Overlaying Business Processes with Social Networks

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Certification

I hereby certify that the work in this thesis has not been submitted for a higher degree to any other university or institution.

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Abstract

Nowadays many companies have invested a large amount of money in information technology, especially in improving business processes. The decision to invest in information technology is made by top management who have requirements and expectations on IT. However, there are gaps in business processes between management's viewpoint and what really takes place. This is a significant gap valuable to examine because it can have a great impact on work effectiveness and productivity. Thus, we need to know how processes are different, we can interpret this difference, and how we can narrow these gaps. In order to examine the reality of business process, we employ Social Network Analysis which plays a role in capturing actual employee work processes. Through overlaying SNA with business processes, we can compare work process in reality with management's expectation, and this can help to determine the fit of tasks to people.

This research is being conducted at selected actual organizations through interviews and questionnaire surveys. Through this case study, we aim to determine if gaps in understanding of business processes exist, and if so analyse these gaps both qualitatively and quantitatively. This research may also provide recommendations on improving or re-designing business processes to narrow any gaps uncovered. Based on data from the real world, this study will propose explanations on currently issued social phenomena, re-illuminating human aspects of Business Process Management and providing foundations to be developed to a generalized theory.

Keywords: business processes, social networks, SNA, BPM, sociogram, sociomatrix, Petri-net

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Chapter 1 Introduction

1.1 Motivation

Information technology and information systems are parts of our life and the impact of these on our daily life are increasing. Also in organizations, use of information technology has developed, keeping up with technological developments. Many organizations have implemented information systems to support the execution of their business processes. Investments in information systems are decided by top managements who have requirements and expectations on them. What top management expects is that business processes implemented in information systems are well followed and fulfilled by its employees and that eventually work efficacy and efficiency are improved. Does the actual work happen as management expected? This question forms a starting point for this study. Since most idealised version of business processes, what management expects, can be different from the reality, and this gap can have a critical influence on work efficacy and efficiency, this is an important gap to try to examine. So, we need to see if the actual work follows the business processes set by management in order to help management to decide better the fit of tasks to people.

1.2 Aim and goal

Business processes are set in the form of policies and organizational procedures and represented by the models, which tend to be structured from the viewpoint of business process analysts or business process participants. However, no one can be sure that the actual work performed is according to this idealised version of business process models. In consequence, this study seeks to overlay idealised business process models with the actual working relationships of staff in practice. The purpose of the study is thus to determine how people work in practice, how management sees they work and then examine the 'gaps' between these two 'views' of work. Because this study is trailing new research approach, it is important to refine the techniques for overlaying business processes with social networks in this stage. So a goal of this study is to focus more on forging techniques for overlaps to determine gaps in the techniques adopted.

1.3 Research contribution

In order to see potential differences between idealised business processes and enacted version in real life, we adopt a couple of research approaches. One such approach is business process modelling which captures the work flows. Another is Social Network Analysis which illustrates the relationships staff have with one another. There is an important concept which can make these two approaches be connected, human aspect of business process, the working relationships between employees in an organization and the social networks these relationships

have created. With this connecting concept, we tried to overlay actual human relationships with 'official' working relationships. Through overlaying the two we gain some understanding of the matches and mismatches in work patterns. One outcome could be recommendations for improving work efficacy and productivity such as re-jigging work practices, changing who works with whom and so on. This combining research approach is very innovative and can contribute to a methodology in information systems research.

1.4 Thesis structure

This study is planned and conducted in a structured way. The next chapter covers the literature related to this topic such as Business Process Management and Social Network Analysis. In chapter three the general research epistemology or underlying frameworks will be introduced while chapter four will explain the methodologies of this study including both qualitative and quantitative methods such as case study, questionnaire survey, and so on. After that chapter five will introduce the organizations studied, starting with organizational theories such as structures, classifications of organizations and Mintzberg's framework. In this chapter the three specific case organisations are introduced. Chapter six presents the analysis of the Business Processes Management processes from the three case organizations. The results of the Social Network Analysis in the three case organizations are discussed in chapter seven. In chapter eight the overlaps between BPM and SNA, and gaps found in the processes are interpreted. Some recommendations with regard to gaps found are provided for improving business processes in the case organizations. Also issues raised during the study as well as limitations in this study are discussed here. Finally chapter nine provides a conclusive summary of the whole thesis.

Chapter 2 Literature Review

2.1 Introduction

The word "business" has a number of different meanings such as company, job, commerce, etc. and it is often used as a synonym of "work". Work also has many forms such as baking bread, building a house, making a car, and so on. Some of these works such as baking bread can be done individually, but normally many of these works are done by a group of people with the help of machines (van der Aalst, 2004). At the same time a group of people can be regarded as an organization when it is formed to achieve a certain goal (Daft, 2010). An organization has a structure or a hierarchy which establishes how work is allocated and how decisions are made (Mintzberg, 1983); usually there are some business units such as departments and teams which are grouped by roles and functions (Daft, 2010). In such business units, people work on tasks and there are processes or procedures to follow, which are called "business processes". Organizations model these business processes to work in a highly efficient way (van der Aalst, 2004).

Nowadays many companies have invested a large amount of money in information technology, especially in improving business processes (Berlingerio et al., 2009). There is much literature which deals with business processes and its related fields such as workflow, business process management, and so on. In this chapter, we start from "business process" and follow the theoretical development to related areas such as workflow and business process management. Then we deal with social network analysis which represents a lens from which to see the organization from a different view. Through this literature review, we begin to know contemporary issues in these fields of research.

2.2 Business process and workflow

First, we need to start by looking at the definition of business process. There have been some definitions of business processes, which have been discussed since the 1930's (Mendling 2008). Papazoglou (2003) described a business process as "a set of logically related tasks performed to achieve a well-defined business outcome" (p. 49). According to Becker and Kugeler (2003), a process is a sequence of activities and a business process is a special process that has business objectives of an organization. The business process can be dealt with as a lifecycle and acts as an important link to the external business partners of the company (Mendling 2008). There has been much research related to "business processes" and through such efforts, many concepts, ideas, approaches, and methods to deal with a business process have been developed so far.

By early 1970's, the focus and interest in the information systems area was on the automation of office work and the logic of business processes used to be hard-coded into applications, which were difficult to change (Mendling, 2008). Office automation helps the workers to do their job and does not have process knowledge to do so. As such the workers use applications in their work such as word processors for writing documents, drawing software for drawing pictures, spreadsheets for calculating, databases for filing, faxes for communication, and so on (van der Aalst, 2004).

From the late 1970's, the flow of information and the coordination of tasks have been controlled more explicitly through workflow concepts such as Petri-nets (Mendling, 2008). A workflow is an idea closely related to reengineering and automating business and information processes in an organization (Diimitrios, 1995). A workflow is not a business process itself, but is a model of business processes which abstract and represents business processes to easily understand and simplify the view of the complex reality. So, the modelling of business processes may therefore be represented through workflow modelling (Papazoglou & Ribbers 2006), in order to facilitate the coordination and integration of manual and automated processes into a cohesive whole (Deokar et al. 2008). A workflow may describe business process tasks at a conceptual level necessary for understanding, evaluating, and redesigning the business process (Diimitrios, 1995).

Figure 2.1 illustrates an example of workflow which deals with a loan application process. As mentioned earlier, a workflow is not a business process in and of itself - it is a conceptual level model of business processes, so the figure draws and expresses the loan application process in a simplified way. The first activity is 'collect info' which gathers data such as age, applied loan amount, annual income, and so on. There is a condition which checks if the amount applied is greater than $200,000 or not. If the condition is satisfied, then the loan application passes to the next activity which is 'request approval', otherwise it goes to the other activity - 'assess risk'. The remaining processes also flows in a same way as drawn in figure 2.1.
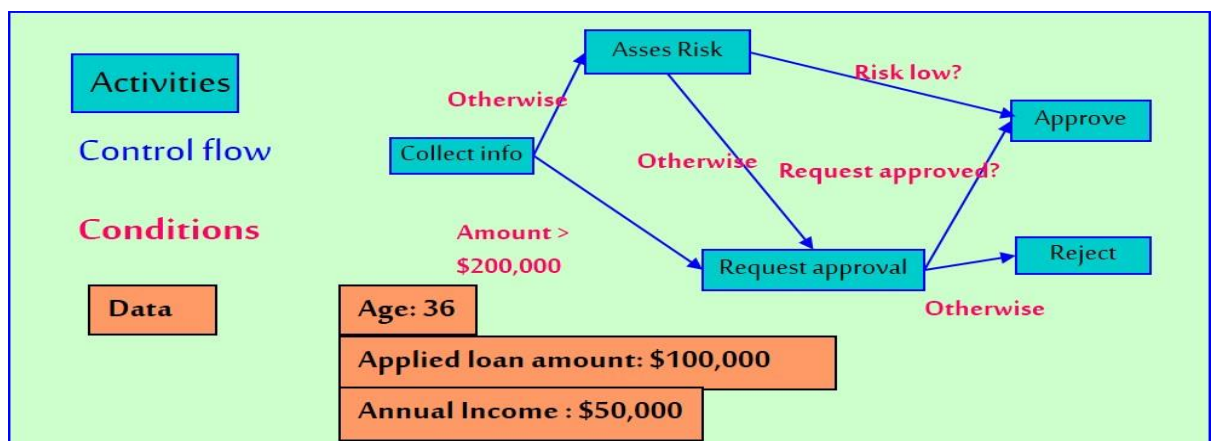
Figure 2.1 Example of a workflow

To manage business processes, a workflow is drawn and implemented in an information system, a so-called "workflow system". Workflow systems represent a series of connected interactions between people and IT systems of an enterprise, typically working towards the automation of a particular business process, supporting the necessary task, document, and information flow, governed in turn by a set of business rules (Caverlee et al., 2007; Stohr and Zhao, 2001). Accordingly, the key challenges to a workflow system or workflow management are implementing an efficient and effective information system of workflows and rapidly coping with the changes inherent in organizational transformation (Caverlee et al., 2007).

2.3. Business Process Management

Before the introduction of Business Process Management (BPM), Business Process Reengineering (BPR) re-designed business processes from basics. Although BPR was quickly diffused, organisations could not yield its potential promise (Huffman, 1997). Since BPR was trying to radically innovate business processes from a zero base, it has faced resistance and unwillingness to those changes BPR has brought; as such the new process view of organizations has not yet been fully realized. Many companies have integrated their core processes, combining related activities and cutting out those that don't add value, but only a few have fundamentally changed the way they manage their organizations (Hammer and Stanton, 1999). A general BPR framework is as shown in Figure 2.2. The procedure can be varied depending on the circumstances of an organization, but normally the sequence is the same (Mohapatra, 2013).
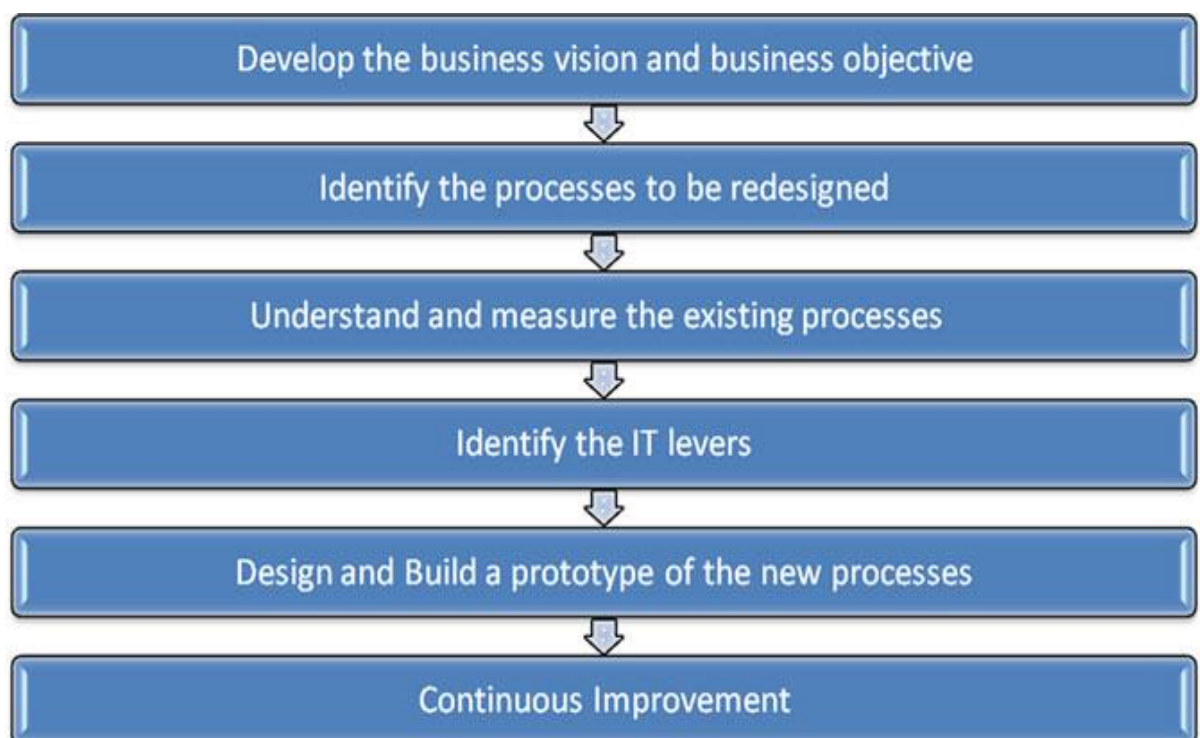
Figure 2.2 BPR Framework (Mohapatra, 2013, p.53)

Today, BPM incorporates insights from business administration, organization theory, computer science and information systems (Mendling, 2008).

2.3.1 Task related aspect of BPM

Different from BPR, BPM offers a definition for BPM as "... a customer-focused approach to the systematic management, measurement and improvement of all company processes" (Lee and Dale, 1998 p. 217). Business Process Management is all of the management activities regarding business processes and it also can be described as a lifecycle (Mendling, 2008). BPM has been defined many times in slightly different ways, which has raised the need to further a certain process or a number of processes, to make an organisation operate more efficiently (Carroll et al., 2010). For example Elzinga et al., (1995) state that BPM consists of "…systematic, structured approaches to analyse, improve, control, and manage processes with the aim of improving the quality of products and services" (p119). Zairi (1997) describes BPM as a systematic approach to analyse, design, implement and evaluate consistently primary activities such as operations, marketing, sales, logistics, services and other major activities of a company's operations. Business Process Management helps the organization to understand and make more effective and efficient workflows at the operational level (Ko, 2009).

Lee and Dale (1998) mentioned the 'value' of BPM in their case study as a method of "measuring the core processes, analysing what works and what doesn't and improving them" (p. 219). They also state three critical factors which are the keys in the success of BPM: (1) process discipline (correct and consistent application of business processes), (2) process improvement, and (3) cross-process integration. Successful BPM enables value-driven processes which make economic value while managing cost, quality and time parameters within business processes (Carroll et al., 2010); therefore BPM could be thought of as a tool which has a great potential (DeToro and McCabe, 1997).

Beginning with a strategic view of the organisation's operations, BPM provides processes as strategic assets in an organization that must be understood, managed and improved to deliver value-added products and services aligned with a customer's requirements. From a middle management perspective, BPM provides an approach to integrate "change capability" in an organization - both human and technological (Weske, 2007). Moving down to the operational level, the integration of technology and people constitutes the core processes of a business. These factors can add value to the organization if business constructs a fitting combination of processes and uses them to the best ends of business objectives; such processes should be simple and flexible. For example, the company may purchase excellent applications or facilities, however if the latter remain unused, the value of the technology will be very low. Alternatively

if the company hires skilled people without proper technological facilities, people will leave the business promptly. As a result of such factors, processes should create a good integration between technology and staff, and ideally the processes should be simple and changeable. Simple business processes are easy to follow and control, while flexible processes give the business an opportunity to upgrade, apply changes and improve their added values. To keep people, technology and business processes aligned together, business processes should be updated through business development and operation, i.e. business process management (BPM) is a method of consistent enhancement to fulfil and cope with operational changes of the organisation (Weske, 2007). The main purpose of BPM is thus to make an organisation's workflow more effective, efficient and better capable of adapting to ever-changing environments. What we have covered above are task related aspects of business processes but there is a human aspect as well in the business process. Now let us examine the human aspect of the business process.

2.3.2 Human aspect of BPM

There is much literature which deals with Business Process Management (Houy et al., 2010), but most of this is concerning technological and task related aspects. Recently however there have been some works undertaken on the human aspects of Business Process Management (Deokar et al., 2008; Fisher 2004; Magdaleno et al., 2008; Rosemann et al., 2006). Generally however overlaying actual human relationships with 'official' working relationships and furthermore the mapping to organisational structures is less well understood. This overlapping and mapping is very important because it can uncover gaps in processes between management's expectation and the reality, and ultimately can help to increase work efficacy and efficiency by narrowing gaps found. We define the human aspect of BPM as the working relationships between employees in the enterprise and the social networks these relationships have created. Analysing the impact of existing social networks in the organisation in turn supports business developers in designing, developing and implementing business processes more efficiently and effectively. Already as early as the 90s, O'Reilly (1991) had used five themes to explain such impacts from different aspects; these were motivation, leadership, job design, turnover/absenteeism and "work-related attitudes, such as job-specification, as affective evaluations about aspects of one's work environment" (p. 435). The highly-cited Social Network Analysis (SNA) researchers, Wasserman and Galaskiewicz (1994) added another theme, that of power. Employees may take on similar attitudes with whom they cooperate or to individuals who occupy the same positions in the social network. Finally, the value of examining activities of actors/employees is that we can examine the mapping of tasks to personnel at a relatively low level of granularity, asking questions of the relationship of staff

with their work processes, or of their working relationships with other colleagues. Figure 2.3 illustrates the overlay between BPM and SNA, which will provide a brief concept about what is being attempted in this research.
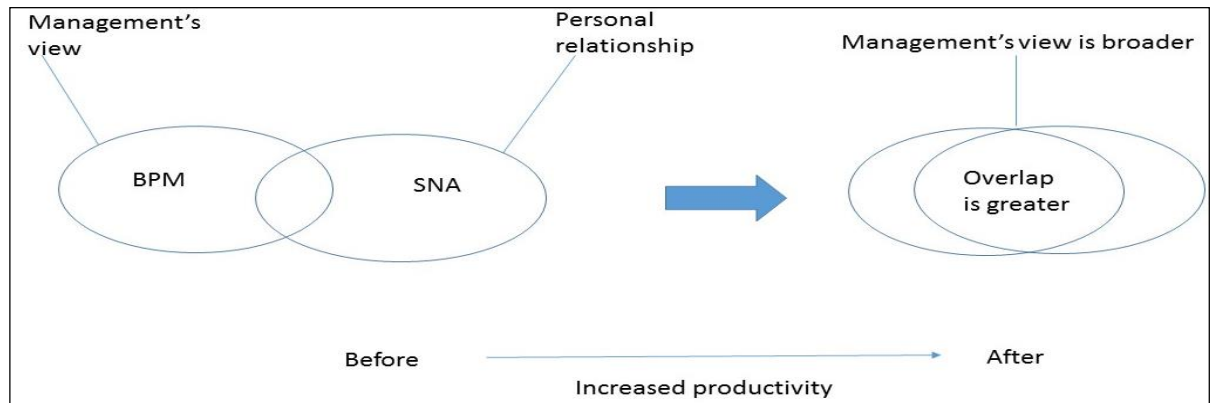
Figure 2.3 Overlaying BPM with SNA

As can be seen in figure2.3, BPM is predefined by the management view and there is a difference between management's viewpoint and actual work processes. This research is trying to overlay BPM with social networks and provide recommendations on the gaps found to help broaden management's view and make the overlaps greater. Eventually this will increase productivity and work efficacy in an organization. With these points in mind, let us now turn our attention towards a means of examining relationships through the lens of Social Network Analysis.

2.4 Social Network Analysis

Social Network Analysis was originally introduced by psychotherapist Jacob L. Moreno (1889 - 1974) in his studies of the relationship between social structures and psychological behaviour (Wasserman and Faust, 1994). Social Network Analysis has been widely used in the business administration area, especially in studies of organizational behaviour which often analyses informal communications in an organization. Formal communication routes can be shown in the organizational chart but informal communication paths are hidden so there has been a need to find and analyse informal communication networks, which is referred to as "social networks" in other terms.

We may define "Social Network Analysis as an established social science approach of studying human relations and social structures by disclosing the affinities, attraction and repulsions operating between persons, and between persons and objects" (Hassan, 2009, p. 64). Social Network Analysis (SNA) has been applied to various areas considering the length of time which it has been used. SNA is a technique and a tool of understanding social relationships between employees, but in the area of business process research, SNA has not been *greatly* used so far

(Keshishi and Busch, 2014). SNA provides the researcher with information showing what promotes or disturbs knowledge flows associating organisational units together which are interacting with each other; that is the "who knows whom, whom shares what information and knowledge with whom by what communication media" (Serrat, 2009 p. 2). There are several advantages to applying SNA to business. For example, to provide a more seamless customer service, customer calls and emails can be processed more effectively through a route which utilizes an internal social network in place (Bonchi et al., 2011). Also through applying SNA, we can discover and grasp the roles and jobs of workers which are not seen and not known to the general view of the management (Poltrock, 2009). Another advantage is SNA can be applied to improve workflow control mechanisms, which permits the structure, creation, management, and re-use of knowledge (Harrison-Broninski, 2010).

In addition, SNA is able to position the IS researcher externally to an organisation in an empirical research sense, rather than observing social networks in workplace through an interpretivist sense. What we are trying to say here is that the researcher can maintain a distance from the research or object being studied and theoretically remain more neutral or impartial as a researcher (positivism), rather than being fully embedded in the research or organisation - thereby affecting the research (interpretivism) (Neuman, 2006). However, just observing social networks in place is not meaningful, observations should be compared with the predefined business processes of management, that is to say the view that management in the firm has of processes. It is thus a very useful and meaningful approach to apply SNA into business processes, which helps us to understand current issues in Business Process Management. Overlaps of SNA and business processes can be an important technique in helping continuous improvement of business processes (Keshishi and Busch, 2014). This technique enables us to discover gaps between pre-defined business processes and actual processes, and to make a more suitable business processes with regard to how work is being conducted in reality, as opposed to how management views processes (van der Aalst and Song, 2004). According to Papazoglou and Ribbers (2006), workflow modelling is one ideal way of representing the work of employees and the structure of their information flow. If indeed there is a method to explain interpersonal relationships between employees in the workplace, we can merge workflow modelling and Social Network Analysis techniques to comparatively analyse the modelled workflow and real working processes. There are two kinds of mathematical tools in Social Network Analysis to represent information about the interactions and relations among actors - one is the sociomatrix and the other is the sociogram (Hanneman, 2005).

2.4.1 Sociomatrix

A sociomatrix represents the Social Network Analysis as a form of matrices. A matrix is a tabular array of numbers, which has rows and columns (Lang, 2002). Hanneman (2005) expresses this concept well, for "representing the information in this way also allows the application of mathematical and computer tools to summarize and find patterns. The most common form of matrix in Social Network Analysis is a very simple one composed of as many rows and columns as there are actors in the data set, and where the elements represent the ties between the actors" (p. 25). The sociomatrix data is the typically further represented using a sociogram. Table 2.1 provides such an example of a sociomatrix. It describes a "liking" relation among four actors. "1" means that an actor likes another, and "0" means that an actor doesn't like another (Hanneman, 2005).

	Bob	Carol	Ted	Alice
Bob	-	1	1	0
Carol	0	-	1	0
Ted	1	1	-	1
Alice	0	0	1	-

Table 2.1 Example of a sociomatrix

2.4.2 Sociogram

A sociogram is graphic representation of social networks that are composed of points or nodes to represent actors and lines or arcs to represent interpersonal relations in a group situation (Keshishi, and Busch, 2014). "When sociologists borrowed this way of graphing things from mathematicians, they re-named their graphs 'sociograms' " (Hanneman, 2005 p. 24). Graphs might represent a single type of relation or more than one type of relation among employees. Each tie between a pair of actors may be directed, or represent co-occurrence, co-presence or a bonded-tie. Social networks can be represented effectively and visually with a sociogram, however if there are too many actors or relations in a sociogram, then it may be too complex to draw and illustrate all relationships (Hanneman, 2005). Figure 2.4 illustrates a sociogram, which uses the same example from the sociomatrix in Table 2.1.
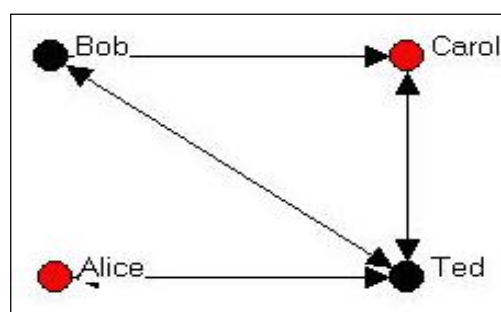
Figure 2.4 Example of sociogram

Other than sociomatrices and sociograms, other techniques exist in SNA as well. Let us examine those techniques in the following sections.

2.4.3 Centrality and power

Centrality and power are important concepts measured in SNA. There are three concepts which are used for measuring centrality or power: degree, closeness and betweenness (Hanneman, 2005). Degree means the ties an actor has with another (Busch, 2008). For example, in Figure 2.4 Ted has a degree of 3, whereas Bob and Carol respectively have a degree of 2, and Alice has a degree of 1. Closeness relates to the distance between actors. If an actor is at shortest distance or shortest path length from other actors, it means that the actor is at closest position, that is to say that actor has the most power (Hanneman, 2005). As such closeness is measured through the sum of the distance or the path length between actors (Scott, 1991). Betweenness means being between the other pair of actors (Hanneman, 2005). For example, in Figure 2.5, actor A can directly contact other actors but other actors contact each other through actor A.
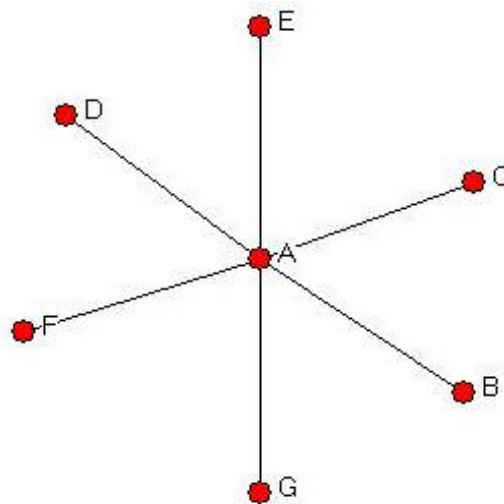
Figure 2.5 A "star" network

2.4.4 Density and Inclusiveness

Density means the proportion of the number of ties between actors to the maximum possible number of ties (Busch, 2008). It can be calculated where l is the number of links between actors, and n is the number of whole actors (Scott, 1991).

$$\frac{l}{n(n-1)/2}$$

For example, in Figure 2.5, the number of links between actors is 6, and the number of all actors is 7. So the density is approximately 0.29. Inclusiveness means the proportion of the number of linked actors to the number of all actors in the network (Busch, 2008). For example, in Figure 2.5, the number of linked actors is 7, and the number of whole actors in the network is also 7, therefore inclusiveness stands at 1, meaning all actors are included.

2.4.5 Cliques

A clique is a sub-group of a network in which all actors are directly linked to one another (Scott, 1991). There can many sub-groups in an organization which are formed according to age, gender, race, ethnicity, religion, and so on (Hanneman, 2005). These cliques have important meaning in analysing the behaviour of human groups (Higgins, 2000). However, the original concept of the clique is too strict to be used for certain purposes (Hanneman, 2005). As such normally scholars use an N-clique instead, where N stands for the maximum length of path for actors to connect to each other (Busch, 2008). For example if n is 3, any actor in the network can be connected within 2 other actors. The techniques we have reviewed so far are very useful for this research, however, SNA techniques are regarded as less formal because their major parts are graphical (Keshishi and Busch, 2014), thus we have some reason to examine more formal methodologies, one such approach being "Petri-nets".

2.5 Petri-Nets

Petri Nets are a formal and well-defined graphic tool for specification, analysis and modelling of processes (Aloini et al., 2012). A classic petri net is composed of places and transitions, which are drawn as circles and rectangles respectively (van der Aalst, 2004). Petri nets have been extended in many ways, which can provide the researcher with a formal means of modelling workflows. A workflow net is a particular class of Petri net, and may include 3 tuples (P, T, F). P is a place, which means a condition; T is a transition, which means tasks; where a token is a workflow status of a single case; finally F is a flow relation between P and T (van der Aalst 1998). A similar approach using the XML Process Definition Language (XPDL) to draw business processes formally is also known, where the fundamental components are activities, transitions, and participants (Delias, 2011). A framework of workflow based social network discovery and analysis was in turn developed to produce software for automatic transformation from workflows to SNA (Song et al., 2010). Figure 2.6 illustrates an example of a Petri net, which deals with an insurance claim.
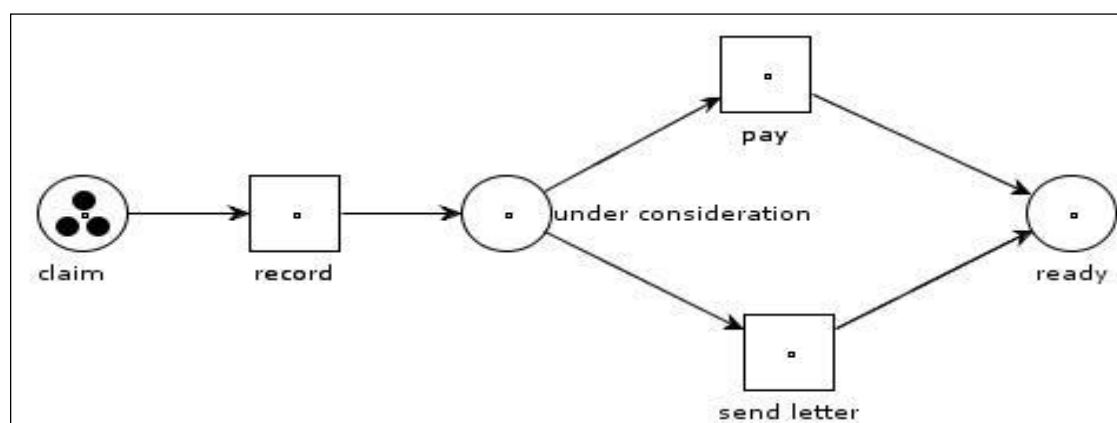
Figure 2.6 Example of Petri net

There exist three places (claim, under consideration, and ready) and three transitions being record, pay, and send letter. As can be seen in Figure 2.6, there are three tokens (black dots) in the claim place. These tokens are distributed amongst the places, indicating the current status of the Petri net (van der Aalst, 2004).

This approach is relevant for what we are attempting to do, that is representing business processes from management's viewpoint. A petri net is formal tool and it provides a precise definition on the process (van der Aalst, 2004). So a petri net is easily analysed and appropriate for formally diagramming business processes which is why we use this tool to model business processes visually.

2.6 Prior work

We have reviewed the literature and the flow of knowledge in the related field of business processes. We have identified likely gaps in business processes between management's viewpoint and what really takes place. The concept of finding gaps with SNA was already introduced in some other papers. According to Carroll et al. (2010), through SNA, we can determine the real connections and interactions among employees in business processes, and whether business processes are well undertaken or not. Normally SNA data can be acquired through interviews and questionnaires, but there is another means for collecting data to find a gap in processes, which is gathering data from the system such as event logs which records workflow events (Bonchi et al., 2011). The latter is often called business process mining and represents a more convenient way of gathering data if we can have access to the event logs (van der Aalst et al., 2007). However the business process mining concept assumes all events are recorded in an information system. Since there can be some activities which were not logged in the system, this can be a limitation in business process mining (van der Aalst, 2005). As such it is better to add other data collection techniques in business process mining approaches to obtain more accurate results. Also prior researches undertaken so far are mostly business process mining and no interviews or questionnaires are added in these researches. Keshishi and Busch (2014) introduced the concept of overlaying business processes with SNA but they used a hypothetical organization to explain this concept. So, now it is time to gather and analyze real data from interviews and questionnaire surveys. That is why this research is necessary and valuable.

2.7 Summary

This chapter started with the word 'business' and proceeded to describe theoretical developments of business process. As shown in the literature so far, large efforts have been

made for improving business processes to increase work efficacy and productivity through information technology. There was also some recognition of the human aspect of BPM and some literature has indeed incorporated the SNA aspect in to BPM. It is important to understand both management and employee points of view when approaching the business processes of an organization. However, there is still little research on overlaying business processes with social networks in real organizations, thus this research tries to provide some evidence from real case sites based on the theoretical background and related works reviewed so far. Now it is necessary to think about how this research will be conducted, namely the research approach. However, before we talk about a concrete research methodology, some discussion on the research epistemology is prudent as the latter will inform the former.

Chapter 3 Research Epistemology

3.1 Introduction

The academic discipline of information systems falls within social science, which explores and explains social phenomena (Recker, 2013). Thus research in information systems also follows a social science research method, that is the 'scientific research method'. However people from outside the social sciences tend only to think of the natural sciences as a science (Neuman, 2006). As such what is science, and where is the science in social science? To answer such questions, this chapter examines what science means in case of the social sciences. There also has been long and lasting debate about the meaning of science (Mills, 1959). So we need to have a look at the history of discussions in this area to understand the argumentation on this topic so far, for this in turn can provide robust foundations and frameworks on research methodologies and epistemologies. Without robust research methodologies, no research can build good theory and cannot stand alone. In this context it is very important to understand the background, history, theoretical development and current issues in research methodology and epistemologies.

3.2 Background

This study belongs to the field of information systems which broadly lies within the social sciences. So, this thesis follows a scientific research methodology which is widely used in the social sciences. There are mainly quantitative and qualitative methods. These scientific methodologies are associated and based on research epistemologies. So, it is very important and meaningful to understand current issues, arguments and directions regarding research epistemologies in the social sciences, which will provide a robust scientific basis and guidelines for rigor in information systems research.

By the early 1800s, only some scholars in philosophy and religious study researched human behaviour in the form of armchair theory (Neuman, 2006). After that the classical theorists made a large contribution to the development of social sciences when they insisted that social phenomena could be researched using science. At this stage we need to examine the definition of science. Recker (2013) defined science as "the attempt to derive knowledge from facts through certain methods in a systematic and organized way" (p.11). Similar to this definition, the classical theorists believed that strict, organized examination of social phenomena, in combination with elaborated, reasonable thinking would be able to comprise scientific research and discover a novel and worthwhile knowledge governing human behaviour (Neuman, 2006); this is the social sciences which is associated with the study of humans or groups of people

(Recker, 2013). When the concept of this social science was accepted, the next questions were "what are the features of the social science?" and "how is it performed ?" (Neuman, 2006). To answer these questions, some scholars followed the natural science model so they included components related to the natural sciences such as independent and dependent variables, statistics, mathematical propositions, and so on (Lee & Hubona, 2009). This type of research approach is normally referred to as 'positivism'. There can be three main research approaches, which are positivist, interpretive, and critical, according to Chua's (1986) classification of research epistemology. Positivism is a systematic method to find out reality such as causal relationships, which can be generalized by empirical verification (Neuman, 2006). Many researchers adopted this approach, but some scholars argued there were certain flaws in this approach, namely human beings exist at the centre of social science as an object of research, where human beings should be approached differently from the object of research as given in the natural sciences (Neuman, 2006). This sort of thinking has the view that the object of study in a social science should be qualitatively approached and subjectively interpreted with the socio-historic context (Recker, 2013). This type of research approach is normally called 'interpretive approach'. The major goal of interpretive research is empathetic understanding of people's daily life experience in specific historical settings (Neuman, 2006). Many qualitative researches are associated with the interpretive approach because interpretation of data forms the core of qualitative methods (Recker, 2013). However, qualitative research may not be an interpretive one if researcher's philosophical suppositions are not interpretive (Myers, 1997). According to Klein and Myers (1999), there are some key principles for conducting interpretive research, which are hermeneutic circle, contextualization, interaction between the researchers and the subjects, abstraction and generalization, dialogical reasoning, multiple interpretations, and suspicion.

There have been long debates on the epistemologies of social science among philosophers and social researchers. Another major epistemology is critical social science. Critical social science recognizes that people's ability to change their circumstances is restrained by many kinds of social, cultural and political dominance (Myers and Avison, 2002). In the 1960s social science started to be re-evaluated and many debates refined these three research epistemologies (Neuman, 2006). However, there exists still much debate and controversy on research epistemologies and methodologies, especially in information systems research. Let us now examine the state of the art in this area, starting by conceptually distinguishing the three major epistemologies.

3.3 State of the Art

Neuman (2006) presented a framework which arranged the suppositions and principles of the approaches into answers to ten questions. Table 3.1 presents these ten questions.

No.	Questions
1	What is the ultimate purpose of conducting social scientific research?
2	What is the fundamental nature of social reality?
3	What is the basic nature of human beings?
4	What is the view on human agency (free will, volition, and rationality)?
5	What is the relationship between science and common sense?
6	What constitutes an explanation or theory of social reality?
7	How does one determine whether an explanation is true or false?
8	What does good evidence or factual information look like?
9	What is the relevance or use of social scientific knowledge?
10	Where do socio-political values enter into science?

Table 3.1 Neuman (2006, p.81)'s 10 questions

With the answers to these ten questions, each approach can be clearly compared to each other and distinguished. First of all let us examine the answers of the positivist approach. First, the ultimate goal of social research is to find out and explain universal causal laws of social phenomena (Neuman, 2006). Second, the basic nature of social reality is empirically evident: it exists in reality and is waiting to be discovered (Mulkay, 1979). Third, the basic nature of human beings is rational thinking and individualistic behaviour. Fourth, the view on human agency takes a deterministic stance. The positivist approach focuses on the impacts of social variables on individuals or groups (Neuman, 2006). Fifth, scientific knowledge is different from and considered better than other forms of knowledge. Sixth, explanation in a positivist approach is based on general causal laws and practices deductive reasoning. Seven, explanations can be determined to be true or false through replication by other researchers. Eight, good evidence should be able to being communicated and shared by others, which is called inter-subjectivity. Nine, social scientific knowledge is used as a tool to improve the social environment and achieve people's goals, which is called instrumental orientation. Finally, a positivist approach is performed in an objective way and free from socio-political values.

Let us now examine the interpretive approach with these ten questions. First, the ultimate goal of social research is to understand social life and meaning in context. Second, interpretive approach has a constructionist view that social processes such as social interaction and people's beliefs determine reality. Third, the basic nature of human being is social interaction, creation and reinforcement of shared meaning. Fourth, the view on the human agency in interpretive approaches is that human behaviours are based on subjective selections and reasons of individuals, which is referred to as 'voluntarism'. Fifth, science is different from common sense but is not superior to all other knowledge. Sixth, explanation in interpretive approaches is

inductive, an in-depth description or symbolic representation, but has limited abstraction about social situations and settings. Seventh, an explanation is true if it is understandable to the people being researched and if it permits other people to look and feel the reality of the people being researched (Neuman, 2006). Smart (1976) refers to this last point as the 'postulate of adequacy', meaning that theories should make sense to the people being researched. Eighth, good scientific evidence or factual information is contingent upon and context specific, and often requires bracketing – meaning it is limited in its generalizability. Ninth, interpretive approaches takes a practical orientation in which people apply knowledge in their daily life. The relevance of social scientific knowledge is from its ability to reflect how people have things in common situations. Finally, in an interpretive approach researchers need to sympathize with and analyze the socio-political values of those they research. So, social science should be relativistic with regard to a value position.

Finally let us examine the critical social science approach through these ten questions. First, the ultimate purpose of critical science is to disclose what is concealed in order to free people from feelings or conditions that make their life unhappy and to permit people more control over their own life or situation. Second, the fundamental nature of social reality is stated using a realist orientation that assumes reality has several layers and that what is observed on surface layer does not easily uncover important structures or causal mechanisms at deeper layers. Third, human beings have unrealized potential and are misled by reification: they are rational and formed by social structures and creative beings that build meaning and social structures. Fourth, the view on human agency is bounded autonomy, which supposes human behaviour is determined thorough subjective selections and reasons but those have boundaries or limits. Fifth, science is not perfect but it can find out something wrong and false in common sense. We can see the viewpoint of critical social science on common sense in Sayer's (1992) words - "common sense tends to naturalize social phenomena and to assume that what is, must be. A social science which builds uncritically on common sense … reproduces these errors" (p. 43). Sixth, explanatory critiques are built through abduction which means repeated re-evaluations of ideas and data are based on applying alternative frameworks or schemes and learning from each. Seventh, theories are tested through applying it into real practice and results of this application are used to modify the theory. Eighth, all evidence can be interpreted differently depending on theory and some theories uncover deeper sorts of fact. Ninth, reflexive-dialectic orientation which is subjective and objective are mixed is adopted toward knowledge: the knowledge is used to provide a basis for engaging in actions that may make people's living conditions better. Finally social reality and the research of it indispensably possesses a moral-political dimensions: so social science demands scholars commit to a value position.

So far we have looked at what the major three research epistemologies are and how they differ. Let us now examine recent issues and discussions on these epistemologies, especially controversies from an information systems research between positivist and interpretive approaches.

3.4 Positivist vs. Interpretive

Among these three research approaches, most ongoing social research is conducted with positivist and interpretive approaches (Neuman, 2006); these two epistemologies are associated with different research methodologies and techniques, which are quantitative and qualitative. Qualitative research normally uses the interpretive approach (Neuman, 2006) and has been developed especially in the social sciences to help scholars research social and cultural phenomena. Examples include case study research, action research and grounded theory amongst others (Recker, 2013). In information systems research, qualitative research has been regarded to be no less valid than quantitative research (Markus, 1997). However, qualitative or interpretive research has occupied a minority position in debates for over a hundred years (Neuman, 2006). One of the main reasons for this is because qualitative or interpretive research depends on the researcher's intuition and subjective interpretation. Also the case study - one of the major methods in interpretive approach normally deals with only a small number of cases. Even if data are analyzed properly and the results are meaningful, it is just for a single case or a few cases. Statistically it is not meaningful since sample size is not enough, so it cannot be generalized and is not suitable to explain causal relationships. Furthermore some positivist social researchers consider it not fully scientific (Neuman, 2006).

Then, what of the positivist approach? Is it so perfect? Are there defects? Positivist social science is broadly held to be the same as science (Neuman, 2006) - it copied and followed the method of the natural sciences; however, there is a controversy on what the meaning of science is, even in the natural sciences (Neuman, 2006). Also, definitions and measurements in the natural sciences are not always accurate (Recker, 2013). In the social sciences accuracy via the positivist approach is not a given. Quantitative methods in the positivist approach deals with numeric data but much such data was not originally numeric. Examples measured numerically include methods such as the Likert scale. As such even in the positivist approach social phenomena as well as measurements can be vague, inaccurate, non-deterministic, and ambiguous (Recker, 2013).

3.5 Epistemological decision in this study

Even if there have been long controversies and debates on social science epistemologies and

methodologies, it is not so important to decide which epistemology or methodology is better. More importantly these long debates and issues give some lessons over how social science research should be conducted. Both positivist and interpretive approaches have their own strengths and weaknesses. It is an idea to mix both together to provide insights not solely available from one side alone. This sort of perspective in critical social science approach is called reflexive-dialectic orientation; this perspective considers positivist's external, empirical reality and the internal, subjective reality of the interpretive approach as two parts of a single unified whole which is being developed and evolved. So, we do not have to treat positivist and interpretive approaches as being opposites. Also there is no unique, perfect approach to social science research; each of three approaches alone is incomplete, not perfect. In other words, it means that the foundation for social science research is not concretely fixed yet and is still developing and evolving through debates and arguments. Therefore we may choose to mix research approaches which are best suited for the research purpose at hand.

Among the epistemologies discussed so far, many parts of this research tried to use the interpretive approach because we are attempting to understand social phenomena such as management's viewpoint, social networks in an organization, and then overlap the two. Klein and Myers (1999) presented seven principles of interpretive research but these principles are not rules of conduct. So, this research did not strictly abide by these principles but tried to include as much as possible. Most parts of data gathered in this research are text based data such as documents, interview data, and so on. So, they are qualitative and need to be interpreted subjectively. This study is not trying to derive or explain causal relationships. Even if there are some quantitative data used in SNA, they are not for generalization of a theory in this stage. They are also used as a whole to understand and interpret how real work is being undertaken. So, interpretive approach is better and suitable for this research purpose.

3.6 Summary

Social sciences have some different research approaches in terms of how we come to know. These approaches start from different supposition about the reason for research and the nature of social phenomena. This chapter introduced three major research approaches which are positivist, interpretive, and critical social science. These approaches give different answers to basic questions about how and why social researches are conducted. Thus in this chapter, we framed different research approaches with ten basic questions and examine the debates and discussions among scholars from each side of these approaches. We cannot say which one is better or best but we can know and understand the strengths, weaknesses, and issues of each research approach. Both rigor and relevance especially in information systems research, may

be better achieved through involving these approaches. The next chapter will focus on the research methodologies.

Chapter 4 Research Methodology

4.1 Introduction

Through a literature review in chapter 2, concepts of Workflow, Business Process Management and Social Network Analysis were introduced; these are beneficial for understanding the nature of the phenomena to review prior research on related domains. Also some research questions were derived during the literature review which were: "are there gaps between pre-defined business processes and actual business processes? and how are they different?", also "how can we interpret these differences?" An outcome for management to consider is "how can we narrow these gaps?" This research tries to answer these questions through well-known but suitable research methodologies. As we have seen in the previous chapter, this research is mainly based on interpretive research epistemologies but there are two types of research methodology in this research - one is qualitative the other is quantitative. This research tries to mix both qualitative and quantitative methodologies, and in so doing adopts a "mixed methodology". Several methods and techniques using this mixed approach are used to collect and analyze data which includes interviews, a questionnaire survey, collecting and analyzing related documents, and so on. Let us explore these approaches in a little detail.

4.2 Qualitative research method

Qualitative methods deal with textual data in the form of words, sentences, pictures, symbols, impressions, and so on rather than numerical data (Neuman, 2006). Such text based data have records of what people have said, thought, done, experienced, etc. through data collection techniques such as interviews, questionnaires, observations, documentation and so on (Recker, 2013). Qualitative research normally uses the interpretive approach (Neuman, 2006) and has been developed especially in the social sciences to help researchers study social and cultural phenomena. Examples include case study research, action research, and grounded theory, amongst others (Recker, 2013). In this research, a case study is conducted on the business processes in an organization as a qualitative research method. All case studies are not qualitative research, which means some case studies use a quantitative approach (Neuman, 2006). Both qualitative research and case study can be conducted with any research epistemologies (Klein and Myers, 1999). However "almost all qualitative research seeks to construct representations based on in-depth, detailed knowledge of cases" (Ragin, 1994 p. 92). Through a case study, this research can see and understand the viewpoint of management for a certain business process. Much of the limited research in this space is theoretical, as such this research tries to examine actual information from a real case site.

4.2.1 Case study

The case study is a research method that investigates in depth a large amount of features and information about very small sets or cases for one period of time or over multiple periods of time (Neuman, 2006). The case study uses the logic of analysis and often explains a causal relationship about how general social entities form and produce results in a specific setting (Walton, 1992). Case studies are thought of as useful especially in the applied social sciences where the goal of the research is to present tools for practical purposes (Gummesson, 1991). Case studies are more desirable in providing learning opportunities rather than in confirming hard theory (Flyvbjerg, 2001). Case studies are helpful in linking the small scope, or the action of individual people to the large scope, or organizational behaviors and process (Vaughan, 1992). The information gathered in a case study is usually more specific, fuller, deeper, and varied (Neuman, 2006). Case studies also rely on multiple sources of evidence, where data needs to converge in a triangulated fashion (Recker, 2013), meaning observing something from different angles or points of view to increase correctness (Neuman, 2006).

The research process for case studies varies depending on the case, the phenomenon, or other restrictions, but generally speaking, case studies follow a linear and iterative process as shown in Figure 4.1.
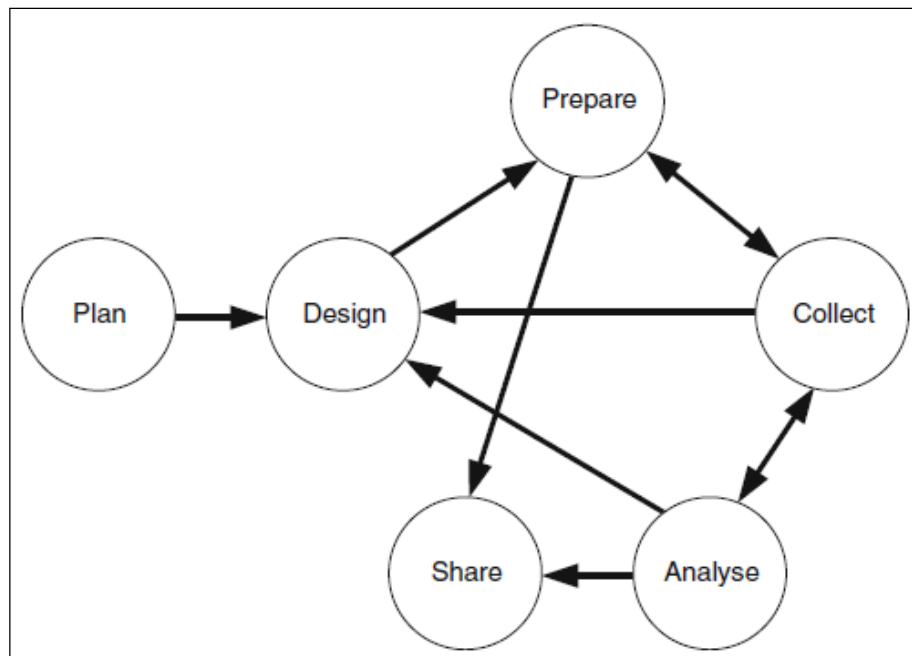
Figure 4.1 Case research procedure (source: figure 5.9 in Recker, 2013, p.96)

First, a rough case study plan was made to determine which organizations need to be contacted as case sites. The whole case study plan made in this research is included in Appendix A. Second, interview questions and questionnaires were designed as a draft. In this design phase, the unit of analysis was determined. That is, one process in the context of a selected organization is the

unit of analysis. Third, the manager or business participants of case organizations were contacted and the meetings for interview were arranged. Fourth, initial data and feedback on the research plan were gathered through interview and meeting. Such feedback was used to improve and update the research design such as using a questionnaire. Steps taken to prepare, collect, analyze, and design were continuously repeated to refine and finalize this research. Another step we cannot omit in this research process was the research ethics application (not shown in the figure). This step is part of the 'prepare' stage in the research process. This process is mandatory if a research involves the participation of humans or animals. The plan of this research was reviewed and approved by a research ethics committee at Macquarie University.

Case selections were based on the principle that a case organization should have clearly defined business processes, rules and procedures, explicit organization structures, well managed documents, and so on. Also it was preferred if employees have understandings on business process, workflow, information systems, and so on, because interviews and questionnaires in this research include those concepts. This selection criteria was met by IT departments in a university, so case selections were made.

The case study approach also employs a variety of techniques to collect data. Among those techniques, this study uses interviews, documentations, and a questionnaire. All kinds of internal and external documents relevant to the unit of research were gathered and used as a data source. For the interviews managers of some functional units within an organization were interviewed to determine the idealised business process models. The interview questions were as follows:

1) What kind of jobs does this department handle? What are the roles and responsibilities?
2) How many people work in this department? Please tell me their names.
3) Do you have an organizational chart? or are there some sub-divisions or teams? Please explain.
4) What are the major business processes in this department? Please explain one of them in detail.
5) Can I have a job description for each position?
6) Do you use an information system to manage business processes?

   6a) What is it? Does that system provide a view of business processes?

As may be guessed in the interview questions, the interviewees were asked some documents such as a job description, an organization chart, and a view of business processes. However, all

documents asked were not collected in some organizations. So, only available documents were used in the analysis. An organization chart was used in mapping actual social relationships to organizational structures. A view of business processes, a workflow, was used in business process analysis. A job description was gathered to interpret business processes in more detail.

Also, a questionnaire was used as a tool of a mixed methodology, which contains both numerical data and text data. Numerical data are used in quantitative analysis, whereas text data are analyzed by qualitative techniques. The questionnaire used in this research is included in the appendix A. The main difference between interview and questionnaire in this research is the purpose of its use. Namely, interview is used to get the idealized version of business process and questionnaire is used to know what actual working relationship is. Another difference is that interview is conducted with the managers or business participants who know and can explain the idealised version of business process whereas questionnaire survey is conducted with the employees. So, data gathered from interviews will be compared with the data gathered from questionnaire surveys to see if there are differences, which eventually answer the research questions.

4.2.2 Data analysis

Data gathered through interviews, documentation, and questionnaires were analyzed through techniques such as coding, memoing, and so on. Coding is one of the most popular techniques to help researchers convert a large amount of data into useful information (Recker, 2013). Coding is allocating tags or labels as units of meaning to the descriptive or inferential information (Miles and Huberman, 1994). Memoing is also used as a data analysis technique, which is a subjective comment about what was being done at the time of data collection (Recker, 2013). Analysis of text based qualitative data is visually presented in the form of maps or diagrams showing how ideas are related (Neuman, 2006). In this research, the results of data analysis were used to derive and draw an organizational structure and predefined business processes from the viewpoint of management. The business processes were drawn in the form of Petri-Net, which enabled us to understand how certain business processes were handled.

4.3 Quantitative research method

Quantitative methods describe a set of techniques to answer research questions with an emphasis on quantitative data (Recker, 2013). As mentioned earlier, this research is not purely quantitative so did not use the whole quantitative research process. For example, this research does not include conceptualization, operationalization of constructs, model development, validity of measurement, etc. A survey with questionnaire and experiments are the main

examples of quantitative methods. In this research, a survey with a questionnaire will be conducted for employees in an organization. This survey produces numerical data so it is analyzed by quantitative methods.

4.3.1 Survey research

Generally survey research is used for at least three purposes, these being exploration, description, or explanation (Recker, 2013). The purpose of this survey is to find out about the situation, attitudes, or behaviors in a social network that are occurring in real business processes. Normally quantitative research uses random sampling where samples are extracted randomly from a larger population (Recker, 2013). However, this survey does not use random sampling because it is different from purely quantitative research. This survey is mixed with a qualitative research so that one approach may inform another. In other words, this survey is conducted for the employees in the chosen case site so it forms part of the case study. All possible employees pertaining to a specific business process were surveyed.

4.3.2 Data analysis

Data gathered through questionnaire survey was analyzed through Social Network Analysis, which produced sociograms and matrices. The latter techniques enabled us to visualise centrality, density, inclusiveness, and cliques through analyzing the degree, closeness, betweenness, and so on, which in turn helped us understand the phenomena of social relationships in an organization. We wished to understand meaningful ideas and recommendations for an organization, such as who represent the focal points in the social network, where a bottleneck may exist in business processes, why there may potentially be a gap in business processes between management's viewpoint and what really takes place.

4.4 Summary

In this chapter both qualitative and quantitative research methodologies were introduced briefly and we talked about how this research is conducted. Although this research adopts a mixed methodology, the major parts of this research are conducted based on an interpretive research approach with a qualitative methodology. Case studies were conducted in some organizations to see if there was a 'match' or 'mismatch' between business processes and Social Network Analysis. Quantitative methodologies were also used to analyze numerical data from the questionnaire survey. Detailed methods and techniques for data gathering and analysis are refined and developed further through an iterative research process. In the next chapter we delve into the case organizations through this methodology.

Chapter 5 Organizations

5.1 Introduction

In this chapter, the focus is on organizations. In some organizations theories need to be introduced to understand the social phenomena taking place. Organizations are deliberately designed social entities composed of people and their interactions among them, to achieve a certain goal (Daft, 2010). Normally, an organization means a company but it does not have to be a whole company. In other words, a department in a company can be regarded as an organization. In this chapter, we examine the organizations in which this research is applied. Organizational structure is mainly described because it is designed by the management so management's viewpoints on the purpose of a certain organization can be understood through it. Organizational structure will be used in comparing actual social relationships with management's expectations. As mentioned in Chapter 4, case sampling was tried based on the selection criteria but final selection was decided and confirmed by the acceptance of participating organizations. So, finally three functional units of the same university became case studies. Again let's call each functional unit 'an organization' here because each functional unit is a unit of analysis, and the process chosen to be analysed in a unit is different from those of other units, even if they all share the same wider organizational context. Also, the interviewees are the managers of each functional unit, not a director, top manager, or CIO of a whole organization. This research was not performed on longitudinal basis so it represents a one-time 'snapshot' at each organization. One organization is an IT department of a university library, and the others are faculty IT service branches in the same university. Before we look further at these three organizations, we need to review some knowledge about organization theory and design such as Mintzberg's (1991a, b, c, d, e; 1983) typology. Thenceforth the three organizations in this research will be described in more detail. In the conclusion of this chapter the three organizations are laid and analysed through Mintzberg's framework.

5.2 Organization structure

As mentioned in the previous section, an organization has a deliberately designed structure. According to Daft (2010)'s definition of organization structure, an organization undertakes official reporting routines, decides how many levels are built in the hierarchy, and defines how many employees are controlled by the manager. Child (1984) defined an organization structure as the design of a system to ensure effectiveness in communication, coordination, and consolidation of endeavours across departments. Generally an organizational structure is divided into three such forms - being functional, project and matrix (Schwalbe, 2011). A

functional structure is most common in normal organizations, which means literally grouping people who perform similar functions such as marketing, finance, information technology, and so on (Daft, 2010). A project organizational structure has project based management and reporting structures so each program or project manager reports to the CEO (Schwalbe, 2011). A matrix structure is a grouping with two or more foci such as function and project (Nadler & Tushman, 1988). The employees in this structure need to report to both managers, which means dual authority and brings about reduced unity of command (Mintzberg, 1983). Nowadays many companies apply and utilize these major structures to varying degrees in their organizations (Schwalbe, 2011). Let us now examine how organizations are configured.

5.3 The organization in five parts

An organization essentially comprises parts and how these parts interact with each other. Mintzberg (1983) provided an organizational structure as illustrated in figure 5.1.
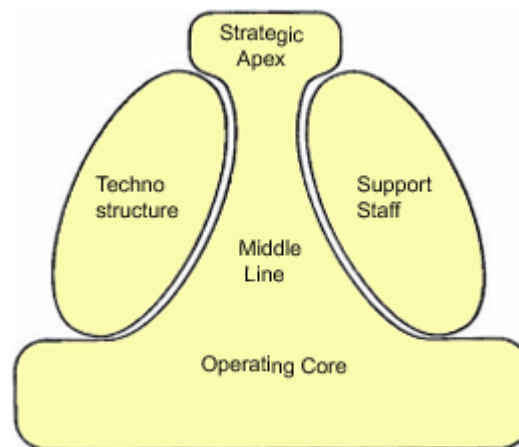
Figure 5.1 The five basic parts of the organization (source: Mintzberg, 1983 p.11)

Mintzberg's framework is widely recognised. We also use this framework as a tool with which we can look into and analyse the case organizations. As can be seen at the bottom of the figure, there is an operating core which consists of the basic tasks of providing products or services. In the case of a university, the operating core could be academics or faculties, which undertake teaching and learning as well as conduct research. At the top of the figure we find a strategic apex, which are the people in charge of managing and directing the overall organization such as the president, board of directors, the chief executive officer, or any top level management (Mintzberg, 1983). In the case of a university, this strategic apex would be a vice-chancellor, deputy vice-chancellors and so on. This strategic apex has a role in making sure that organization performs its mission well and that it satisfies the requirements of people who have control or power in the organization (Mintzberg, 1983). There is also a middle line between the strategic apex and the operating core. This middle line is a chain which connects the strategic apex to the operating core (Mintzberg, 1983). In small organizations, the chief executive officer

or other manager can manage all staff members, so there may be no middle line in that organization. In the university context this is likely to be represented by deans of faculties and heads of departments. One the left of the figure exists a technostructure. The technostructure represents people who analyse and standardize other people's work in the organization (Mintzberg, 1983). In the university context these would be committees creating and maintaining learning and teaching policies as well as committees aiding and overseeing research output. One the right of the figure are the support staff. As the term suggests, such staff support the organization (Mintzberg, 1983), such as payroll, public relations, the mailroom, security, IT and so forth. The library in a university could also be a part of the support staff, so this research examines three organizations which are part of the support staff in Mintzberg's structure.

5.4 Classification of organizations

There were furthermore largely 5 kinds of organisations categorized by Mintzberg: being those of entrepreneurial, machine, diversified, professional and innovative firm. The *entrepreneurial firm* (Mintzberg, 1991b) has a small number of staff and the management structure is generally flat (Busch, 2008). This type of firm is suitable to dynamic circumstances since it is concise and flexible to adapt itself to and cope with environmental changes rapidly (Daft, 2010). The *machine organisation* (Mintzberg, 1991c) typically undertakes routine work and standardization, which means that business processes are simple and easy to be standardized. In this kind of organization a middle line (Mintzberg, 1983) is well structured and it facilitates formal communication (Busch, 2008). This type of organization includes competent technical and administrative staff such as engineers, market investigators, and business analysts to examine, standardize, and formalize business in a mass production environment (Daft, 2010). The *diversified company* (Mintzberg, 1991d) is a modernized organization which has headquarters with some subdivisions; this type of organization appears as the size of organization grows and subdivisions thus specialize in certain fields (Busch, 2008). Typically this organization has few top management and support staff, whereas a larger administrative and technical group supports the subdivisions (Daft, 2010). The *professional bureaucracy* (Mintzberg, 1991a) usually undertakes knowledge-intensive processes through its highly qualified staff who were educated at university. This type of organization provides knowledge based services or products even if these are inclined to be relatively standardized (Busch, 2008), and has small number of technical support staff since professionals comprise the largest component of the whole organization, and there exist a lot of administrative support staff to support and process the 'paperwork' (Daft, 2010). Finally the *innovative firm* (Mintzberg, 1991e) or *operating adhocracy* (Mintzberg, 1983) features high technology, or it often represents

exclusively specialized products. Project based intensive work and teams are another characteristic of this type of organization (Busch, 2008). The five basic parts of this type are mixed together and there are often many overlapping teams (Daft, 2010). An example of the innovative firm would be Ditto Motion (http://www.dittomotion.com) - a Korean company specializing in producing motion pictures and motion graphic design. Ditto Motion is working wholly based on projects ordered by customers. It has a very flexible structure to meet the needs of each project. Teams of Ditto motion are composed dynamically and temporarily for the project to be undertaken. Once a project is completed, the team for that project can be disbanded and the human resources from that team can become available for composing another team for other projects. Let us now examine the organizations in this research, which will be labelled A, B, and C for reasons of anonymity.

5.5 Organization A

Organization A is an IT department of a library at a university. There are 10 people in this organization including a manager. This organization mainly provides IT services to the library and users of the library. This organization is divided in to two parts. One is the IT operations team which has seven employees including one IT operations manager. The other is the design and development part which has two senior systems analysts. The organizational structure of this department may be seen in Figure 5.2 below.
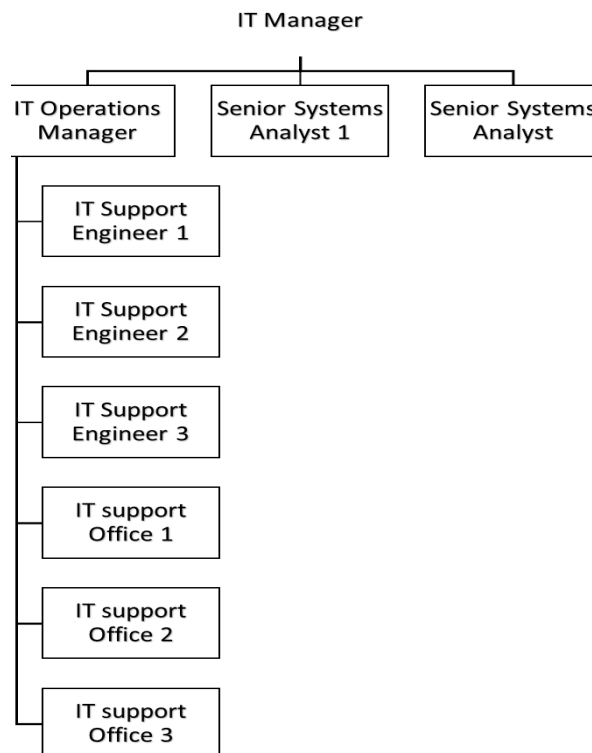
Figure 5.2 Organizational structure of Organization A

5.6 Organization B

Organization B is an IT service department of a faculty at the same university. There are eleven staff including a manager of this department. This organization provides IT services to the staff and students in the faculty and is largely divided in to two parts. One is a service desk team which has normally five employees including one service desk manager. The other is system administration with six employees. The organizational structure of this department may be seen in Figure 5.3.
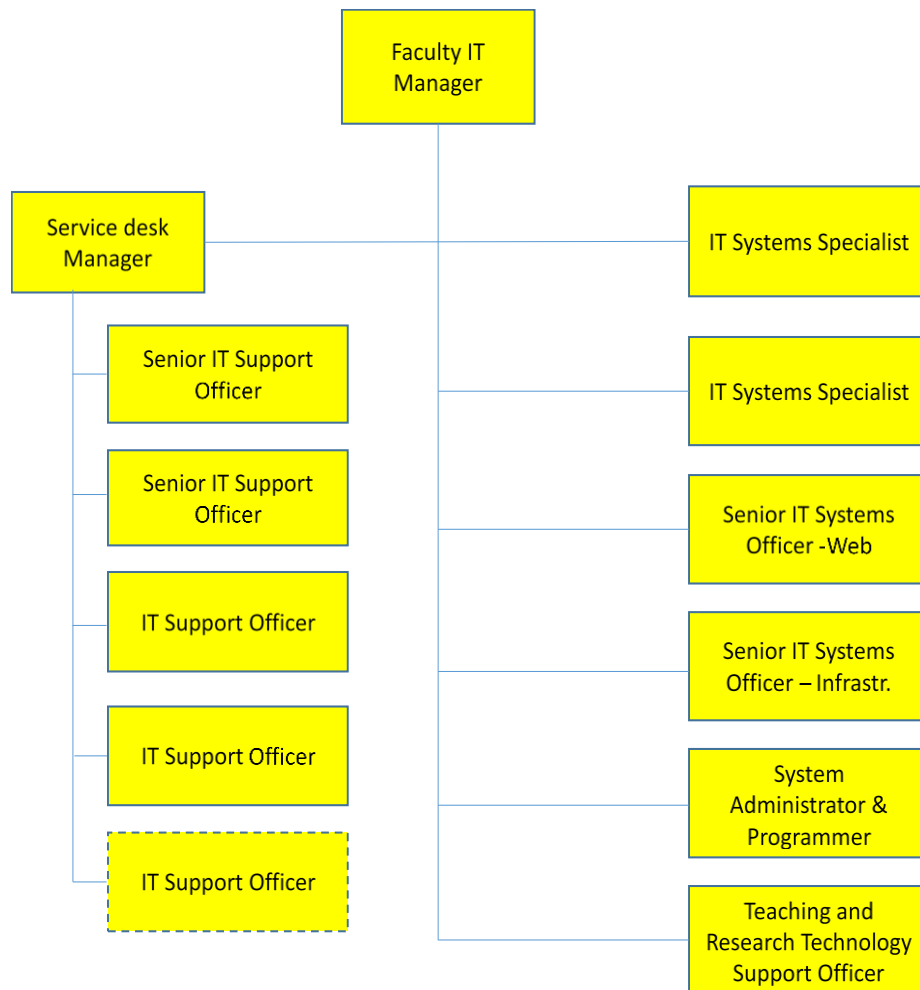
Figure 5.3 Organizational structure of Organization B

5.7 Organization C

Organization C is an IT service department of another faculty at the same university. There are six staff in this organization including a manager of this department. This organization provides IT services to the staff and students in the faculty. This organization is not divided into a team or a sub-group. The organizational structure of this department can be seen in Figure 5.4.
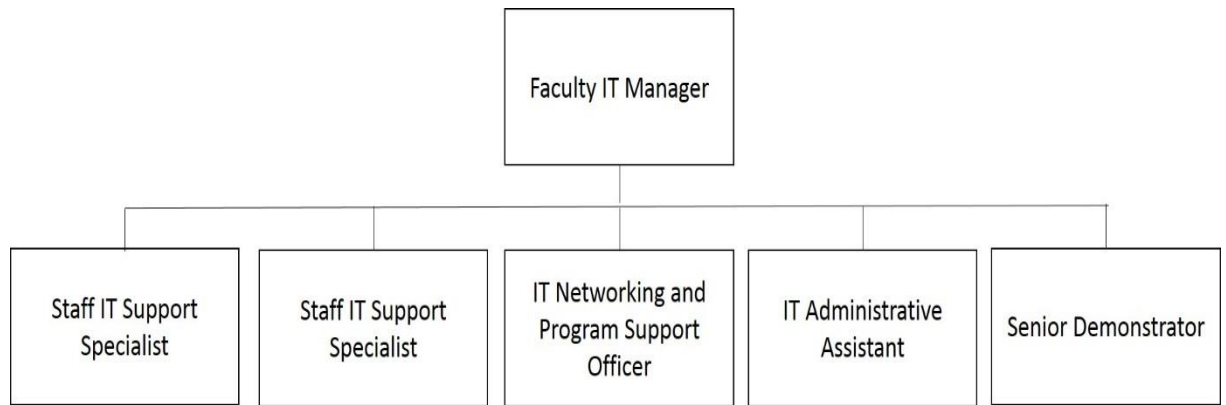
Figure 5.4 Organizational structure of Organization C

5.8 Summary

This chapter introduced organization categories such as Mintzberg's five basic parts of the organization and then looked at the classification of each organization type. Also three organizations under examination in this research were briefly introduced being those of an IT department of a university library and two faculty IT service branches in the same university. As mentioned in Mintzberg's framework, these three organizations are parts of a professional bureaucracy (Mintzberg, 1991a) because a university provides highly professional and knowledge based services, which are undertaken by qualified tertiary-educated staff. In this professional bureaucracy, these three IT service departments belong to the support staff because the support staff includes all jobs supporting the operating core - which is teaching and research. In the next chapter, we will go further into these three organizations in terms of their business processes.

Ch. 6 Business Process Analysis Results

6.1 Introduction

This chapter examines the results of analysing business processes structured from the viewpoint of business analysts and business participants. The business process models provided in this chapter represent a further interpretation of interview and document data collected from the managers and business participants. The result is shown in the form of Petri-nets which may be used to formally draw business processes. The petri-nets are being used in a simplistic way like a flowchart to illustrate processes, which means 'tokens' are *not* used to describe flow in the process. Also WoPeD (Workflow Petri Net Designer) was used as software for expressing Petri-nets. Data gathered from the interview with the manager and the documents provided, are normally major sources of this BPM analysis. Data from the questionnaire responses are also added to analysis to ensure the precise drawing of current business processes. During the interview with the manager of each department, they were asked to choose a certain business process in which all of their employees were involved. This is because normally there is more than one business process in a department, and not all employees are related to all processes - even within same department. At the interview it was found that some employees deal with a business process which is purely related to external partners. Also, most employees are involved in several business processes, so it is important to sort and select the most appropriate process for the research presented here. The business processes chosen were: an incident management process, a service desk process and a software deployment process. Let us examine each department's result of analysis.

6.2 Incident Management Process in organization A

Organization A chose an incident management process to be analysed for this study. In the analysis of incident management process, a drawn workflow, interview results, questionnaire results, and job descriptions of each employees were used. Interview with the manager of organization A helped overall understanding of incident management process. Figure 6.1, 6.2, 6.3, and 6.4 were derived from a workflow gathered from organization A. The workflow is not in the form of Petri-nets and expresses incident management process as one whole picture. So, this workflow was broken down into one higher level process and three sub processes during the analysis. Also this workflow was transformed into Petri-nets. Questionnaire results in BPM related questions and the job descriptions of each employee were used to interpret and confirm the specific role of each employees in the process. An incident can be defined as 'an unplanned interruption to an existing IT Service or a reduction in the quality of an IT Service.' The incident

management process can be drawn hierarchically because it has some sub-processes. Also, it is linked to other business processes such as problem management and change management. Figure 6.1 illustrates the top level business process of the incident management. Each transition (rectangle) has a sub-process, which can be seen in Figure 6.2, 6.3, and 6.4 in turn.
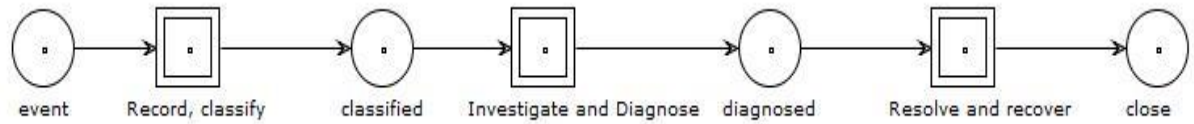
Figure 6.1 Higher level process of incident management

Figure 6.1 is often called a higher level process, and provides an overall view of a whole process. As can be seen in Figure 6.1, this incident management process starts if an event occurs. After that it is recorded and classified. The next step is investigation and diagnosis, which is followed by resolution and recovery. Then this case is closed. This is a coarse-grained way of describing the main flow of incident management. We may now look at further sub-processes of this higher level process. Figure 6.2 shows a sub-process of the record, and classify transition in Figure 6.1.
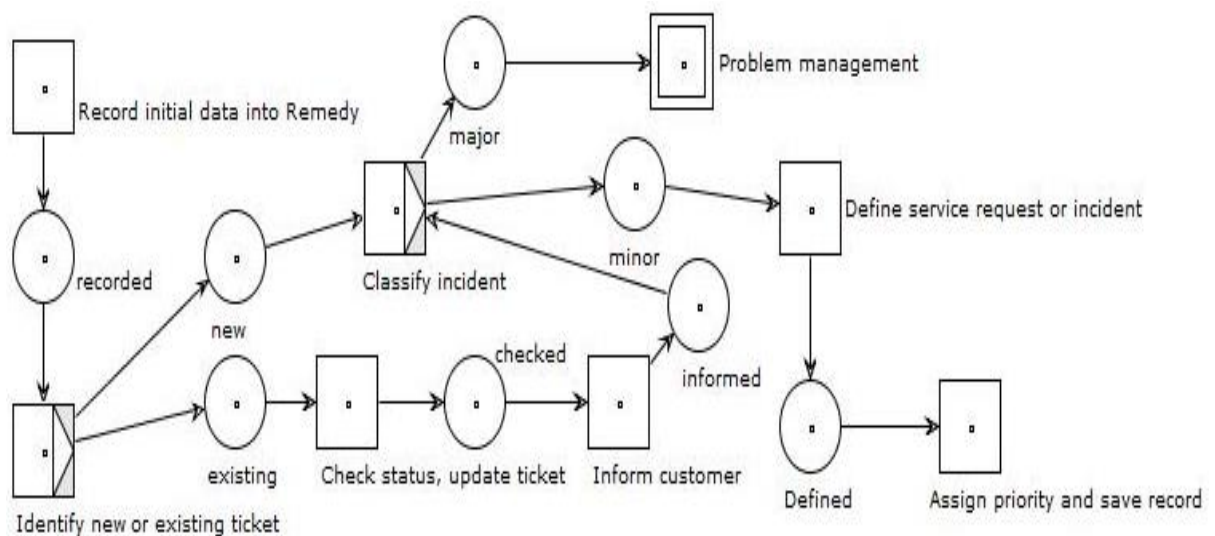
Figure 6.2 Sub-process of record, classify transition

As can be seen in Figure 6.2, this sub-process starts by recording initial data into remedy. The next step is identifying a new or existing ticket. If it is new, the incident is classified into two types such as major and minor. If it is existing, the status of the ticket is checked and updated. Then the customer is informed and this step passes to the classifying incident. If the incident is major, it passes to the problem management process, which is not within the scope of incident management. If the incident is minor, a service request or incident is defined. After that, a priority is assigned and finally the record is saved. Now this sub-process ends so the 'record,

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classify' transition finishes and the next transition, 'investigate and diagnose' starts. Figure 6.3 shows a sub-process of the 'investigate and diagnose' transition in figure 6.1.
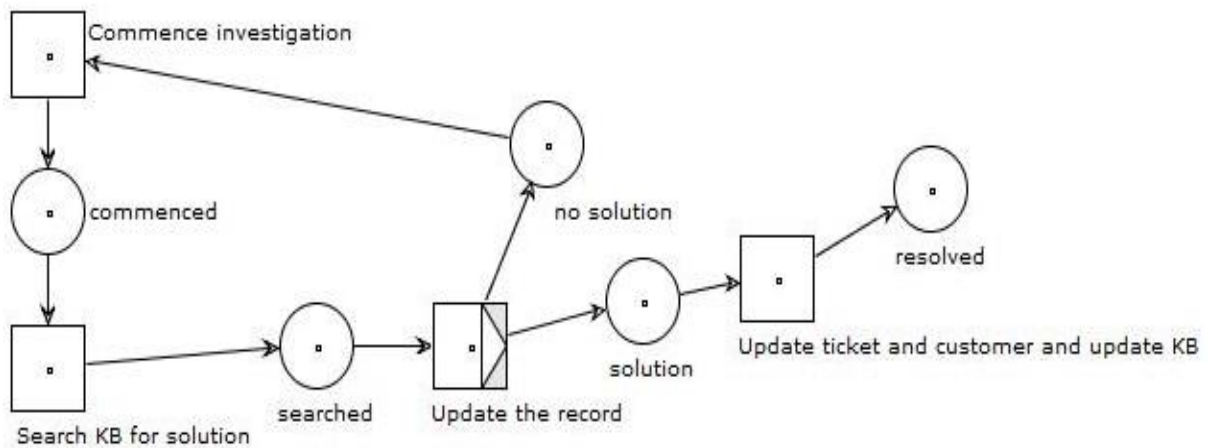
Figure 6.3 Sub-process of investigate and diagnose

As may be seen in figure 6.3, the first transition is 'commencing investigation'. Then, the next transition is searching the Knowledge Base for a solution. After that, the record is updated and if there is no solution, it repeats the investigation. If a solution is found, the ticket and Knowledge Base are updated and the customer is informed. Then, this sub-process ends so the 'investigate and diagnose' transition finishes and the final transition 'resolve and recover' commences. Figure 6.4 shows a sub-process of the resolve and recover transition in figure 6.1. As can be seen in figure 6.4, this sub-process starts by assessing the solution found. If it needs a change, it passes to a change management process, which is not a part of the incident management process. If it does not need a change, the solution is tested, then the solution is applied and the service is recovered. After that, the resolution is confirmed by the customer and the remedy ticket is set to 'resolved'. This is the end of whole incident management process.
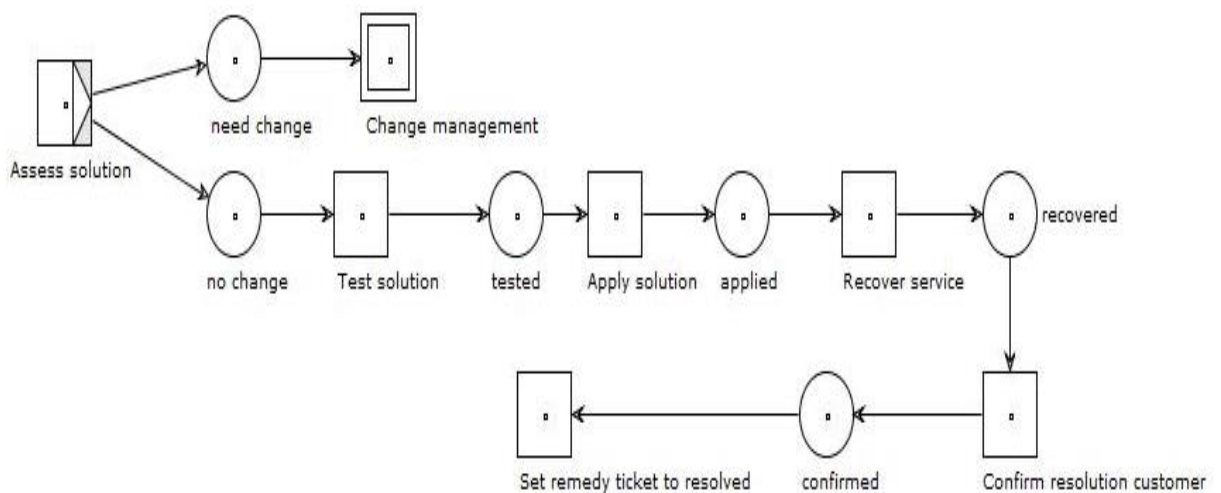
Figure 6.4 Sub-process of resolve and recover transition

6.3 Service Desk process in organization B

Organization B chose a service desk process to be analysed for this research. In the analysis of service desk process, interview results and questionnaire results were used. Neither the job descriptions nor a workflow were collected for service desk process in organization B. Interviews with the manager and an employee of organization B helped more understanding of service desk business process. Figure 6.5 was drawn according to these two interview results. Questionnaire results in BPM questions were also used to interpret and confirm the drawn business process.

A service desk is a one stop contact point from the customers. As such it deals with various issues including service requests, incidents, problems, errors and so on. A service request is the thing that users want this organization to do, such as giving them advice or providing an account or access to a server. End users or customers might not be able to distinguish incidents, service requests, and problems. They come to the service desk when they have an IT related issue in their work. Here a service desk business process in general was drawn at a conceptual level, as it would be too complicated to break down the process according to the classification of issues. Also, there were no drawn or codified business processes for the service desk in this organization. All the employees and the manager of this organization can distinguish the concept of an incident, a service request, a problem and so on. However, those terms are professional as well as technical so it is not necessary to draw a business process here which can be understood by the people engaged in that area. In this context, Figure 6.5 was drawn with the customer's point of view of the service desk business process.
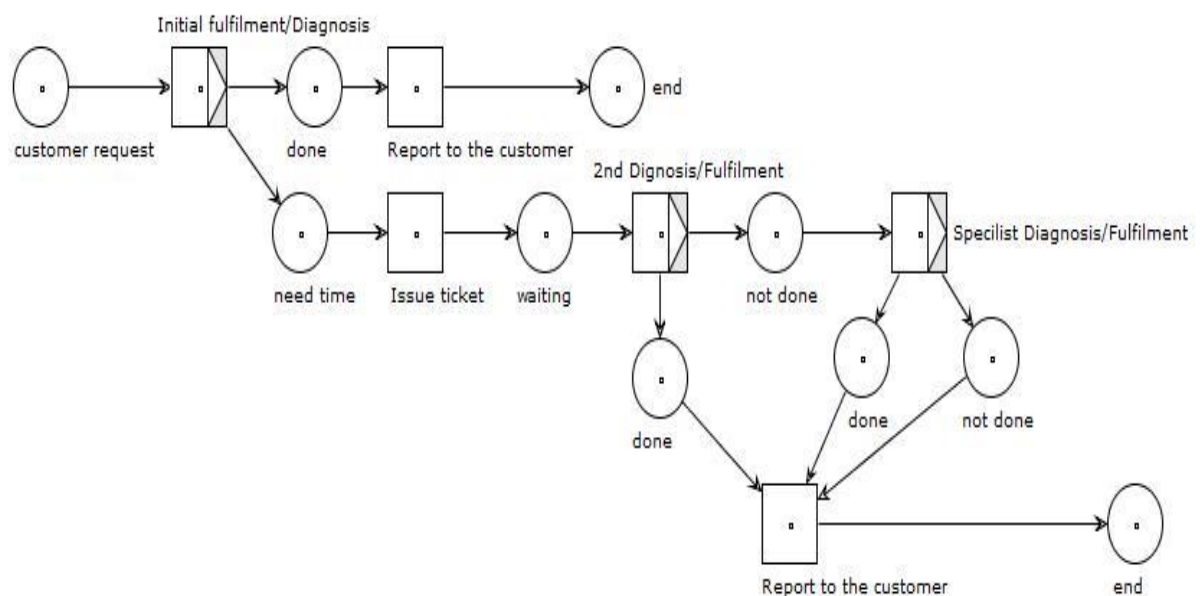
Figure 6.5 Service desk business process

As can be seen in Figure 6.5, this process starts if there is a customer request, which can be a service request or an incident or a problem and so on. If this request can be done easily, it can be fulfilled immediately and the customer is reported promptly. However, if time is needed to fix or fulfil the issue, a ticket is allocated. If that is the case, the second diagnosis or fulfilment is done for that issue. If it is done at this stage, it is also reported to the customer and this case is closed. If it can't be done in this step, it passes to 'specialist diagnosis/fulfilment'. After this step the result is reported to the customer no matter what it is, and the process thereby ends.

6.4 Software deployment process in organization C

Organization C chose a software deployment process to be analysed for this research. In the analysis of software deployment process, a drawn workflow, interview results, and questionnaire results were used. The job descriptions of each employees in organization C were not collected. Figure 6.6 was derived from a workflow collected form organization C. The software deployment process in organization C actually has more detailed sub-tasks or sub-processes, but here it is illustrated in a simplified view to make it easier to understand. Interview results with the manager of organization C was used to understand the documented workflow and draw a draft of software deployment process. The workflow is not in the form of Petri-nets so this workflow was transformed into Petri-nets. Questionnaire results in BPM related questions were used to develop and refine the draft of drawn software deployment process.

As can be seen from Figure 6.6, this process starts from a user's request for a new application, which is followed by checking whether it is available in the Standard Operating Environment (SOE). If it is available in SOE, the licence is required and there are two kinds of licence. One is a site licence and the other is an individual one. If it is a site licence whether it is pre-installed or not, it is checked. If it is pre-installed, the user can have access to that software, so the case is closed. If it is not installed, installation is performed from the start menu then the application is available for the user. So the case also ends. In the case of an individual licence, licence availability is also checked and if it is not available, it goes to the purchase application. If it is available, the users are added to application group and some work is done for installation from the start menu application. There are some deeper and technical sub-processes in this 'add users to application group' transition. Also 'purchase application' has more detailed sub-processes, but these detailed sub-processes are skipped for analysis.
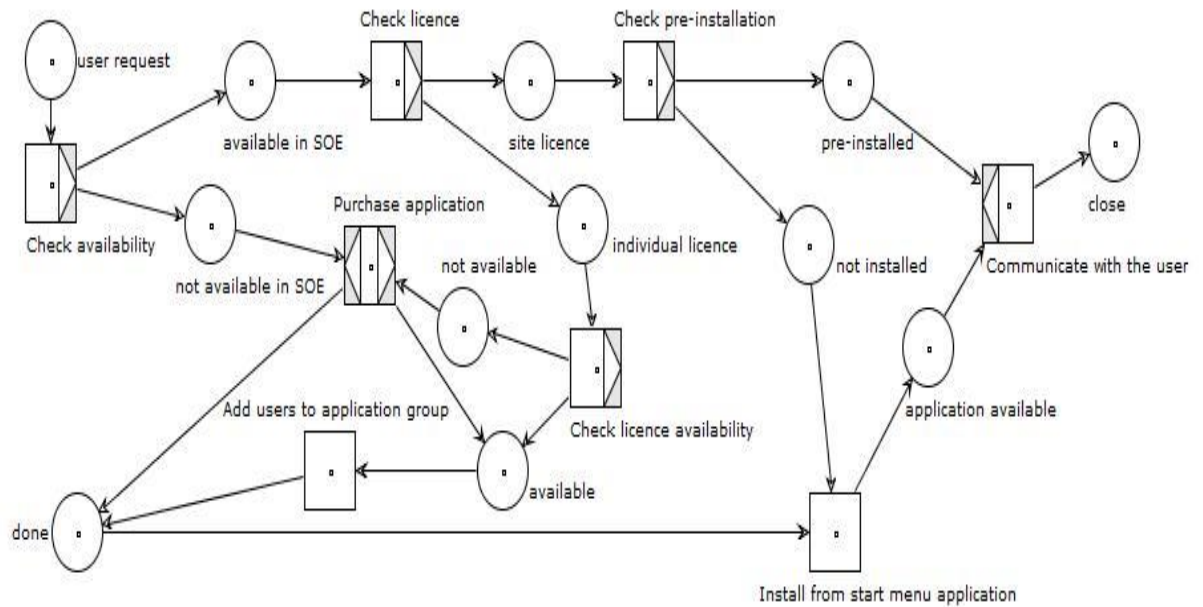
Figure 6.6 Software deployment business process

6.5 Summary

So far we have examined the results of business process analysis in our case study sites. The business processes illustrated are mainly based on the documents provided by management and as such represent management's point of view. The incident management process chosen by organization A has a more detailed and clearer definition; it was already drawn in the form of a flow chart, so it has simply been converted into a Petri net. However, organization B does not have any drawn business processes, so it is newly made according to the data gathered. The service desk business process in organization B may not look different from the incident management process in organization A; this is because the IT service department performs similar roles and work, and the service desk process handles incidents as well. In the next chapter, the results of Social Network Analysis will be discussed to see the actual working relationships among employees in the three organizations.

Chapter 7 Social Network Analysis Results

7.1 Introduction

In this chapter, we examine the results of analysing social networks between employees of the organizations under study. The result is mainly shown in the form of sociomatrices and sociograms. Other quantitative measurements are analysed as well. The quantitative data have been gathered from questionnaire responses. In the questionnaire, the levels of frequency of contact, importance of the person, and importance of the occasion for individuals of relevance, were asked for analysing their social relationships. There were eight responses out of nine from organization A. In organization B, eight people responded out of eleven employees. Also four out of five people participated in this survey from organization C. The questionnaire was distributed to all employees except the managers of each organization, because we already presented management's viewpoint in a previous chapter, which was represented by a pre-defined business process. So the focus here is on the social and personal relationships among employees. In some particularly small organizations, managers might be involved in a step of a business process and may undertake a certain role as a part of a business process, as well as the manager's role. However, in this study we tried to separate managers in the narrow sense of the term from their employees in order to clearly visualise the difference between management's viewpoint and actual work processes.

7.2 SNA in organization A

The eight participants from organization A are labelled from Actor one to Actor eight for reasons of anonymity. Table 7.1 presents a sociomatrix of organization A, which represents the level of frequency of contact.

		Frequency of contact							
		Actor 1	Actor 2	Actor 3	Actor 4	Actor 5	Actor 6	Actor 7	Actor 8
Name of person	Actor 1	0	8	8	8	8	8	8	8
	Actor 2	5	0	3	3	3	3	6	2
	Actor 3	8	6	0	9	8	9	6	8
	Actor 4	8	7	9	0	8	9	7	8
	Actor 5	8	6	8	8	0	8	6	8
	Actor 6	9	6	9	9	7	0	6	7
	Actor 7	7	8	6	6	5	6	0	5
	Actor 8	9	8	9	9	9	9	8	0

Table 7.1 Sociomatrix of frequency of contact in organization A

The integers in this sociomatrix range from one to nine, where nine means hourly contact, which is the highest frequency of contact, and one refers to quarterly contact (once every three months), which is the lowest frequency of contact. The meaning of each scale may be found in the

questionnaire which is included in the appendix A. Table 7.2 shows a sociomatrix of organization A which represents the level of importance of the person.

		Importance of the person							
		Actor 1	Actor 2	Actor 3	Actor 4	Actor 5	Actor 6	Actor 7	Actor 8
Name of person	Actor 1	0	3	3	3	3	3	3	3
	Actor 2	3	0	2	2	2	2	4	2
	Actor 3	3	4	0	5	4	5	4	4
	Actor 4	3	5	3	0	3	3	5	3
	Actor 5	5	4	5	5	0	5	4	5
	Actor 6	5	3	5	5	4	0	3	4
	Actor 7	4	5	4	4	3	4	0	2
	Actor 8	4	4	4	4	4	4	4	0

Table 7.2 Sociomatrix of importance of person in organization A

In this sociomatrix, the number ranges from one to five, where five means 'must see the person', which is the highest importance of the person, and one indicates 'no need to see the person at all', which is the lowest importance of the person. Table 7.3 below shows a sociomatrix of importance of the occasion.

		Importance of the occasion							
		Actor 1	Actor 2	Actor 3	Actor 4	Actor 5	Actor 6	Actor 7	Actor 8
Name of person	Actor 1	0	8	8	8	8	8	8	8
	Actor 2	8	0	5	5	5	5	8	5
	Actor 3	8	8	0	8	8	8	8	8
	Actor 4	7	7	7	0	7	7	7	7
	Actor 5	8	8	8	8	0	8	8	8
	Actor 6	8	8	8	8	8	0	8	8
	Actor 7	8	8	8	8	8	8	0	8
	Actor 8	8	8	8	8	8	8	8	0

Table 7.3 Sociomatrix of importance of the occasion in organization A

Importance of the occasion is measured as an integer from one to eight. In this case eight means a routine or formal meeting, which is defined as the highest importance of the occasion, whereas one means 'usually see the person outside of work', which is defined as the most informal occasion, namely the lowest importance of the occasion. As can be seen in Table 7.3, most actors here gave a very high score like seven or eight to other actors in terms of importance of the occasion except actor two. So, this sociomatrix itself does not provide a distinctive and meaningful set of results. Since organization A has a small number of employees, they sit very closely to each other and have frequent meetings both formally and informally. According to the response of actor two, he has formal and routine meetings only with actor one and actor seven. It is because actor two is one of two senior systems analysts who work closely with the IT operations manager and another senior systems analyst. He might think these relationships are only formal. One more thing we can consider in this sociomatrix is the summation of three sociomatrices, which are the sum of three eight by eight matrices. According to Wasserman and Faust (1994), sociomatrices can be summed because they are also matrices. Table 7.4 shows the summation of these three sociomatrices.

		Total							
		Actor 1	Actor 2	Actor 3	Actor 4	Actor 5	Actor 6	Actor 7	Actor 8
Name of person	Actor 1	0	19	19	19	19	19	19	19
	Actor 2	16	0	10	10	10	10	18	9
	Actor 3	19	18	0	22	20	22	18	20
	Actor 4	18	19	19	0	18	19	19	18
	Actor 5	21	18	21	21	0	21	18	21
	Actor 6	22	17	22	22	19	0	17	19
	Actor 7	19	21	18	18	16	18	0	15
	Actor 8	21	20	21	21	21	21	20	0

Table 7.4 Sociomatrix of total social relationships in organization A

These social networks can be viewed in the form of sociogram, which express social relationships graphically. Figure 7.1 is a sociogram representing frequency of contact in organization A.
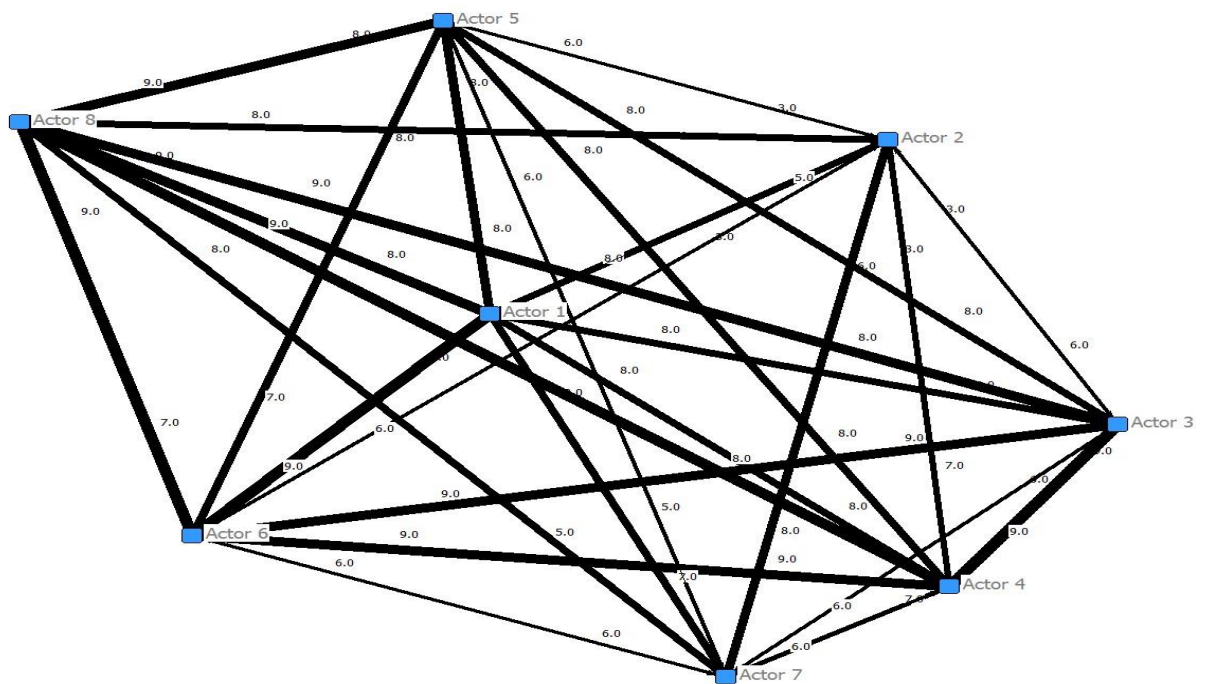
Figure 7.1 Sociogram of frequency of contact in organization A

In figure 7.1, the width of ties between the nodes represent the strength of relationships among actors. We see that actor two has a stronger relationship with actor seven than with any other actors. Also, actor 1 has a strong overall relationship with all actors. Similar patterns can be found in the importance of the person and importance of the occasion as well. Figure 7.2 illustrates a sociogram of the importance of the person in organization A. In Figure 7.2, some interesting findings were discovered. Namely, actor four is working with actor one in the IT operations team, while actors two and seven are not in the IT operations team. However, actor four has a stronger relationship with actor two and actor seven than with actor one in terms of the importance of the person. Another interesting finding is that actor two regards other actors as less important, except actor seven, but most actors did not think of actor two as a less important colleague.
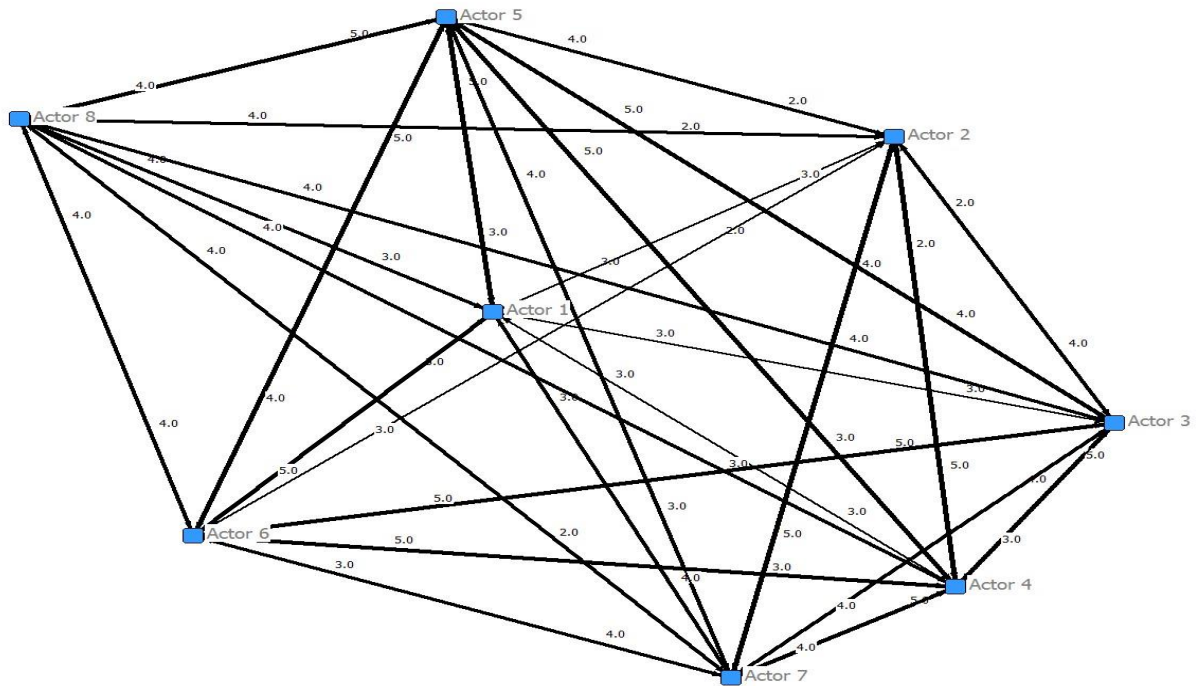
Figure 7.2 Sociogram of importance of the person in organization A

In this sociogram, the width of ties does not always mean the same degree of bi-directional relationship; namely actor two gave a two score against actor four and actor four gave a five score against actor two. This relationship is expressed stronger than the relationship between actor four and actor one, which is represented as three bi-directionally. So, we need to look at the numbers together which are labelled on the line. Figure 7.3 below illustrates a sociogram of the importance of the occasion in organization A.
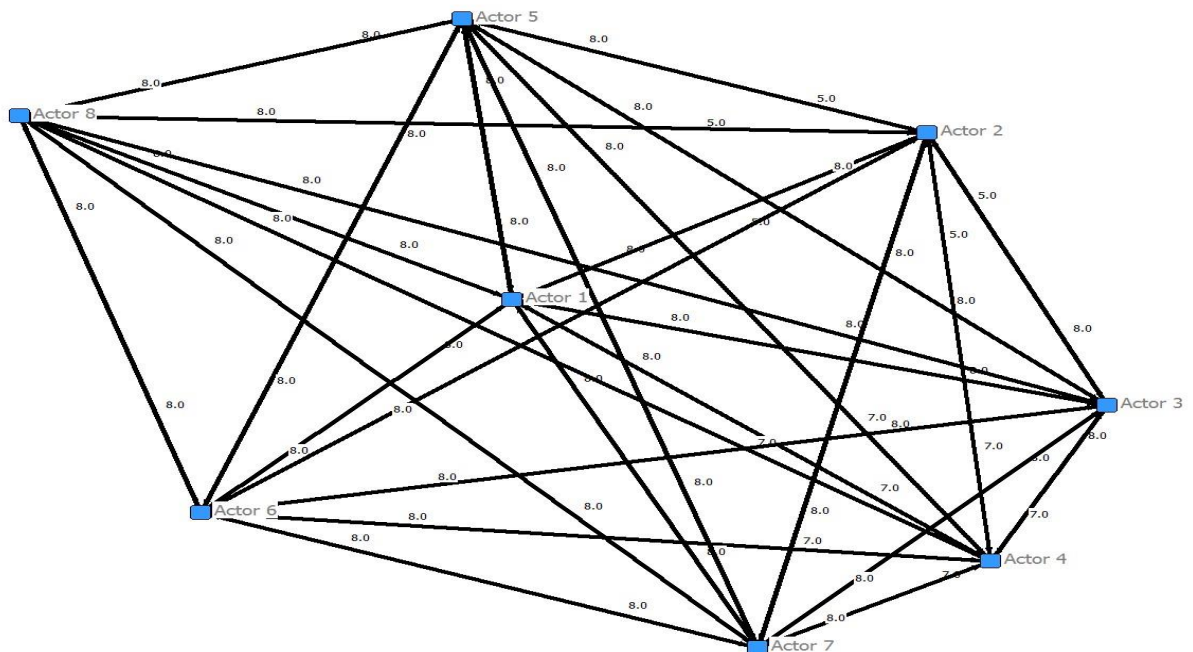
Figure 7.3 Sociogram of importance of the occasion in organization A

As mentioned with regard to the sociomatrix of the importance of the occasion, this sociogram does not provide remarkable results since almost every actor gave high scores such as seven or eight to other actors. We may now examine the sociogram which illustrates the overall social

relationships in organization A. Figure 7.4 is a sociogram of the total social relationships in organization A, which are based on the sociomatrix in Table 7.4.
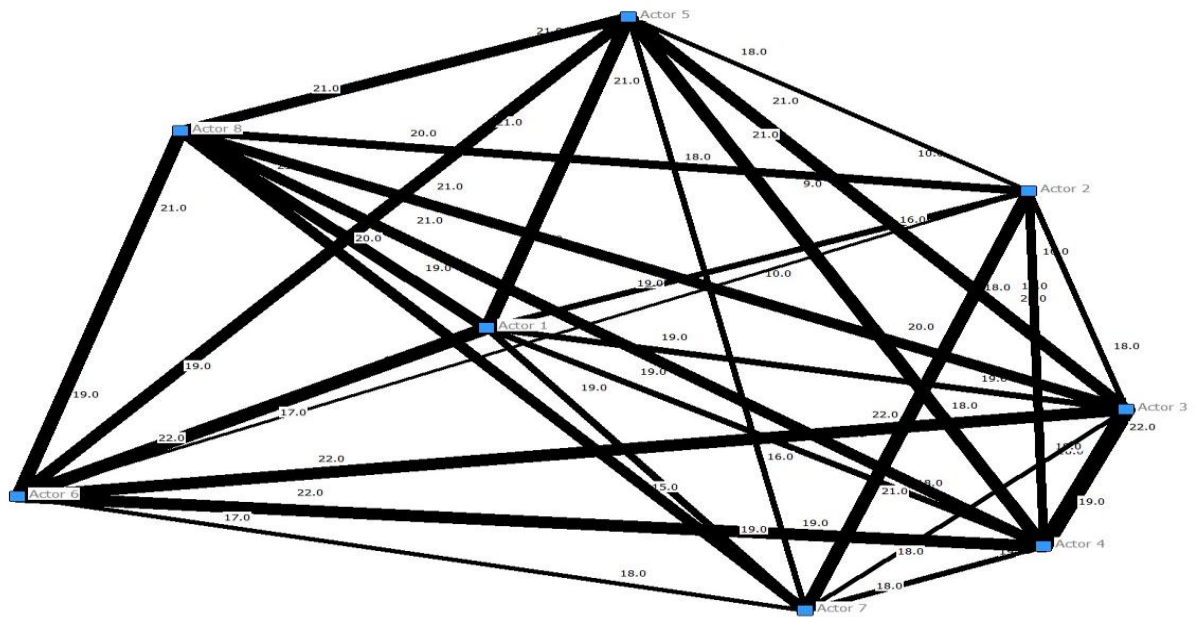
Figure 7.4 Sociogram of total social relationships in organization A (all threshold)

This general view does not provide more specific and special features of the social relationships, so we need to focus on the more distinctive characteristics among these sociograms. Furthermore we need to adjust the value of the threshold to identify meaningful quantitative measurements such as the centrality, density, the cliques, and so on. First of all the value of the threshold is gradually increased to determine any cliques in the sociogram with regard to the importance of the actor. Figure 7.5 shows these three cliques for organization A, which are formed under the condition that the threshold is greater than four.
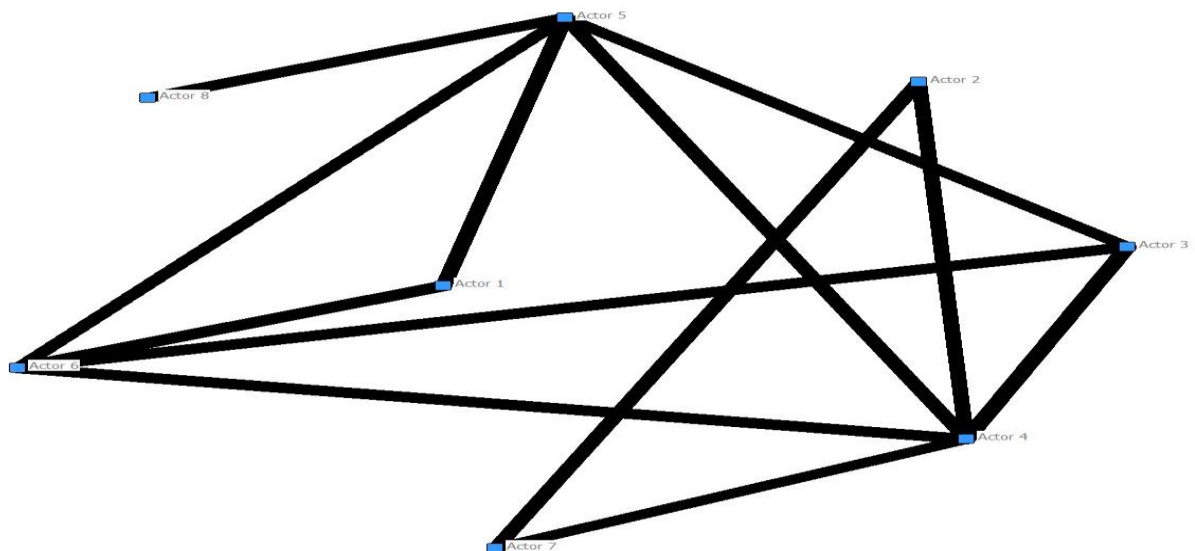
Figure 7.5 Sociogram of importance of the person in organization A (Threshold >4)

As may be seen in Figure 7.5, the first clique is composed of actors one, five, and six. The second clique is made up of actors two, four and seven. The third clique comprises actors three,

four, five and six. The employees of the IT operations team in organization A belong to the first clique or the third clique. The second clique has two employees from the design and development team and one employee from the IT operations team. Here we can recognize that actor four can play the coordinating role between the IT operations team and the design and development team. In the IT operations team, actors five and six have a closer relationship with the manager of IT operations team. Also, actor five has the widest relationship with all employees in the IT operations team, while actor 8 appears to be relatively isolated in this organization.

Now let us measure centrality and power. As mentioned in chapter two, centrality and power is measured by three concepts: degree, closeness and betweenness. In terms of degree, both actors four and five have a degree of five, since they have five ties with other actors respectively. In terms of closeness actors four and five are the shortest path length from other actors as shown in Table 7.5. In terms of betweenness, both actors four and five are between six other pairs of actors respectively. Therefore, both actors four and five have the most centrality and power in organization A.

Name of person	Path length between actors								
	Actor 1	Actor 2	Actor 3	Actor 4	Actor 5	Actor 6	Actor 7	Actor 8	Sum of path length
Actor 1	0	3	2	2	1	1	3	2	14
Actor 2	3	0	2	1	2	2	1	3	14
Actor 3	2	2	0	1	1	1	2	2	11
Actor 4	2	1	1	0	1	1	1	2	9
Actor 5	1	2	1	1	0	1	2	1	9
Actor 6	1	2	1	1	1	0	2	2	10
Actor 7	3	1	2	1	2	2	0	3	14
Actor 8	2	3	2	2	1	2	3	0	15

Table 7.5 Closeness between actors in organization A

The next quantitative measurement mentioned in chapter two was inclusiveness and density. However, these measurements are not meaningful in this organization because all employees are connected to each other. We may therefore state that the density in organization A is one and the inclusiveness is also one, meaning all actors are included. These figures can be different if we adjust the value of the threshold.

7.3 SNA in organization B

The eight participants from organization B are labelled from Actor A to Actor H again for reasons of anonymity. Table 7.6 shows a sociomatrix of organization B, which represents the level of frequency of contact.

		Frequency of contact							
		Actor A	Actor B	Actor C	Actor D	Actor E	Actor F	Actor G	Actor H
Name of person	Actor A	0	8	6	6	6	6	8	8
	Actor B	7	0	7	7	7	7	7	8
	Actor C	7	6	0	7	7	7	6	7
	Actor D	4	5	6	0	6	5	4	7
	Actor E	6	6	7	7	0	7	5	6
	Actor F	6	5	7	6	6	0	4	6
	Actor G	6	6	6	4	4	6	0	5
	Actor H	9	9	8	7	7	7	8	0

Table 7.6 Sociomatrix of frequency of contact in organization B

As can be seen in this sociomatrix, the relationships among actors A, B and H are stronger than the relationships among other actors. Table 7.7 below shows a sociomatrix of organization B which represents the level of importance of the person.

		Importance of the person							
		Actor A	Actor B	Actor C	Actor D	Actor E	Actor F	Actor G	Actor H
Name of person	Actor A	0	4	2	2	2	2	3	2
	Actor B	2	0	4	4	3	3	2	3
	Actor C	4	3	0	4	4	4	4	5
	Actor D	3	3	5	0	4	3	3	5
	Actor E	3	2	4	4	0	4	2	3
	Actor F	3	3	4	3	3	0	2	3
	Actor G	1	2	2	2	2	3	0	1
	Actor H	4	4	4	4	4	4	4	0

Table 7.7 Sociomatrix of importance of the person in organization B

This sociomatrix highlights interesting features which differ from Table 7.6. Namely, some actors of the service desk team rated the importance of the same team members lower than that of others. Of course the frequency of contact is not directly related to the importance of the person. So, even if they contact each other more frequently, it does not mean they regard each other as a more important colleague. Table 7.8 shows a sociomatrix of the importance of the occasion in organization B. As may be seen in Table 7.8, actors A, B and G did not differentiate the importance of the occasion at which they meet other employees.

		Importance of the occasion							
		Actor A	Actor B	Actor C	Actor D	Actor E	Actor F	Actor G	Actor H
Name of person	Actor A	0	4	4	4	4	4	4	4
	Actor B	5	0	5	5	5	5	5	5
	Actor C	5	5	0	7	7	7	5	5
	Actor D	5	7	8	0	7	7	5	7
	Actor E	5	6	6	5	0	6	5	5
	Actor F	5	6	6	5	6	0	6	5
	Actor G	5	5	5	5	5	5	0	5
	Actor H	8	8	7	5	5	5	5	0

Table 7.8 Sociomatrix of importance of the occasion in organization B

As analysed in the previous section, we also summed these three eight by eight sociomatrices to derive the overall social relationships among employees of organization B. Table 7.9 provides the summation of these three sociomatrices.

		Total							
		Actor A	Actor B	Actor C	Actor D	Actor E	Actor F	Actor G	Actor H
Name of person	Actor A	0	16	12	12	12	12	15	14
	Actor B	14	0	16	16	15	15	14	16
	Actor C	16	14	0	18	18	18	15	17
	Actor D	12	15	19	0	17	15	12	19
	Actor E	14	14	17	16	0	17	12	14
	Actor F	14	14	17	14	15	0	12	14
	Actor G	12	13	13	11	11	14	0	11
	Actor H	21	21	19	16	16	16	17	0

Table 7.9 Sociomatrix of total social relationships in organization B

We can more easily understand these social relationships if we visualise them through a sociogram. Figure 7.6 is a sociogram of frequency of contact in organization B.
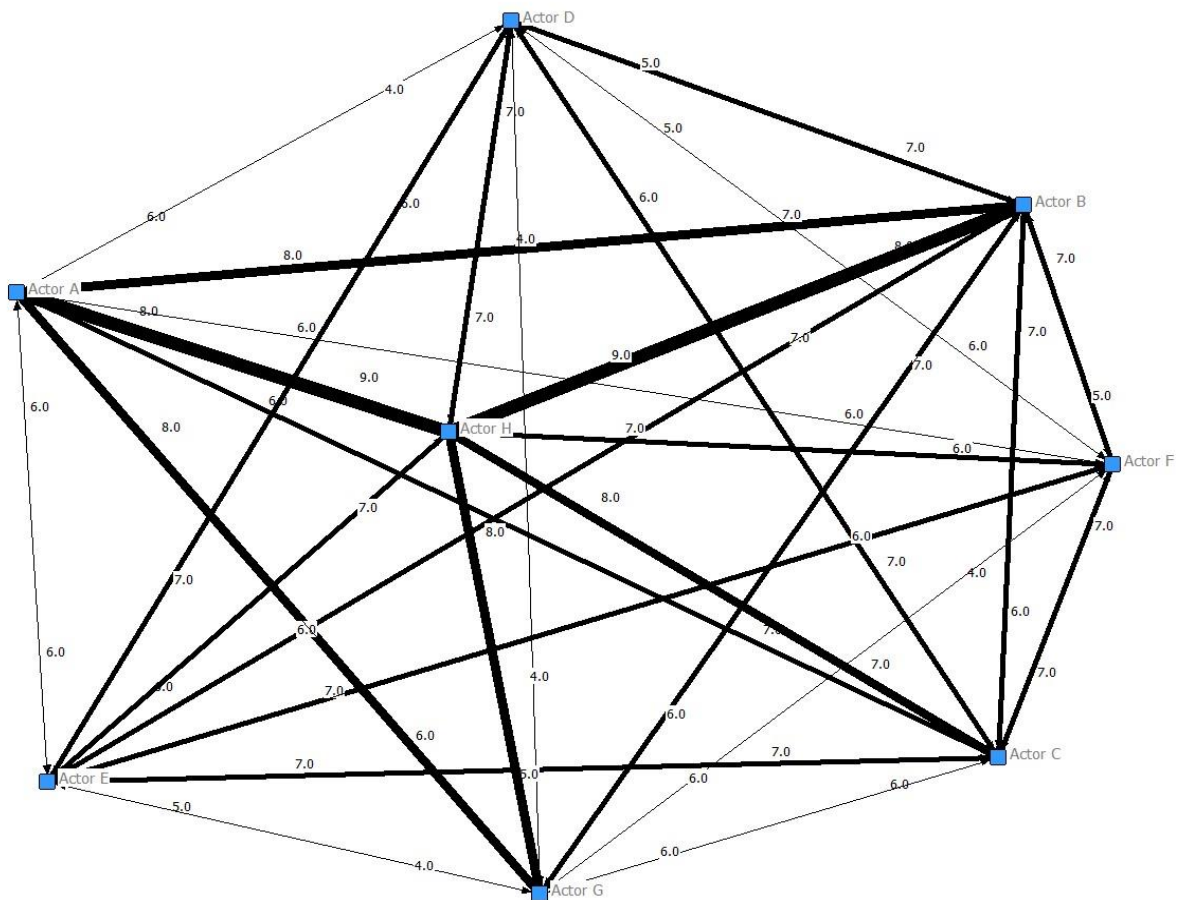
Figure 7.6 Sociogram of frequency of contact in organization B

As can be seen in Figure 7.6, actor H has a strong overall relationship with all actors. Actor H in particular has a stronger relationship with actors A and B than with any other actors. Actor H is a manager of service desk team so he has a role to allocate the service desk jobs to the appropriate person, that is why he has a closer relationship with all other employees in organization B. Also, even actors A and B belong to his team, so the frequency of contact among them is necessarily higher than with other employees. The next sociogram is Figure 7.7, which represents the importance of the person in organization B. It is necessary to compare Figure 7.7 with Figure 7.6, as there exist some differences between them.
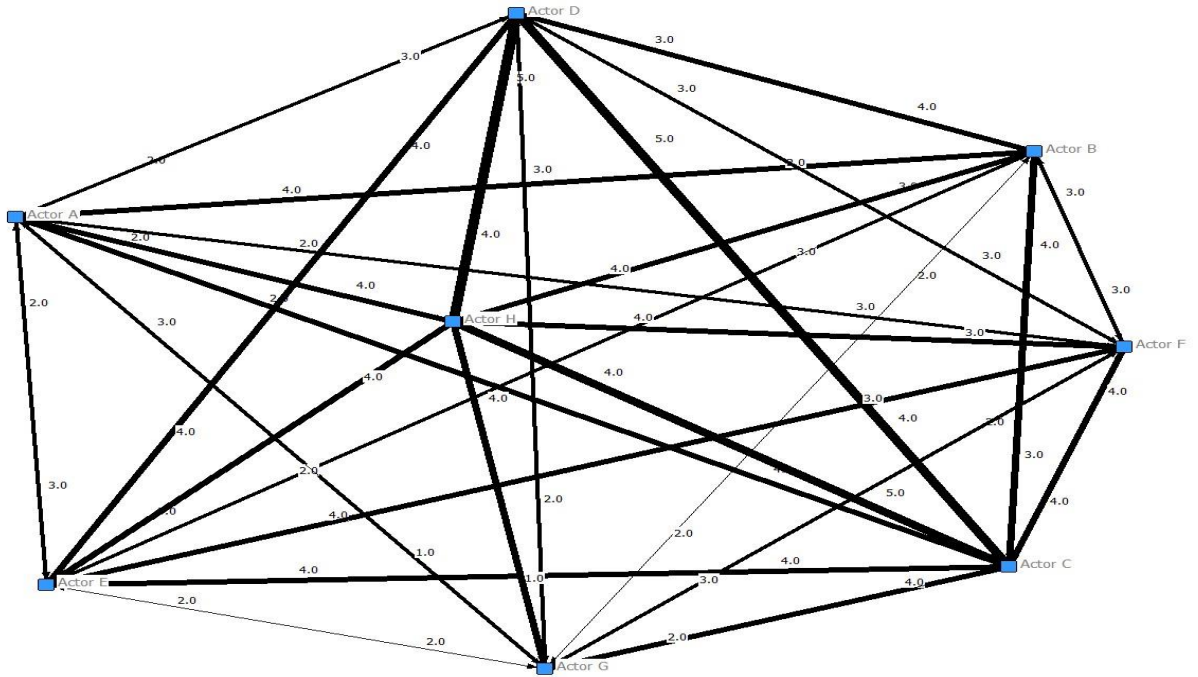
Figure 7.7 Sociogram of importance of the person in organization B

In Figure 7.7, the relationship among actors C, D and H is stronger than any other relationship in organization B. Figure 7.8 is a sociogram of the importance of the occasion in organization B.
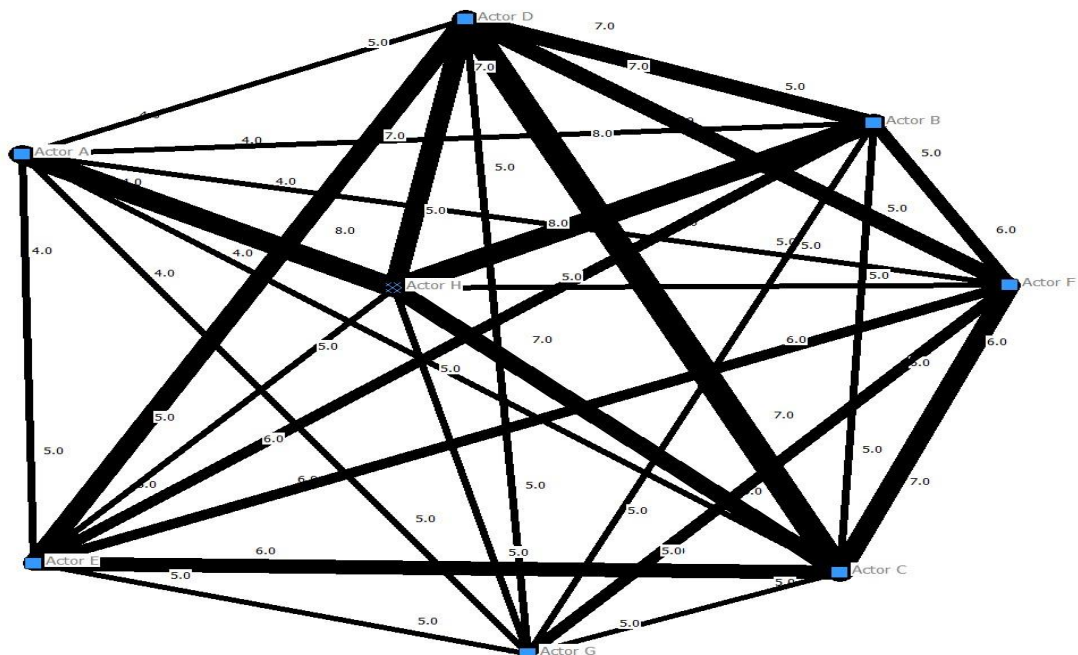
Figure 7.8 Sociogram of importance of the occasion in organization B

As can be seen in this sociogram, actor H has stronger relationship with actors A, B, C, and D than with any other actors. Also, the relationship between actor C and D is the strongest among all relationships, the same as in Figure 7.7. In the service desk business process, which can be seen in Figure 6.5 in chapter six, both actor C and actor D are just fulfilling a service or diagnosing issues. That is to say, there is no special reason why actor C has a stronger

relationship with actor D than with any other actors. That is the difference between BPM and SNA. In BPM we cannot see who has closer relationship with whom. So, we need to find out the type of social relationship through SNA and interpret the meaning of such a relationship. The next sociogram we need to examine is Figure 7.9 which shows overall social relationships of organization B. This sociogram is drawn based on the sociomatrix in Table 7.9. As can be seen in Figure 7.9, actor H has stronger relationship with actor A and actor B, who belong to a service desk team, so management's viewpoint almost fully overlaps with the social relationship.
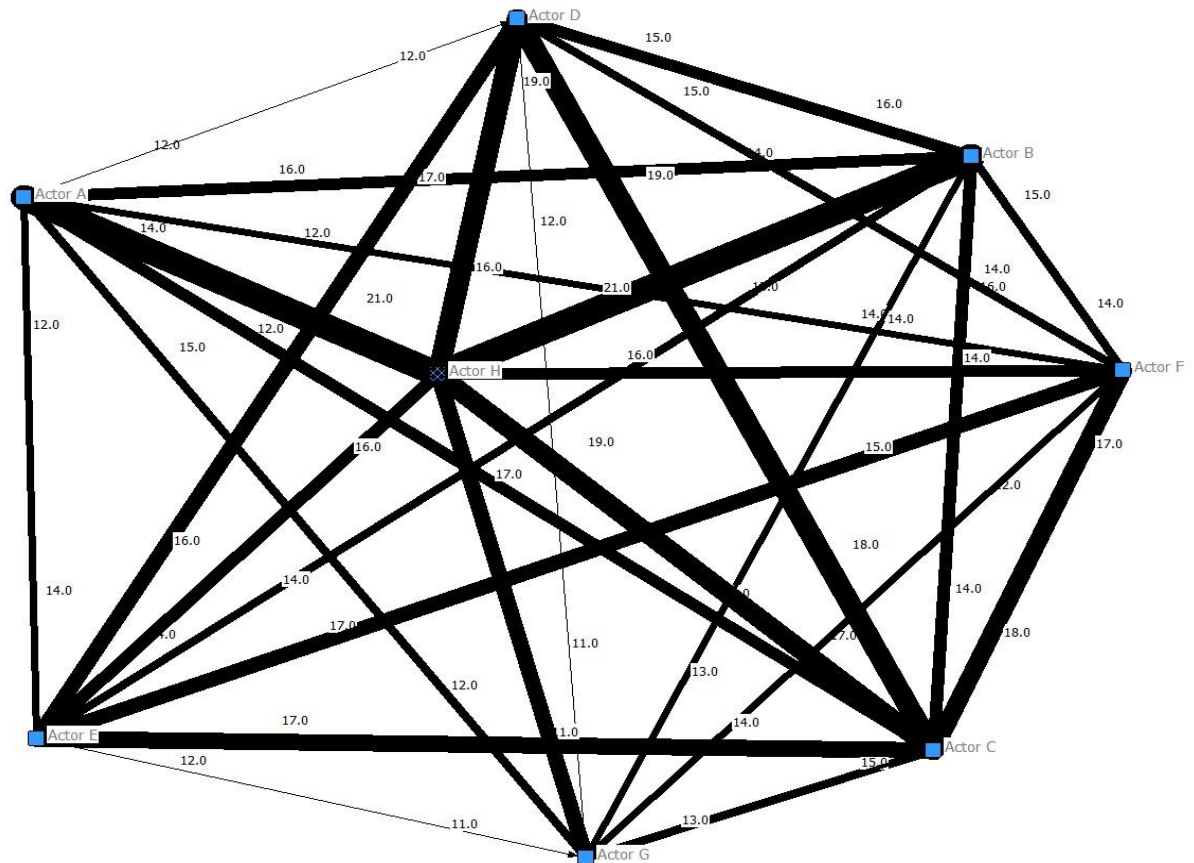
Figure 7.9 Sociogram of total social relationships in organization B

We can also find some cliques in Figure 7.9. The first clique is comprised of actors C, D, and H. The second clique is made up of actors A, B, and H. There are some more cliques which can be found, but it is not meaningful to list all cliques found. What is meaningful here is the fact that most cliques found in Figure 7.9 include actor H, that is actor H is in the centre among the cliques in organization B and can play the coordinating role between the cliques and this can clearly be seen if we increase the threshold here. Figure 7.10 shows clearly some more cliques for organization B, which are formed by increasing the value of threshold up to over fifteen. In this sociogram we can measure centrality and power. In terms of degree, actor H has the highest degree - a degree of seven, while actor C has the second highest degree -a degree of six, since actor H has seven ties with other actors and actor C has six ties with other actors.

Figure 7.10 Sociogram of total social relationships in organization B(Threshold > 15)

In terms of closeness, actor H has the shortest path length from other actors as shown in Table 7.10.

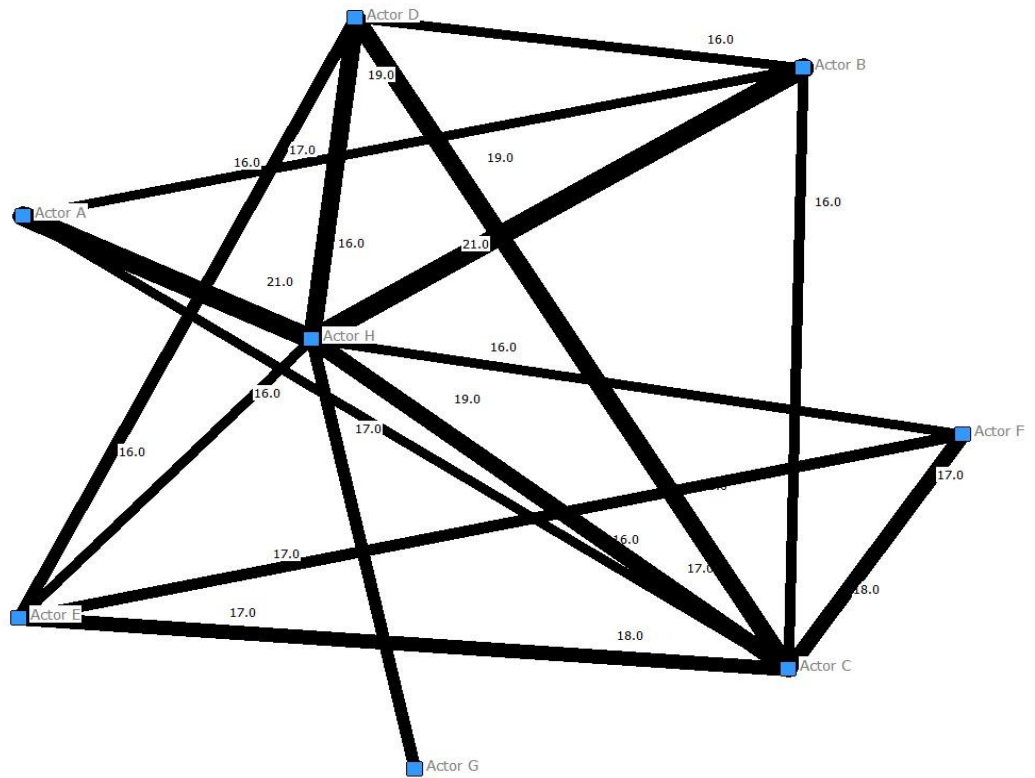| Name of person | Path length between actors | | | | | | | | |
	Actor A	Actor B	Actor C	Actor D	Actor E	Actor F	Actor G	Actor H	Sum of path length
Actor A	0	1	1	2	2	2	2	1	11
Actor B	1	0	1	1	2	2	2	1	10
Actor C	1	1	0	1	1	1	2	1	8
Actor D	2	1	1	0	1	2	2	1	10
Actor E	2	2	1	1	0	1	2	1	10
Actor F	2	2	1	2	1	0	2	1	11
Actor G	2	2	2	2	2	2	0	1	13
Actor H	1	1	1	1	1	1	1	0	7

Table 7.10 Closeness between actors in organization A

In terms of betweenness, actor H is between twelve other pairs of actors, which means the highest betweenness in organization B. Therefore, actor H possesses the most centrality and power in organization B.

Measurements such as inclusiveness and density are not meaningful in case of all thresholds because all employees are connected to each other. Namely, density in organization A is one and inclusiveness is also one. However, if we increase the value of the threshold, we can find who is isolated. Figure 7.11 shows that actor G is isolated when the value of threshold is increased up to over seventeen.
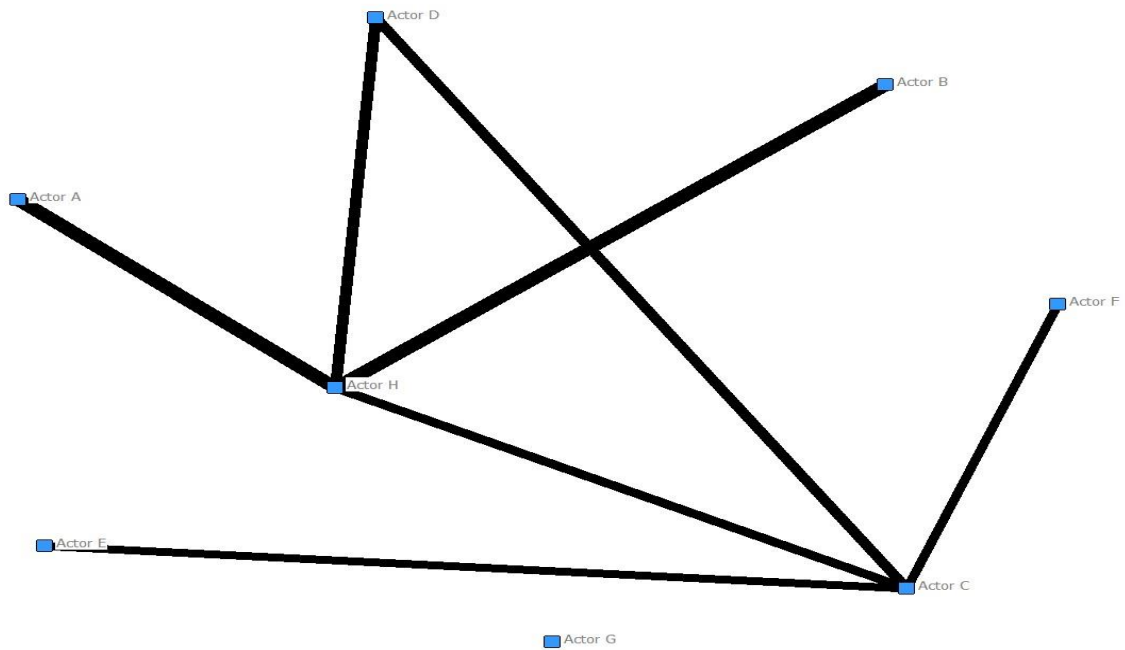
Figure 7.11 Sociogram of total social relationships in organization B (Threshold > 17)

7.4 SNA in organization C

The four participants from organization C are labelled from Actor I to Actor L once again for reasons of anonymity. Table 7.11 shows a sociomatrix of organization C, which represents the level of frequency of contact.

		Frequency of contact			
		Actor I	Actor J	Actor K	Actor L
Name of person	Actor I	0	8	8	8
	Actor J	7	0	7	7
	Actor K	6	6	0	6
	Actor L	9	8	7	0

Table 7.11 Sociomatrix of frequency of contact in organization C

As can be seen from figure 7.11, most actors here gave same scores to other actors in terms of the frequency of contact except actor L. Also the frequency of contact is high overall since the number of employees is very small. Table 7.12 below shows a sociomatrix of organization C which represents the level of importance of the person.

		Importance of the person			
		Actor I	Actor J	Actor K	Actor L
Name of person	Actor I	0	4	4	4
	Actor J	4	0	4	2
	Actor K	3	4	0	4
	Actor L	5	4	5	0

Table 7.12 Sociomatrix of importance of the person in organization C

This sociomatrix does not provide a remarkable set of result, but one thing interesting is actor J gave a two score against actor L and actor L gave a four score against actor J, lower than against other actors. This means the social relationship between actor J and actor L is the weakest among all relationships in organization C. The next sociomatrix is Table 7.13, which shows importance of the occasion in organization C.

		Importance of the occasion			
		Actor I	Actor J	Actor K	Actor L
Name of person	Actor I	0	5	5	5
	Actor J	5	0	5	5
	Actor K	4	4	0	4
	Actor L	7	7	7	0

Table 7.13 Sociomatrix of importance of the occasion in organization C

As shown in Table 7.13, actors did not give discriminatory scores against other actors in terms of importance of the occasion. One thing we need to consider is that actor L thinks much differently from actor K. Namely, actor L gave a seven score against all other actors and actor K gave a four score against all other actors. The next sociomatrix is Table 7.14, which is determined by the sum of three four by four matrices.

		Total			
		Actor I	Actor J	Actor K	Actor L
Name of person	Actor I	0	17	17	17
	Actor J	16	0	16	14
	Actor K	13	14	0	14
	Actor L	21	19	19	0

Table 7.14 Sociomatrix of total social relationships in organization C

This sociomatrix shows the social relationships overall in organization C but there is no new and conspicuous characteristic except that the relationship between actors J and L is relatively weaker than any other relationships in organization C. Now let us examine the analysis with a sociogram. Figure 7.12 is a sociogram which represents the frequency of contact in organization C.
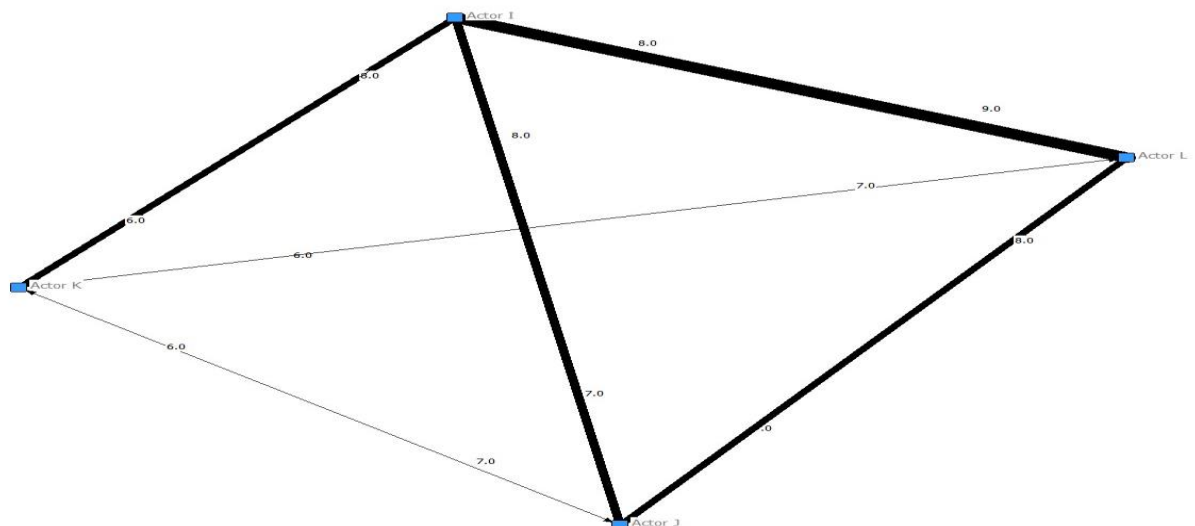
Figure 7.12 Sociogram of frequency of contact in organization C

As can be seen in this sociogram, the relationship between actor I and actor L is stronger than the relationships among others. Also one clear clique which is composed of actors I, J, and L is discovered. The next scoiogram is Figure 7.13, which illustrates the importance of the person in organization C.

Figure 7.13 Sociogram of importance of the person in organization C

As shown in Figure 7.13, the width of ties between actors does not look different, which means there are no remarkable features. The next sociogram is Figure 7.14, which represents importance of the occasion in organization C.
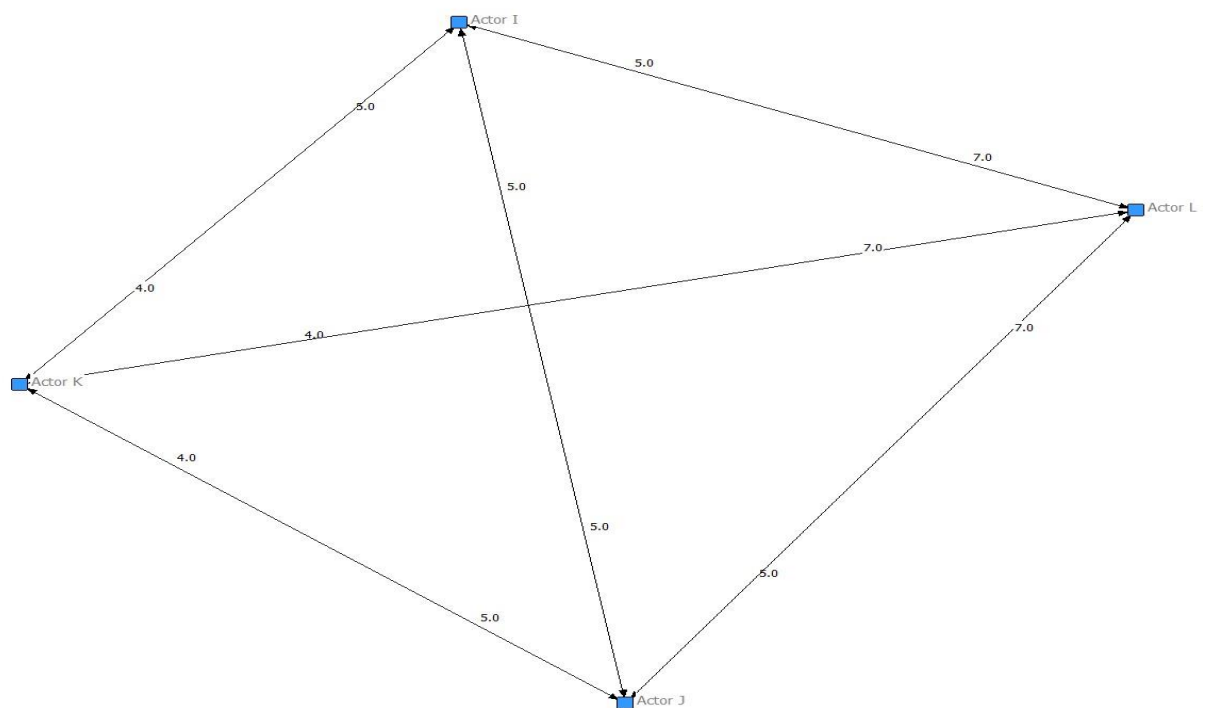
Figure 7.14 Sociogram of importance of the occasion in organization C

The sociogram in Figure 7.14 looks similar to Figure 7.13, because the relationships between the actors have few differences. Th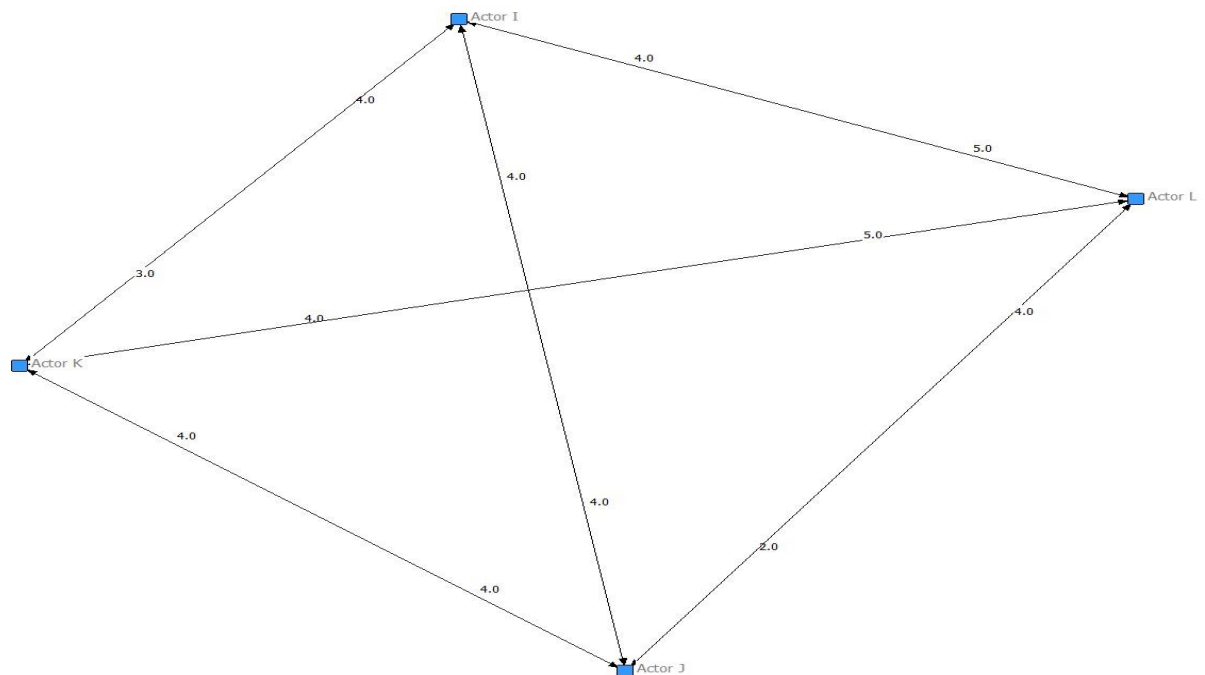e next sociogram is that of Figure 7.15, which provides a comprehensive view of the social relationships in organization C.
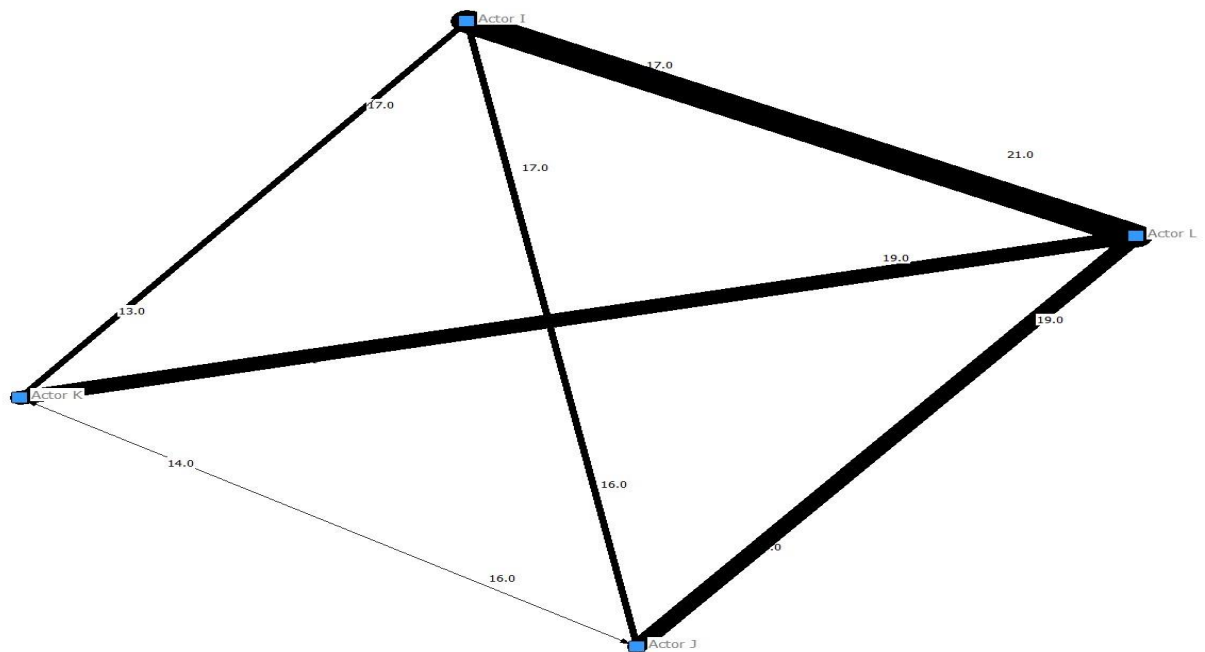
Figure 7.15 Sociogram of total social relationships in organization C

The sociogram in Figure 7.15 shows that actor L has overall close relationships with all actors. Also there are two clear cliques. One is composed of actors I, J, and L, and the other is made up of actors I, K, and L. Now we need to increase the value of threshold to measure centrality and power. Figure 7.16 shows the sociogram of total social relationships in organization C, which are formed by increasing the value of threshold up to over seventeen.

Figure 7.16 Sociogram of total social relationships in organization C (threshold > 17)

In the sociogram in Figure 7.16, we have measured centrality and power. In terms of degree, actor L has the highest degree, a degree of three, whereas all other actors have a degree of one. In terms of closeness, 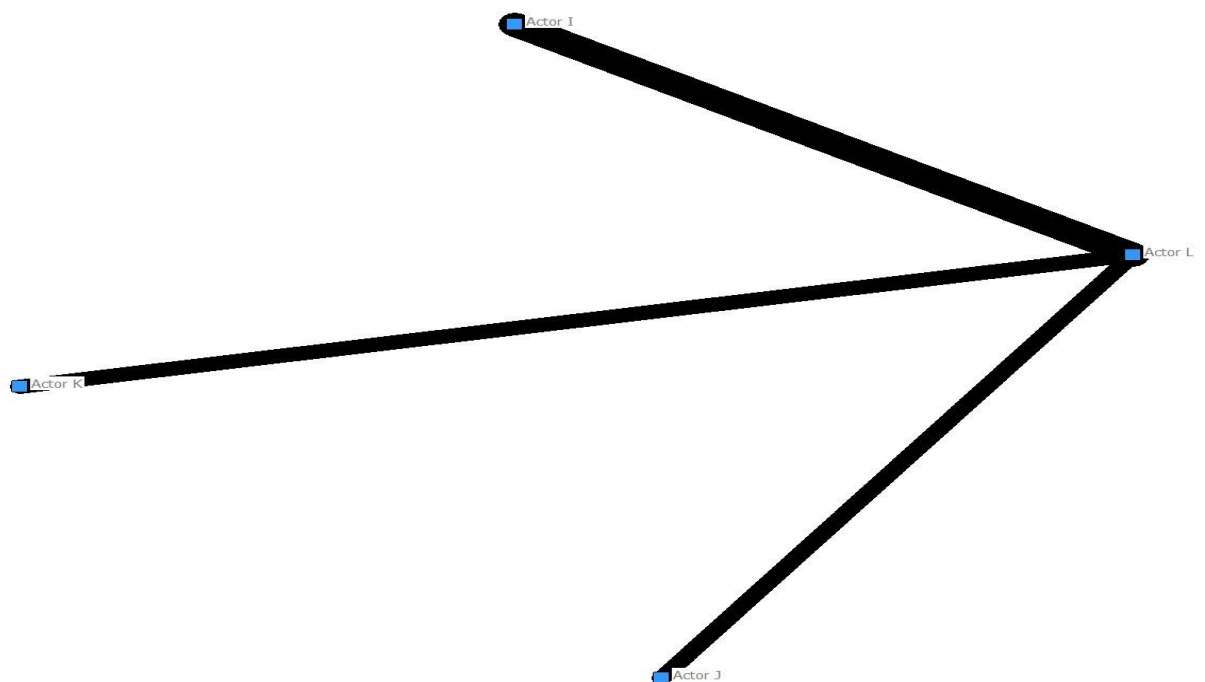actor L also has the shortest path length from other actors. In terms of betweenness, actor L is between three other pairs of actors, which means the highest betweenness in organization C. Therefore, actor L has the greatest centrality and power in organization C. Inclusiveness and density are not meaningful in case of all thresholds because all employees are connected to each other.

7.5 Summary

In this chapter, we examined the results of Social Network Analysis to see what really happens in relationships among employees. The results show who has closer relationships with whom than with any other employees and who thinks whom is more important, and so on. Also we can determine who has the centrality and power in an organization, and who is isolated. We can utilize these sorts of results to improve the business processes and increase productivity and efficacy. The interpretation and utilization of these results will be discussed in the next chapter. In addition the results of chapter six and chapter seven will be overlaid to determine whether there are any gaps between management's viewpoint and the actual working relationships.

Chapter 8 Discussion

8.1 Introduction

In this chapter the results of the Social Network Analysis and the Business Process Management are discussed together. If there are gaps between management's viewpoints and the actual working relationships, some recommendations for narrowing the gaps or utilizing hidden relationships will be provided. As the research progressed, considerable discussion with the case organizations enabled feedback from the organisations. As such some issues with the case organizations and the limitations of this research will be mentioned. Again, the purpose of this study was to refine techniques for overlaying business processes with social networks as a means of determining the fit of tasks to people.

8.2 Organization A

Organization A has only ten employees including a manager so the overlap between management's viewpoint and the actual working relationships is relatively large. The frequency of contact among employees is high overall and they very often see each other at formal and informal meetings. Also workers in the same group have closer relationships than with workers in other groups; this means the social relationships are almost fully overlapping with management's viewpoint as seen through figures 7.1 to 7.8. However, some hidden relationships were found. As discussed in chapter seven, there were three cliques not fully overlapping in the organization structure. These cliques can ideally be utilized as working groups or teams when there is a need for a specific project, a task force team, or reorganization. Also two workers who are not managers, have centrality and power, so they can play a coordinating role and be utilized as leaders or a sub-managers of small groups or teams. Another factor to be considered is one slightly isolated employee who needs to be watched carefully to see if the isolation causes bottlenecks or pain points in any given business process.

8.3 Organization B

Organization B is also small one, which has only twelve employees including a manager. One finding was that the relationships among three actors in the same team - that is the service desk team, were stronger than the relationship among other actors. This finding was determined by overlapping an organization chart with SNA. Another thing which needed to be discussed included 'was there a difference in SNA between organization A and organization B?'. In regard to the importance of the occasion, scores in organization A were mostly high such as seven or eight, but scores in organization B were relatively lower and different from one another.

So, it seems that organization B is typified by more informal meeting types than organization A, even though the size of organization is nearly the same. As may be seen in the organization structure of each organization in chapter five, organization A is more tightly structured with a team, however several employees in organization B are not tied as a team. That could be a possible cause of the difference between the two Social Network Analyses. There are also some cliques which are invisible from management's point of view. In addition, the person who has the most centrality and power - actor H, is a service desk manager but the person who has the second highest centrality and power - actor C, belongs to certain cliques which do not include actor H; this means that actor C is a key employee who needs to cooperate with actor H.

8.4 Organization C

Organization C has five employees, the smallest among the three case sites. There are no teams or working groups within this organization. Overlaying BPM with SNA, there were few differences between management's viewpoint and the actual social relationships. However, there were also two cliques which were not seen from management's perspective. These two cliques could be utilized as working groups or teams. Also one employee - actor L, forms the centre of a social network, belonging to both cliques; this actor can be utilized as a team leader or sub-manager, playing a coordinating role between the manager and employees. Another thing which needs to be considered is that actor L has a relatively weak relationship with actor J; there might be conflicts between them, or they may feel less comfortable in case they need cooperation from each other. If there is a need for people to work together, it is necessary to consider the social relationship between them in order to improve work efficacy and productivity.

8.5 Issues and limitations of this research

During the questionnaire survey, one identical question was asked by the case organizations, being why the managers of each organization were not included in the questionnaire? In the SNA component of the questionnaire, the managers were not in the list of employees. This was because managers and their employees needed to be separated to clearly distinguish management's viewpoint from the social relationship amongst employees. However, the view that managers in the case organizations do not belong to senior management (e.g. board of directors, CIO, CEO, or senior directors) was raised. As such it may have been prudent to include the managers of the case organizations as with 'normal' employees.

Also worth mentioning is that the scope of this research was not university-wide. Since the scope was limited to selected departments within a university, managers of the departments

were separated from their employees so as to regard their viewpoint as management's viewpoint. Another issue or limitation was that the chosen business processes were all internal, meaning there were no cross-departmental or cross-sectoral business processes. Because the chosen processes were internally performed within a small organization, the impact of the social relationships on business processes amongst them were also small. Staff sat close to each other, met every day, and knew each other's work very well. If a business process is a cross departmental one, social relationships with other department's employee's would vary and likely give more distinctive results. To get access to the employees of other organizations, approval from the management of that organization was required. Contact was made with other departments during this research, but some organizations did not wish to participate.

Another issue or limitation is that the recommendations on narrowing gaps were provided by subjective interpretation of the case study results. So, these tend to be lack of evidences or supporting materials. If recommendations are made based on enough evidences observed in the case study, the epistemology of the study will be positivism (Orlikowski and Baroudi, 1991). So, this issue can be a limitation of interpretive research.

8.6 Techniques for overlaying

Business processes shown in chapter six were not matched to employees on a one to one basis. Many employees have the same flow of work but work independently. Also there is no work which is performed by one employee exclusively. So, it is difficult to map each task to a certain employee. Also, the way of overlaying has not been concretely set up and the process of overlaying has not been clearly visualized. In this research, overlaying is comparing the results of analysis between business processes and social networks. Also documents, interview results, and questionnaire results were used to interpret and find out the overlaps. It is very important to select a suitable business process to be analysed, which is clearly defined, the tasks of which are allocated to each employee independently. Otherwise it is hard to map each employee to the drawn business processes. Since a business process is typically a broader view pre-defined by management, it may not be decomposed to the level of detail required. Therefore at such a high level there may appear to be no mismatches in work patterns. In future research, the detailed and appropriately decomposed level of business processes need to be derived and analysed. Also cross-departmental business processes which show clear roles and duties of each employee, need to be chosen in a larger organization.

8.7 Contributions

This research tried a new approach which combined business process analysis with social network analysis. The assumption that most managements view of the business processes can be different from the actual business processes and that this difference might have an impact on work efficacy and productivity presents new attention and direction in this field of study. However, since this research took just the first step on the way to final research goals, the results of this study did not give full and satisfactory ultimate outcome at this stage. One thing to which this study contribute is a methodology. Overlaying business process and social network is a new and innovative way, even if it is not perfectly built at the moment.

8.8 Summary

This chapter discussed the results of overlaying management's point of view with Social Network Analysis. Since the size of the case organizations was small, there were no remarkable gaps found. However, there were also certainly hidden 'realities' which could not be seen in the business processes drawn. Recommendations on the findings were also provided to improve business processes more effectively. Other issues which have been raised during the research were to refine the scope, definitions, and techniques of the research. Since this research is only at a rudimentary stage, the approaches are perhaps naïve.

Chapter 9 Conclusion

9.1 Overview of work

This thesis opened by posing certain research questions. Those questions were "are there any gaps between management's point of view and actual working relationships?", "how are they different?", "how can we interpret this difference?" and "how can we narrow this gap?" First the literature review provided background to this study, why it was necessary, and why it was important in line with the theoretical background. The theoretical development and what had been done so far in the field of study was then discussed. After that in order to answer the research questions raised and how to approach this research from an underlying philosophical viewpoint, the research epistemology was discussed. The mainstream research epistemology in this study was an interpretivist approach, whereby data was interpreted subjectively within the socio-historic context. This study neither explained a causal relationship nor generalized a theory, but tried to explore a social phenomenon. In terms of research methodologies, this study is took both a qualitative and quantitative methodology, that is a mixed methodology.

Case studies with three genuine organizations were designed and conducted with interviews and a questionnaire survey. In total twenty employees and three managers from three organizations participated in this study. Also since this research involved the participation of humans, a formal approval from an institutional review board was compulsory. This research was reviewed and approved by a university research ethics committee and has been undertaken in accordance with the *National Statement on Ethical Conduct in Human Research*.

With this research design and methodology, the research examined the overlaps of Business process Management (BPM) and Social network Analysis (SNA). Organizational structures for each organization were drawn from data gathered during the interviews with managers of the case organizations and used as a representation of management's view via BPM. For BPM analysis, a simplified Petri net - a graphical modelling tool for business process was used to understand the workflow of each organization more easily. For SNA, sociogram, sociomatrix, and some quantitative measurements have been used to analyse actual working relationships in the case organizations. Management's point of view which includes BPM and an organization structure was compared with SNA, which shows the working relationships amongst employees.

The result shows some gaps between these two, but the gaps are not large since the number of employees in the case organizations are small. Nonetheless, some helpful advice was provided to management from the gaps discovered. More importantly, this study has trailed some research approaches and determined certain weak points, limitations, and issues to be

considered, which can be meaningful for refining such research techniques in future. Hopefully the results, methodologies, and experiences of this study can be shared with other researchers to improve the quality of further research in this field of study.

9.2 Future work

The limitations of this study, mentioned in chapter 8, need to be handled to overcome in the future work. First of all, case selection is the most important thing in the future research. The case selection in this research was not done as wanted because one major potential case site denied participation. However, it is necessary to secure an access to an organization which has enough number of employees to participate in the survey. Also, future research should find out bigger gaps between idealised business processes and actual processes than in this research and it needs to try positivist approach to present a more generalized theory with enough evidences so it can contribute to a body of knowledge in this field of research.

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Appendix A

\<Case Study Plan\>

Year	Months	Milestone & Deliverables	Tasks
2015	February	• Identification of Case study	• Identify overall concept, main idea, and scope of case study
	March	• Identification of Case selection Criteria	• Discussion with Supervisor regarding case selection criteria
	April	• Case selection • Preparation of draft interview question and questionnaire	• Discussion with Supervisor regarding case selection rationale • Select potential cases
	May	• Case site preparation • Initial meeting and interview	• Contact case sites and get acceptance • Arrange initial meeting • Explain research project and encourage participation • Interview with managers
	June	• Update details of case study plan • Research Ethics application • Another meeting if necessary	• Reflect feedbacks of initial meeting • Selection of business process to be analysed • Repeat meeting and feedback to refine research design
	July	• Questionnaire survey	• Conduct questionnaire survey • Interviews if necessary
	August	• Data analysis	• Analyze interview and survey results
	September	• Interpreting and finalizing interview and survey results • Writing results	• Derive business processes and social networks • Find gaps and give explanations on the meaning of gaps • Discussion and writing whole results

<Questionnaire>

This questionnaire is made up of two parts. One is questions for social network analysis, and the other is for business process analysis. A pecific buisnee process chosen will be given to the respodents for business process analysis questions. Social network analysis questions are asked to see the working relationship among employees and business process analysis questions are asked to confirm the specific role and work of each employee in the chosen process.

Social Network Analysis Questions

1) What is your current position? and what is your role ?

2) If you have any task based issues, how and where do you raise them? through email, phone, in person,...etc.?

3) When working, who else do you interact with? What is the purpose of that interaction? How does it occur?

4) Please select the levels of frequency of contact, importance of the person, and importance of the occasion for individuals of relevance to yourself.

Please select most appropriate one for each person

		Frequency of contact								
		Hourly	every few hours	daily	once every couple of days	Weekly	biweekly	monthly	bimonthly	quarterly
Name of person	To be named									
	To be named									
	To be named									

Please select most appropriate one for each person

		Importance of the person				
		Have to see the person	Very important	Moderately important	Can get by without seeing the person	Try not to see the person
Name of person	To be named					
	To be named					
	To be named					

Please select most appropriate one for each person

		Importance of the occasion							
		Routine/ formal meeting	Informal yet pre-arranged meeting	Lunch/ Morning Tea/ After noon Tea	Just 'bump into' the person around the workplace	Send the person an email	Send the person a fax	Phone them	Usually see the person outside of work
Name of person	To be named								
	To be named								
	To be named								
	To be named								

Business Process Analysis Questions

5) How does the process start ?

6) What event triggers the process ?

7) Is there more than one way the process could start?

8) How do you know when the process is complete? (What are the determining factors?)

9) Are there different end states for the process? For example, one that signifies successful completion and others indicating failed or aborted attempts. What are the normal end states and what are the exceptions?

10) Where else might the process go and why?

11) How do you know when one part is done?

12) Are there business rules associated with the process, states, and completion status?

13) What parts of the process do you seek to eliminate, and why?

14) Where do you spend most of your time, and why ?

15) Where in the process do you repeat work? How often, and why?

16) What does your manager think happens in the process? What really happens?

17) When pressed for time, what steps in the process do you skip or work around?

18) What are your assigned duties?

19) What are the tasks required for you to perform your duties according to your role?
    a. List each task - Estimate of hours per week, Estimate of total hours per each term?

    b. How often do you perform each task? (daily, weekly, each term, annually)

20) How many people in your office or area are involved in this process?
    a. Total number of people performing same tasks – total time it takes to complete the tasks for each term

    b. Who are they?

    c. What are their roles?

21) Where in the process do time delays exist?

22) Do people actually hand something off ? and where ?, or is it submitted to a system with the assumption that it is handed off?

23) What data are put into systems when you are performing your job? And what data are taken out ? (What data are input and output for your work ?)

24) What pains does the process cause? What do people want or desire from the process?

    Relative process pain points:

    o What and where could something happen ?

    o Why would it happen ?

    o How bad is it ?

    o Who is going to do what about it, and is it effective?

Appendix B

\<Research Ethics Approval\>

Dear Dr Busch

RE: Ethics project entitled: "Examining the overlaps of Business Process Management and Social Network Analysis"

Ref number: 5201500161

The Faculty of Science Human Research Ethics Sub-Committee has reviewed your application and granted final approval, effective 24/06/2015. You may now commence your research.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:

 http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.

The following personnel are authorised to conduct this research:

   Dr Peter Busch
   Me Eui Dong Kim

NB. STUDENTS: IT IS YOUR RESPONSIBILITY TO KEEP A COPY OF THIS APPROVAL EMAIL TO SUBMIT WITH YOUR THESIS.

Please note the following standard requirements of approval:

1.   The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).

2.   Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 24 June 2016
Progress Report 2 Due: 24 June 2017
Progress Report 3 Due: 24 June 2018
Progress Report 4 Due: 24 June 2019
Final Report Due: 24 June 2020

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

3.   If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4.   All amendments to the project must be reviewed and approved by the Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5.   Please notify the Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6.   At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites: http://www.mq.edu.au/policy/

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have final approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

If you need to provide a hard copy letter of Final Approval to an external organisation as evidence that you have Final Approval, please do not hesitate to contact the Ethics Secretariat at the address below.

Please retain a copy of this email as this is your official notification of final ethics approval.

Yours sincerely,
Goran Strkalj, Deputy Chair
Faculty of Science and Engineering
Human Research Ethics Sub-Committee
Macquarie University
NSW 2109