ is a major informal communication medium within an organisation. As the name suggests, the grapevine is entwined throughout the organisation with branches going in all directions. It facilitates the speed at which a rumour can spread. Rumours, once started, spread quickly and are often hard to stop (Crampton et al. 1998). Thus, grapevine is considered to offer an abundance of operating knowledge and disseminates important insights with great speed and economy (Crampton et al. 1998). The availability of such information and the efficacy of the grapevine are predicated on the key element of trust insomuch that some operating knowledge is simply assimilated as rituals passed on by trusted individuals. Ritual criteria for truth are commonplace in daily life. For example, Barley (1988) identified a variety of problem-solving routines used by radiological technicians that appear to be purely ritualistic, reflecting a blind faith that a given action has a beneficial consequence. The efficacy of such procedures needs not to be demonstrated; they are part of the common stock of knowledge because they are simply “what is done there” (Pentland 1995). Knowledge within informal networks can thus be seen as first and foremost, socially laden with trust; and secondly, knowledge in such instance cannot be conceived as static or centralised, but as having “emerged” from organisational daily activities (Orlikowski 2002; Tsoukas and Vladimirou 2001). These characteristics invariably strengthen into relationships that evolve into a variety of informal networks:

- An advice network configures around informal key problem-solvers or technical experts to provide operational knowledge, and

- Casual and task-related interactions develop into the general communications network, which guide information flow and resource use.

Based on consideration of the above informal networks, our objective is to develop a methodology, under the broad action research framework, which goes beyond the explicit/tacit split to incorporate specific processes and techniques for identifying and mapping knowledge that is embedded in social activities and relationships of people involved in business processes.

KNOWLEDGE ELICITATION, PROCESS AND SOCIAL NETWORK ANALYSIS IN INFORMAL NETWORK

In view of the social and dynamic representation of informal networks and the embedded knowledge presented in the previous section, we require techniques that will allow us to examine the complex informal relationships that the people involved (actors) have with one another when they carry out business processes, and to identify the knowledge that is embedded in this social structure. As a result, process-, social network- analysis (SNA) and knowledge elicitation become the key elements of our methodology.

The main purpose of process analysis is to gain an overview of how the business processes are carried out as a system, identifying the processing requirements, inputs and outputs and data that are stored and used (Satzinger, Jackson and Burd 2000). The appreciation of these elements can highlight the various crucial constructs of knowledge activities. For example, we can conceptualise the input/output elements of a process model to specify the procedural and structural connections of actors involved in knowledge activities. Data stores reflected in process model can also give us a preliminary indication to the sources of codified organisational knowledge.

Social network analysis is focused on uncovering the patterns of social interactions by mapping and measuring the relationships and flows among people, teams, departments or organisations (Cross et al. 2001). In relation to information systems, Social Network Analysis techniques have been applied in the study of the computer-mediated communication, diffusion of innovation, IS implementation, as well as, the study of the social influences of communications and information technologies (Hislop et al 1998; Zack 2000). In using process- and social network analysis- in our methodology, we will be able to map the informal network that carries out the business processes and identify the knowledge sources and flows.

Knowledge elicitation, on the other hand, is aimed at identifying and extracting knowledge from experts. It is a process that has been practiced many years across disciplines ranging from psychology to artificial intelligence. Thus, there is a wide range of knowledge elicitation techniques, reflecting different goals and paradigms of the diverse disciplines (Hoffman et al. 1995; Vennix et al. 1992). Knowledge elicitation techniques will complement social network analysis by exposing the types of knowledge that are embedded in the business processes.

In the synthesis of these constructs into a research framework, we use an action research approach to analyse and reflect more about the application of these techniques on which our methodology will be based.

METHODOLOGY DEVELOPMENT: AN ACTION RESEARCH

In response to calls to increase the relevance of IS research, action research has become a well-established research method in information systems. The central features of action research that contribute to it being a relevant research method have been summarised by Baskerville & Wood-Harper (1996, 1998) as:

- the researcher takes a participatory role, with expected benefits for both researcher and organization,
- each research social setting is different requiring findings to be interpreted in context
- the knowledge obtained can be immediately applied based on an explicit, clear conceptual framework,
- the research is viewed as a cyclical process linking theory with practical changes in the social setting

For our purposes, we see action research as both an end and a means. Our objective at this stage is to develop a set of techniques for mapping socially embedded knowledge that can be tailored to the specific requirements of individual organizations. These techniques would be applied in action research projects to help organizations develop KM strategies. In the course of these action research projects we aim to investigate and learn about the nature and process of knowledge that is socially embedded in organisational processes. As a means to this end, we use action research to analyse and reflect more about the application of the techniques on which our methodology will be based.

Although there are a variety of representations of the action research cycle, in practice action research involves the two stages of diagnosis and therapy. Checkland and Holwell (1998) suggest that the cycle of action research involves the researcher identifying a real world problem situation (A in Figure 1) which is of potential interest to their research themes. Before taking any action in the problem situation, the researcher needs to declare a

particular set of linked ideas (a theoretical framework F) and a methodology (M) that they are going to use to investigate the problem situation.

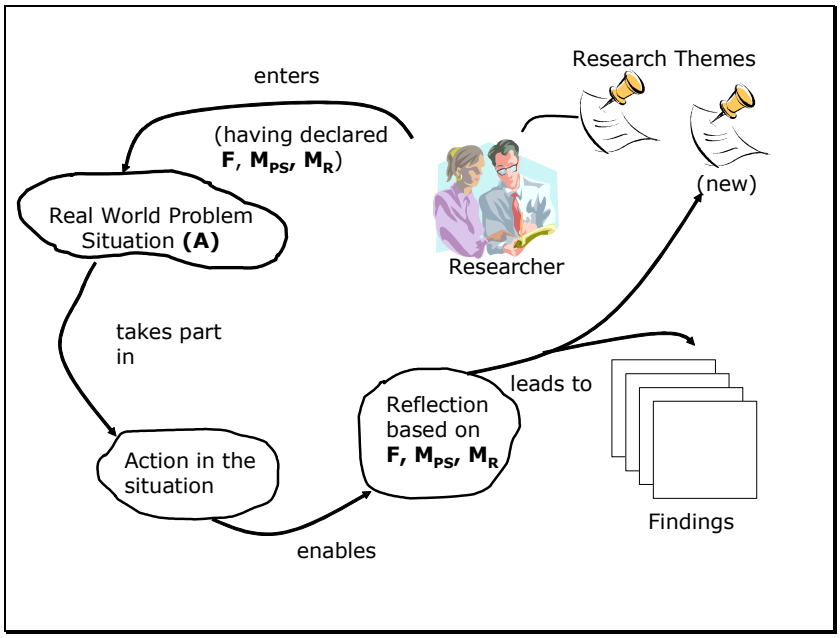

Figure 1: The Action Research Cycle (after Checkland 1998 and McKay & Marshall 1999)

Mckay and Marshall (1999) emphasise the dual cycle of interests being addressed in an action research project, namely the interests of the client or the problem situation and the interests of the researcher. Consequently they differentiate between the methodology for solving the problem situation (M_{PS}) and the methodology for conducting the research itself (M_R). This differentiation is of concern to us because our objective is to develop a methodology for helping organisations to unlock embedded knowledge (M_{PS}) while at the same time learning about embedded knowledge through taking part in knowledge mapping (M_R).

Furthermore, in developing the problem solving methodology we are using an action research cycle to develop and refine our methodological techniques. We are, in essence, conducting an action research project for future action research projects. To put this situation in terms of Figure 1, the findings of our current research project, will relate to the problem solving method (M_{PS}) of future projects. In the following sections we describe the learning cycles of the action research project that we have used to develop our problem solving method and explain the central features of our proposed methodology.

CASE DESCRIPTION

The methodology development effort was undertaken at the Business Information Technology Services (BITS) division in an Australian university. The main function of BITS is to provide computing support to the approximately 5000 students and 900 academic staff in the Business School. Considering the pervasiveness of information technologies in education, BITS' ability to maintain and support the students and staff in their daily tasks is considered to be critical the operation of the Business School.

BITS' operations are under the supervision of an IT manager who operates under the authority of the Head of Administration, and the advice of the IT policy committee that is made up by 9 academic staff nominated by their respective disciplines groups. The structure of BITS can be conceived in 3 tiers: two internal tiers and an external tier. The internal tiers are made up of the full-time and casual staff of BITS while the external tier consists of the network of software and hardware vendors that supply the information technology (IT) infrastructure components to BITS. Internal tiering is based on the level of expertise, thus we can think of tier 1 to include staff with peripheral computing support knowledge and tier 2 to include specialised IT staff that are domain-specific, e.g. Unix, networking, Macintosh etc. Throughout the duration of the research, tier 1 has 9 casual staff while tier 2 has 7 tenured or contracted staff.

The operating strategy adopted by BITS in fulfilling its role is to provide a single point of contact for staff and students with computing issues. Known as Help Desk, the point of contact represents the 'frontline' of BITS and seeks to resolve 80% of the issues and queries that go through them. The Help Desk is staffed by casual staff, who form the tier 1 support. Tier 1 staff are equipped with basic computing knowledge and by comparison, their efforts are not as knowledge intensive as tier 2 support, we reiterate that knowledge is *de facto* implicated in all

types of organisational work (Wenger 1998) and it is the identification and elicitation of such knowledge that drives and motivates this research.

The main role of the Help Desk can be summarised as:

- The provision of technical support to students and academic staff in a wide range of services including user accounts, application, hardware, printing, usage quota etc. and
- The information hub to BITS by redirecting special issues and queries to tier 2 support based on the nature and specifics of the issues and queries.

RESEARCH METHODOLOGY: THE FRAMEWORK

Our methodology (MR), illustrated in more details in Figure 2, is adapted from the knowledge elicitation procedure by Hoffman et al. (1995). A main feature of our methodology is the combination of process analysis, knowledge elicitation and social network analysis techniques to identify and extract knowledge embedded in formal business processes and the associated social networks. Another significant feature of our methodology, which results from our action research approach, is the central role of analysis and reflection after each phase.

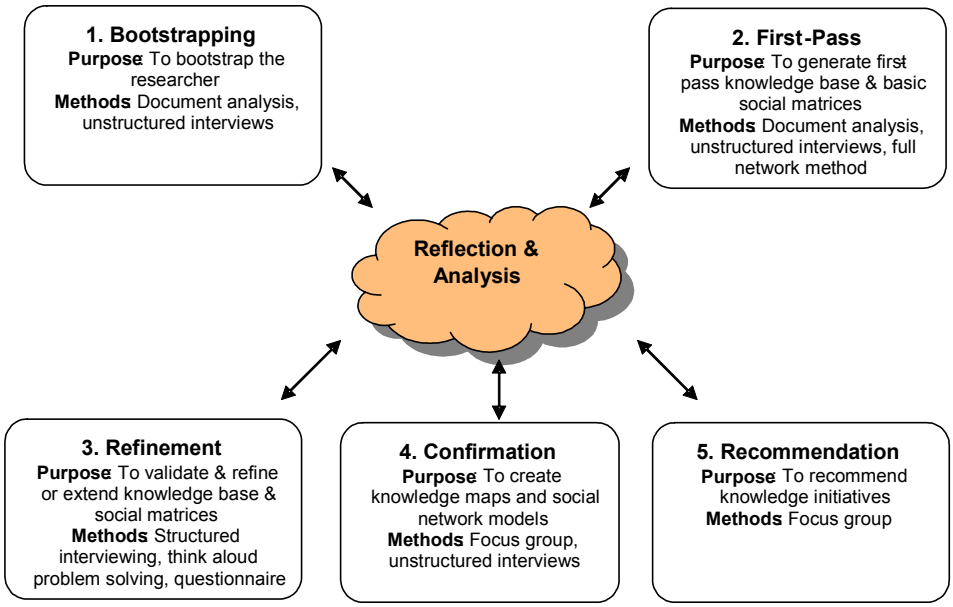

Figure 2: Phases of Methodology

In the following section, we will discuss the phases of the methodology as illustrated in Figure 2. For each completed phase, we will also discuss our learning from the analysis and reflection.

DEVELOPING METHODOLOGY: THE LEARNING CYCLES

Bootstrapping

The first phase of the methodology is the bootstrapping process. The aim of bootstrapping is to familiarise the researcher with the domain, which in this case is the computing support provided through the Help Desk in BITS. Document analysis and unstructured interviews were conducted with tier 1 and tier 2 staff to gain familiarity with the processes of providing computing support and a general idea of the ties each actor has with one another.

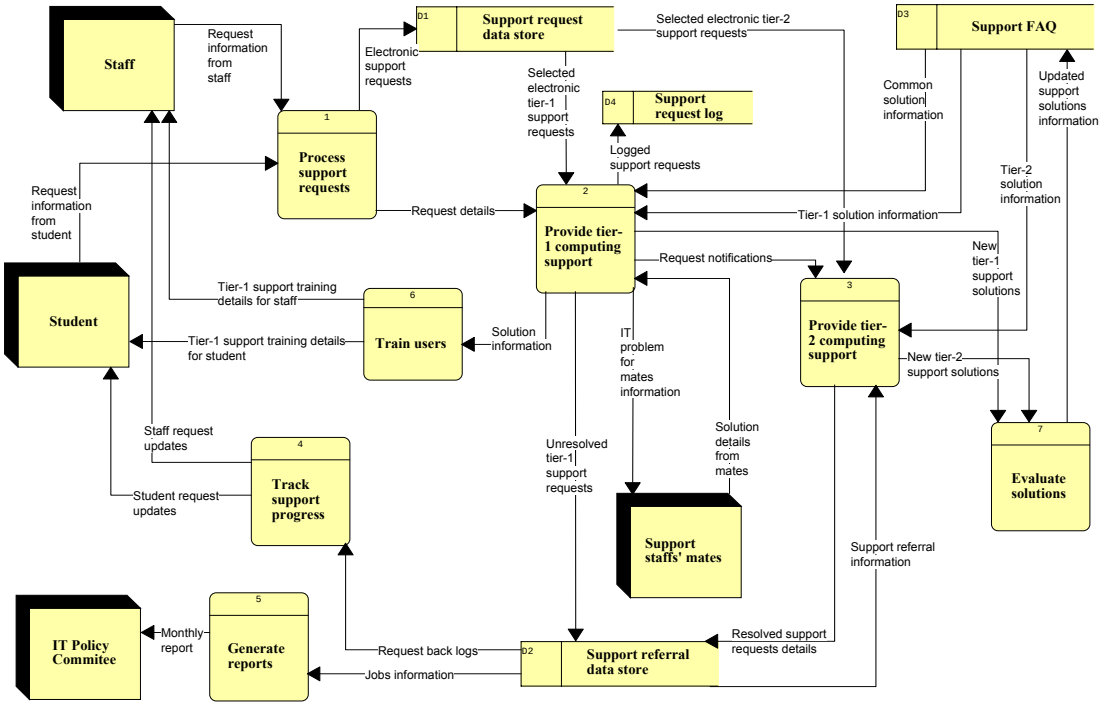

Figure 3: Data Flow Diagram of Computing Help Desk Support (Level 0)

Reflection & Analysis

Using the data, we developed data flow diagrams (Figure 3) as a logical representation of how the help desk provides computing support to the staff and students in BITS. The aim of generating this logical representation is to ensure we share a common understanding of how the help desk works. Through our analysis of the data flow diagrams, we gained insight into the codified knowledge utilised in this business process that we then used to structure our interviews in the second phase.

We also gained insight into the physical information technology (IT) infrastructure and the formal work roles and responsibilities. Such information may illuminate our analysis of the social structures at a later phase. As part of reflection, we reviewed our interviewing strategy so that we may gather the information that reveals more about the types of knowledge used and ties that the actors have with one another.

First Pass

The second phase of our methodology is aimed at generating a first-pass knowledge base and basic social matrices. A first-pass knowledge base refers to 'a meaningfully organised list of propositions that express many of the core concepts, the definitions of terms, and the procedural rules that are followed in the domain' (Hoffman et al. 1995). Social matrices contain network data that will provide a picture of the relations of the actors involved, i.e. their social structure. In order to get a full picture of how the actors are socially related to one another, we used the full network approach from social network analysis to find out each actor's ties with other actors. The techniques we used in this phase include document analyses, unstructured and semi-structured interviews.

Reflection & Analysis

With the data, we generated our first-pass knowledge base about the Help Desk, and basic friendship and advisory matrices. Analysing the first pass knowledge base, we detected the existence of knowledge other than the codified types that we have identified in the previous phase. This led us to develop a basic knowledge categorisation scheme to help us make out the types of knowledge that we have gathered.

Our knowledge categorisation scheme is adapted from a framework developed by Blumentritt and Johnston (1999), which classifies knowledge into the categories of codified, common, social and embodied. **Codified** knowledge refers to knowledge that has been made explicit through writing or other means of capturing that lead to a readily transferable form. Codified knowledge is often seen as being equivalent to information. **Common** knowledge is knowledge that is commonly accepted as standard, like in work routines, but not captured explicitly. **Social** knowledge refers to knowledge about interpersonal relationship and cultural issues

like knowing who has knowledge about a particular topic or problem. **Embodied** knowledge is in direct contrast to codified knowledge, consisting of the experience, background and skills a person has accumulated over the years. We see codified knowledge as residing at an organisational level, embodied knowledge at an individual level, and common and social knowledge as the gradual transition between the two.

As a result of applying the knowledge categorisation scheme, we became aware of the types of knowledge that we have not yet discovered fully. For instance, a few actors mentioned sharing knowledge about dealing with difficult users (in terms of their attitude towards the support staff), which we have omitted in this phase of data collection. Thus, by using the knowledge categorisation scheme, we were able to structure our strategy for the next phase of data collection. We foresee that this knowledge categorisation scheme will also be a useful tool at the recommendation phase when we present our findings to the organisation.

After categorising the knowledge we have identified, we created our first set of social network models, which relates people to types of knowledge. These models provided insight into the types of knowledge that each actor possesses, which will complement our knowledge maps at the recommendation phase.

Using the network data from the friendship and advisory matrices, we plotted our first set of knowledge maps that provide a pictorial representation of the social structure in BITS. Figure 4 shows an example of the knowledge maps we have produced. Visual analysis of the knowledge maps revealed ties between actors that need to further clarifications and possible ties that need to be explored, which we planned to do in the next phase.

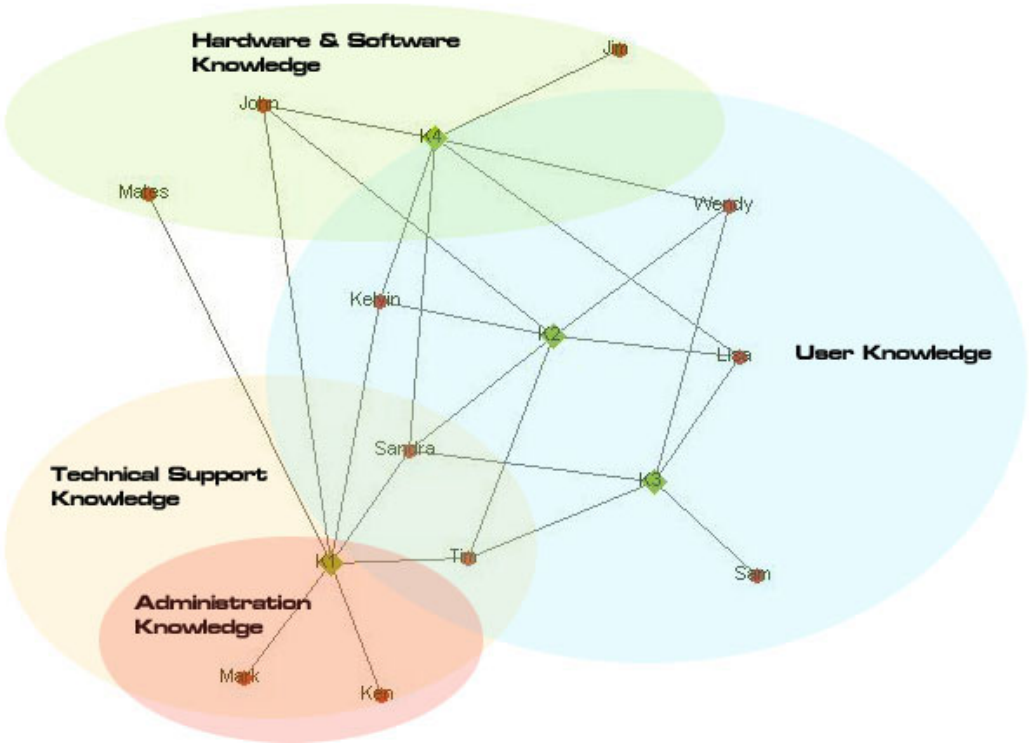

Figure 4: An Example of Knowledge Map – Social Network

Refinement

The third phase of our methodology is to refine and validate the first-pass knowledge base and the social matrices. From the analysis and reflection in the previous phase, we have determined the types of information we require from the actors. Thus, the techniques for this phase need to be more structured and focused. Hoffman et al. (1995) suggest using techniques like structured interviewing, tasks analysis and think-aloud problem solving to obtain more focused information to refine and validate the first-pass knowledge base. These techniques include using test cases so actors can work through their familiar tasks and reveal the knowledge they may utilise. In addition, we would also develop a questionnaire based on the data from the social matrices to clarify existing ties and explore possible relationships. The data collected from this phase will be used to refine the knowledge maps and social network models developed in the previous phase.

Confirmation and Recommendation

While in the previous phases of our methodology, our focus is on collecting data from the actors, the next two phases require the actors to play a more collaborative role. The aim of the confirmation phase is to validate the accuracy of the knowledge base and social matrices with the actors. This will involve presenting the knowledge maps and social network models we have refined in the previous phase and discussing them through with the actors in focus groups. Any details that may have been omitted will be collected mainly through unstructured interviews.

Once the accuracy of the knowledge maps and social network models is confirmed, we will proceed with our analysis to generate recommendations about appropriate knowledge initiatives for the organisation. Our analysis will utilise knowledge maps, social network models and the various representations of the formal business processes like data flow diagrams, the physical IT infrastructure and the organisational structure.

CONCLUSION

As the significance of Knowledge Management gains acceptance, companies must choose, from the plethora of techniques and theories, what will be most productive for their particular knowledge environment. We have argued that incorporating informal social structures will provide understanding beyond the explicit/tacit split.

We have presented a five-stage framework for elicitation of the processes, embedded knowledge and social networks that support a work system for IT services in an organisation. Our research in progress has completed the first two stages and we have been able to demonstrate data flow diagrams of the processes and a social structure map of actor interactions.

Reflection and analysis are intrinsic to the methodology for our research, which relies on feedback and refinement of our techniques for establishing the knowledge environment prior to future research or consulting activities. While we expect to make changes to our methodology during the remainder of this research we are confident that the approach will provide a valuable model for preliminary work on any KM project.

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