THE INFLUENCE OF POWER ON KNOWLEDGE FLOW AND UTILISATION OF
SOCIAL CAPITAL: A CASE STUDY IN PROCESS & PRODUCT INNOVATION
IN CHINA

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Xuelin Liu
School of Management
University of Leicester

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Chapter 1

Introduction

1. The Factors Influencing Knowledge Flow and Innovation

Organisations seek new technology and new ways of doing things. In so doing, they could obtain competitive advantages through innovation (Porter, 1990). A number of research demonstrates that successful innovations rely on the search for and obtaining new ideas or information from various sources (e.g. Clark et al., 1992; Tidd et al., 2001; Parker and Vaidya, 2001), and on creating and applying new knowledge (Nonaka and Takeuchi, 1995; von Krogh et al., 2000). Therefore, innovation and knowledge flow are closely related. Knowledge sharing is important for firms’ innovative performance (Spencer, 2003).

However, there are many factors affecting knowledge flow and thus causing problems for innovation. For instance, the types of knowledge are found as one of the factors affecting the ease of knowledge sharing (Dixon, 2002; Hanson, 1999; Howells, 1996). Certain type of knowledge (i.e. tacit knowledge) tends to be more difficult to share than other types of knowledge.

Structural positions and relations between organisations are also the factors influencing knowledge flow. Research demonstrates that firms, better connected with various external organisations and groups, are able to gain more innovation resources through the social networks and social capital (Burt, 1992; Conway, 1997; Nahapiet and Ghoshal, 1998). Thereby, social networks and utilisation of social capital are crucial for knowledge flow and innovation.

Moreover, research (Davenport and Prusak, 1998) suggests that trust-based relationship is essential for knowledge sharing. In addition, with some scholars arguing that cognitive factors are crucial for knowledge sharing, it is suggested that developing a shared language and shared meaning (Boland and Tenkasi, 1995; Brown and Duguid, 1991) in
‘communities of practice’ facilitates knowledge sharing (Lave and Wenger, 1991). Thus, ‘communities of practice’ is valued for managing knowledge for innovation.

However, how these issues are related to each other in influencing knowledge flow and innovation is not clearly pointed out. Considering the relationship between these issues and the concepts of social networks, social capital, and ‘communities of practice’ (COP), a question should be asked, how are these three concepts related to each other in examining the factors which influence knowledge flow and innovation? And, are there any other factors affecting knowledge flow?

2. Aims of This Research

This research recognised the need to study these issues in a further step. Firstly, this research investigated the interrelated elements of the concepts of social networks, social capital, and COP. In this way, it might be shown how the elements of these three concepts can be mingled together to help to better understand knowledge flow and innovation.

Second, it should be noticed that there are conflicts about the ownership of knowledge (McInerney and LeFevre, 2000), conflicts between departments/units (Tsai, 2002), and conflicts between employees and management (Contu and Willmott, 2003). Those conflicts affect knowledge flow. Those interpersonal or inter-group conflicts in knowledge processes indicate that knowledge flow is linked to power (Hislop, 2005). However, the issue of power has not been fully explored in the literature of knowledge management and innovation (ibid). This research aimed to contribute to the understanding of knowledge flow by investigating the influence of power relations on knowledge flow.

In addition, recent studies show that people who have different culture background also differ in knowledge sharing behaviour (see Inkpen and Pien, 2006; Michailova and Hutchings, 2006). This indicates that cultural context has an impact on knowledge
sharing. Understanding the influence of cultural context on knowledge flow therefore becomes significant, because knowledge is gradually accessed and shared across cultural and national boundaries with the increase of the extent of internationalisation (Quintas, 2003). On that account, it is necessary to examine the influence of the cultural context on knowledge flow.

By and large, this research combined elements of the concepts of social networks, social capital, and COP to explain how knowledge flow might be facilitated and impeded, as well. It dwelled upon the important but relatively unexplored issues of power in relation to knowledge flow. By analysing the empirical data from two innovation projects in a high-tech company in China, this research tried to answer the following four research questions:

1. How do the effects of social capital affect knowledge flow?
2. What is the relationship between power, knowledge flow, and social capital?
3. How do power relations influence knowledge flow and the utilisation of social capital?
4. How does the cultural context affect knowledge flow?

3. Plan of Thesis

The literature review part of this thesis is divided into three chapters. Chapter 2 discusses the importance of innovation, and how innovation and knowledge flow were closely related. Also introduced are two different but related approaches of managing knowledge for innovation. The link between these two approaches indicated that social networks, the concepts of social capital, and COP were important for investigating knowledge flow and innovation.

Chapter 3 has four main sections. The first three sections introduce the origins and main elements of the three concepts (social networks, social capital, and COP) respectively. The last section examines how these three concepts complemented each other to help
better understand knowledge flow and innovation. The discussion also found that there was a need to inspect the influence of power relations on knowledge flow.

Chapter 4 discusses why power relations are important for understanding knowledge flow by taking a close look at power issues not fully explored in the literature related to social networks, social capital, and COP. In reviewing the different frameworks of power, it suggested that Hardy’s framework (1994; 1996) of the four dimensions of power can help to investigate how power relations influenced knowledge flow and innovation through an in-depth survey of the influence of power from different angles – from resource/process power, through symbolic power, and to the power of the system.

Chapter 5 explains and discusses the overall strategy and perspectives adopted by this research, and the techniques and methods used to collect and analyse data. Case study was adopted as the method of this research. Apart from observing people, the empirical data was gathered by interviewing 26 people related to two innovation projects in a high-tech company in China.

Chapter 6 is an introduction to the case, which provides the background information about the company, about the focal projects, and about related people.

The results of data analysis are presented in Chapter 7 and Chapter 8. Chapter 7 presents the results of the product innovation project (3G). First, it discusses the positive and negative effects of the three dimensions of social capital on knowledge flow (the elements of concepts of social networks and COP were mingled with the three dimensions of social capital in the discussion), and the effects of the four dimensions of power on knowledge flow and on the utilisation of social capital.

Chapter 8 interprets the results of the process innovation project (ERP). It uses the same structure as Chapter 7 to discuss the relations between power relations, knowledge flow, and social capital.
Chapter 9 and Chapter 10 are devoted to case comparison and in-depth discussion of the results. Chapter 9 focuses on the effects of the different dimensions of social capital. The results suggested that different dimensions of social capital had either positive or negative effects on knowledge flow. The contingent effects of social capital were related to the context and the nature of the innovation projects.

Chapter 10 compares the results of power influence discovered in Chapter 7 and Chapter 8, and shows the closely interrelated relations between knowledge flow, social capital, and power. It was found that the four dimensions of power had contingent effects on knowledge flow and the utilisation of social capital, and that knowledge flow and the utilisation of social capital also confirmed the power relations. The power of the system embedded in cultural context was the backdrop of the effects of other three dimensions of power and social capital on knowledge flow.

Chapter 11 discusses the contributions, implications, and strengths and weaknesses of this research, and ends with suggestions for further research in light of the results of this research as well as the research method employed by this research.
Chapter 2

Innovation and Knowledge Flow

1. Introduction

The aim of this chapter is to discuss the link between innovation and knowledge flow, and the approaches to managing knowledge flow for innovation. The discussion is split into two sections. Section 2 reviews the importance, types, and process of innovation, the link between innovation and knowledge flow, and the perspectives on knowledge. Section 3 introduces two different approaches to managing knowledge flow for innovation (networking approach and community approach). These two approaches are based upon social networks, the concepts of social capital and COP which are important for understanding knowledge flow and innovation (These three concepts will be discussed in Chapter 3).

2. Innovation and Knowledge

2.1. Why Innovation?

Innovation is different from invention; it can be defined as “a process of turning opportunity into new ideas and of putting these into widely used practice” (Tidd et al., 2001:38). Innovation includes the developing of new technologies and new ways of doing things (Porter, 1990).

The importance of innovation is well acknowledged in the literature. Innovation has been seen as the most fundamental and significant for nations and organisations: innovation along with science and technology becomes the essential assets of nations seeking to secure economic competitiveness (López-Martinez and Piccaluga, 2000; Lundvall, 1992); innovation brings competitive advantage to organisations by developing new products, establishing new processes, and providing new services (Hamel and Prahalad, 1994; Kay, 1993; Porter, 1990).
There are different types of innovation. Regarding the type of change that innovation incurs, generally speaking, innovation can be categorised as product and process innovation (Tidd et al., 2001:6). Product innovation is “offering something no one else can”; and process innovation is to improve organisation process “in ways others cannot match” (ibid), such as enabling the organisation process to do things faster and at a lower cost. The differences between these two types of innovation are: first, product innovation focuses on the exploring of external sources, while process innovation needs to explore “internal strengths and weaknesses – where the processes and activities within the organizations help and where they hinder it reaching its strategic goals” (emphasis original) (Tidd et al., 2001:265). Second, continuity is more in need for process innovation than for product innovation, as success of process innovation depends on “a steady stream of change resulting from regular review and fine tuning of the organization’s processes” rather than on “occasional giant leaps and dramatic radical innovation” (Tidd et al., 2001:264).

Despite the discrepancy, both product and process innovation search for new ideas, and apply them to improve the existing product/process. The innovation process of them is similar. There is a traditional view that innovation follows a linear process, a systematic stage/gate process – “a roadmap from idea to lunch consisting of discrete stages, each stage preceded by a Go/Kill decision pint or gate” (Cooper, 1994:4). For instance, in a linear process (see Rogers, 1995) innovation starts with the stage of generating and conceptualising new ideas, and then moves to the stage of developing innovation, implementing changes resulted from innovation, and finally, ends with the stage of making innovation become routine.

However, research finds that the linear model neither represents the actual process of innovation (Cooper, 1994; Edwards, 2001; Hislop, 2005) nor promises success of innovation (Newell et al., 2002), as “innovation is usually a complex iterative process that is not linear” (Edwards, 2001: 221). Research suggests that innovation process is the iterative and overlapped processes of seeking, selecting, and implementing new ideas.
2.2. Innovation and Knowledge Are Closely Related

Innovation and knowledge are closely related. First, since innovation is “[s]uccessful exploitation of new ideas” (UK DTI Innovation Unit definition, 1994, cited from Tidd et al., 2001: 38), knowledge is the most important source of innovation (Howells, 1996; von Krogh et al., 2000). Knowledge flow is of importance for success of innovation, as “innovations are undertaken in the context of existing knowledge but with a need to learn from external sources.” (Parker and Vaidya, 2001: 129). Success of innovation needs to mobilise various types of knowledge to make new things or create new processes that others can not.

Second, as mentioned before, innovation process is the process of combining, exchanging and sharing knowledge, applying knowledge, and creating new knowledge (Clark et al., 1992; Newell et al., 2002; Swan and Clark, 1992). Therefore, innovation process becomes knowledge process which involves creation, utilisation, management, and manipulation of knowledge (Hislop, 2005). Tidd et al. (2001:339) put that, “Innovation is increasingly seen as requiring the creating, combination, sharing and deployment of knowledge - and this places strong emphasis on the channels and mechanisms which are used for communication.” In other words, innovation processes tend to be “highly interactive”, and “require the development and utilization of networks, and they involve the utilization of diverse bodies of knowledge” (Hislop, 2005:160). This highlights the important role of networking for innovation. Meanwhile, considering the close relations between innovation, and knowledge and knowledge flow, it is necessary to understand what knowledge is.

2.3. What is knowledge?

Knowledge is seen as a dynamic human process of justifying personal belief toward the truth (Nonaka and Takeuchi, 1995: 58). Knowledge is different from information (Lilley et al., 2004). It is “information combined with experience, context, interpretation, and
reflection. It is a high-value form of information that is ready to apply to decisions and actions.” (Davenport et al., 1998:43). Knowledge also can be defined as being able to do something (Blackler, 1995).

Polanyi (1967: 7) thinks that knowing is composed of two different types of knowledge – practical (tacit) and theoretical (explicit) knowledge. Unlike explicit knowledge which can be verbalised, tacit knowledge is something which “we can know more than we can tell” (p.4). Nonaka and Takeuchi (1995) propose that knowledge be categorised into two different types of knowledge – tacit and explicit knowledge. They assert that tacit and explicit knowledge is distinctive: explicit knowledge is objective, sequential, and theoretical knowledge; it is knowledge of rationality. Tacit knowledge is subjective, simultaneous, and practical knowledge; it is knowledge of experience (ibid). Nonaka and Takeuchi (1995) think that tacit knowledge is highly personal, and difficult to formalise and communicate with others, as it consists of mental model, beliefs, and perceptions.

Nonaka and Takeuchi’s concept is criticised by a number of scholars. On the one hand, challenging the view that “tacit knowledge is mainly personal” (Nonaka and Takeuchi, 1995), Spender (1996) argues that tacit and explicit knowledge not only exist at individual level, but exist at organisational level as well. Four types of knowledge - individual tacit knowledge (automatic type of knowledge), individual explicit knowledge (conscious type of knowledge), organisational tacit knowledge (collective knowledge), and organisational explicit knowledge (objectified knowledge) - have interactive relations (Spender, 1996; 1998). Among those four types of knowledge, organisational tacit knowledge (collective knowledge) is the most important for organisation learning and organisation’s competitive advantage.

On the other hand, the dichotomy of tacit/explicit knowledge is questioned by researchers (Blackler, 1995; Hislop, 2005; Tsoukas, 1996; Werr and Stjernberg, 2003). Tsoukas (1996) argues that tacit and explicit knowledge is ‘mutually constituted’ as two inseparable aspects of knowledge, rather than two different types of knowledge. This is supported by Polanyi’s view (1969) that no knowledge is completely explicit, as
knowledge is "either tacit or rooted in tacit knowledge". Polanyi (1967:7-20) thinks that knowledge is composed of tacit and explicit knowledge, and explicit integration can not replace its tacit counterpart.

Tsoukas (1996) further points out that knowledge is inseparable from the particular context in which it is developed. In other words, knowledge is embedded in practice (Hislop, 2005). With such a consensus, research (Gherardi and Nicolini, 2002; Gherardi, 2000; Newell and Galliers, 2006; Orlikowski, 2002) suggests that knowledge is developed in people’s everyday interaction – in the process of knowing how to get things done in the context of established routines and procedures in organisational work. This kind of perspective on knowledge is called “practice-based epistemology” by Hislop (2005). Hislop (2005:29) points out that there are seven specific, but interrelated, factors of knowledge from “practice-based epistemology”, and that these seven factors are important for understanding knowledge. They are: knowledge is embedded in practice, tacit and explicit knowledge is inseparable, knowledge is embodied in people, knowledge is socially constructed, knowledge is culturally embedded, knowledge is multidimensional, and knowledge is contestable. The practice-based perspective on knowledge suggests that interactions in practice can help to share knowledge and to develop new knowledge, thus benefiting innovation.

3. Different Approaches to Managing Knowledge for Innovation

Based upon the understanding of innovation and knowledge, there are two different approaches to managing knowledge for innovation: the networking approach and community approach (Newell et al., 2002). Details are as follows.

3.1. Networking Approach

The networking approach draws upon the idea that social capital resided in social networks is one of important sources of innovation, as “innovation generally arises from a portfolio or network of actors and relationships” (Conway and Steward, 1998; Steward, 2001). The networking approach focuses on the factors which determine the access to
external resources for innovation. It suggests that knowledge be combined and exchanged via different networks to facilitate innovation (Nahapiet and Ghoshal, 1998). In the innovation literature, three distinctive characteristics of innovation networks are highlighted by research (Conway and Steward, 1998; Steward, 2001).

First, the key roles of external sources and boundary-spanning activity are important for obtaining innovation sources (ibid). Some individuals can play the role of boundary-spanners to obtain new ideas from outside by connecting external networks, and then sharing and diffusing those new ideas to people in their own organisation (Allen, 1977; Conway, 1997; Tushman and Scanlan, 1981).

Second, the diversity of internal and external actors involved in the development process provides innovation sources (Conway and Steward, 1998; Steward, 2001). In other words, innovation is benefited by gaining knowledge through internal ties based upon the internal interface between project groups, functional departments, and divisions (Conway and Steward, 1998; Steward, 2001); and also through external ties based upon the connection with research organisations, suppliers, competitors, users, consumers and distributors (Bessant, 1999; Grandori and Soda, 1995; von Hippel, 1988; Meeus, et al., 2001); and finally through various types of inter-organisation collaboration (strategic alliances, joint ventures, and partnerships).

Third, informal ties or personal relationships which supplement the formal ties within and between organisations benefit innovation. Informal networks are important for accessing and gaining new knowledge and ideas across the departmental and organisational boundaries (Conway, 1994; 1995; Freeman, 1991; Kreiner and Schultz, 1993; Steward and Conway, 1996).

However, there are also limitations in adopting the network approaching to managing knowledge for innovation. Because innovation is not only about searching for new ideas, but also about integrating and applying new knowledge, the networking approach faces challenges: to begin with, because knowledge is developed in a particular practice, it is
not easy to be understood and shared by people from a different context; moreover, lack of trust might impede knowledge sharing through social network ties. As Hislop (2005) points out,

"the difficulty faced by collaborators in innovation networks is that appropriate trust-based social relations may not exist ... it is not uncommon that the collaborators will have only limited acquaintance with each other, may have only limited common knowledge, and may have divergent values and identities." (p.170)

3.2. Community Approach
The community approach highlights the important role of trust and shared understanding in facilitating knowledge sharing and knowledge creation (Newell et al., 2002:155). First, by working together, the close interactions develop trust among the members (ibid). This kind of relationship positively influences members' attitude toward knowledge sharing.

Second, shared experience in practice helps to develop shared understanding amongst members of communities to facilitate knowledge sharing, as Orr (1990) puts it,

"Details of practice, including aspects of tacit knowledge, are part of the information circulating in the community memory. The common experience of practice provides the context which makes meaningful these points which could never be explained without the experience." (p.170)

Boland and Tenkasi (1995) further point out that joint work and shared narratives help to construct strong perspectives within a 'community' which are of importance for knowledge creation. Furthermore, narratives can create boundary objects which allow for perspective taking between communities (Boland and Tenkasi, 1995). Therefore, they can facilitate knowledge sharing between communities, and then benefit innovation.

However, there are also limitations of community approach. For instance, community approach is not effective in searching for innovation sources from external groups: because of strong and distinct perspectives, communities might disregard the value of knowledge from an external world, not to mention take the perspective from a different community. What's more, the community approach also fails to explain how better
connected communities tend to be more effective in accessing new knowledge for innovation.

3.3. The Link between Networking Approach and Community Approach

As discussed in Section 3.1 and 3.2, networking approach and community approach have their own strengths as well weaknesses in managing knowledge for innovation (see Table 2-1 for summary). In fact, these two approaches are complementary. Firstly, they have different focuses about the managing of knowledge flow. Networking approach emphasises the search for new knowledge from external sources, while community approach focuses on knowledge creation and the application of knowledge within communities. Because the searching for knowledge, and the creating and applying of knowledge are different but interrelated processes of innovation (Clark et al., 1992), these different focuses complement each other in explaining the link between knowledge flow and innovation.

Second, both approaches suggest utilising social capital for innovation but with different emphasises: network approach emphasises exploration from external sources, while community approach suggests exploitation of internal synergy. Since both internal and external knowledge are important for success innovation (see Tsai and Ghoshal, 1998; von Hippel, 1988), these two approaches are complementary in obtaining innovation sources.

Third, networking approach highlights boundary-spanning as important for innovation, while community approach underlines that trust and shared understanding are crucial for knowledge sharing and innovation. Since boundary-spanning, trust, and shared understanding stress the different but important factors of knowledge sharing, combining networking approach and community approach can help to understand knowledge flow and innovation from structural, relational, and cognitive aspects.

In addition, networking approach is related to social networks and the concept of social capital. Community approach is based upon the concept of COP. Therefore, social
networks, the concept of social capital, and COP are important for understanding knowledge flow and innovation. Next chapter will introduce these three concepts.

Table 2-1: Summary of different approaches to managing knowledge for innovation

<table>
<thead>
<tr>
<th></th>
<th>Networking Approach</th>
<th>Community Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding of knowledge</td>
<td>Knowledge is located external to the adopting unit in explicit or implicit forms</td>
<td>Knowledge is socially constructed, and embedded in practice</td>
</tr>
<tr>
<td>Primary activity with respect to knowledge</td>
<td>Knowledge is acquired through access to external networks and sources of information</td>
<td>Knowledge is created and applied through development of social communities</td>
</tr>
<tr>
<td>Critical resources for innovation</td>
<td>Social capital</td>
<td>Social capital and intellectual capital</td>
</tr>
<tr>
<td>Critical 'success factors'</td>
<td>Boundary-spanning</td>
<td>Trust and shared understanding</td>
</tr>
<tr>
<td>Related concepts</td>
<td>Social networks, social capital</td>
<td>COP, social capital</td>
</tr>
</tbody>
</table>

Source: Adapted from Newell et al. (2002:153).

4. Chapter Summary

Innovation is important for the competitive advantage of organisations. Innovation and knowledge are closely interrelated, because knowledge is the source of innovation, and innovation process is the process of sharing, exchanging, applying, and creating knowledge. Knowledge can be either personal or collective. It is embedded in practice, and it is both tacit and explicit. Tacit knowledge and explicit knowledge is indivisible.

There are two different but important approaches to managing knowledge for innovation: networking approach and community approach. These two approaches have strengths but also weaknesses. They are complementary in managing knowledge for innovation. These approaches are closely related to social networks, the concept of COP, and social capital. This suggests discussing these three concepts side by side with the investigation of knowledge flow and innovation.
Chapter 3

Interrelated Social Issues Which Affect Knowledge Flow

1. Introduction

As mentioned in the previous chapter, the concepts of social networks, COP, and social capital can help to understand knowledge flow and innovation. This chapter discusses how these concepts explain the complexity of knowledge flow from different angles, the limitations of these concepts, and how these three concepts can complement each other in bringing forth a holistic understanding about knowledge flow and innovation. Sections 2, 3, and 4 each focuses on one of these three concepts to review the history of their theoretical development, and their key ideas and limitations. Section 5 discusses the inter-relations between the key elements of these three concepts in depth.

2. The Social Network Perspective

2.1. The Origin of Social Network Concepts

The network perspective has a relative long and complex history of theoretical development. During the 1920's, it emerged from two bases: the structural concerns of the British anthropologist Radcliffe-Brown, and the 'gestalt' tradition in psychology, associated principally with the work of Köhler (Conway, 1994; Scott, 2000). The conceptual development of the social network perspective obtained nutrition from various disciplines of sociology, anthropology, and role theory (Tichy et al., 1979: 508).

Although the social network perspective has many very diverse strands in its theoretical development (Scott, 2000: 7), network research focuses on relations and patterns of relations (Kilduff and Tsai, 2003). Since the 1930's, the social network approach has been adopted in many research areas, and made great contribution to the studying of innovations (see Jones et al., 2001).

On the one hand, the social network approach provides a set of methods (Scott, 2000) to collect, analyse, and represent data, through which it is possible to investigate the source
of innovation, and paths of knowledge flow in different ways. Generally speaking, there are three orientations of network research: metaphorical, graphical and mathematical (Conway, 1997; Conway, 2001; Jones et al., 1998). Whereas mathematical orientation of network approach (social network analysis) requires complete coverage of network data, graphical orientation of network mapping approach allows research to investigate social relations and innovations with a small number of samples (Conway and Steward, 1998).

On the other, the social network approach contains various theoretical concepts (Degenne and Forse, 1999; Kilduff and Tsai, 2003) which help to understand knowledge flow and innovation from the angle of social structure and social relations (Rogers, 1987). Those various concepts can help to investigate knowledge flow and innovation from three different levels: tie level, individual level, and network level (Kilduff and Tsai, 2003). Following subsections discuss those theoretical elements of the social network approach from these three levels.

2.2. Tie Level Concepts

2.2.1. The Strength of Ties

The strength of a network tie is often linked to knowledge flow. The strength of a network tie refers to the frequency of actors' interactions, and the degree to which actors acknowledge and fulfil obligations (Aldrich, 1979; Mitchell, 1969; Tichy et al., 1979). Granovetter (1973) suggests that the strength of a tie between two actors should be evaluated by several factors: "the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie" (p. 1361). The strength of ties can therefore be described as weak (infrequent and distant relationships) and strong (frequent and close relationships) (Hansen, 1999; Krackhardt, 1992).

Strong ties and weak ties play different roles in facilitating/impeding knowledge flow and innovation. On the one hand, strong ties are effective in facilitating the sharing of contextual and tacit knowledge (Hansen, 1999), because strong ties can engender willingness and motivation to share this kind of knowledge (Granovetter, 1982). More
importantly, they can help to develop trust and foster shared values and norms of reciprocity (Dyer and Nobeoka, 2000; Gulati, 1995; Uzzi, 1997) which are essential for the sharing of contextual and tacit knowledge. However, close interactions in dense networks might lead to knowledge redundancy (Burt, 1992; Granovetter, 1973). Therefore, depending heavily on strong ties, organisations might become inward-looking, thus failing to acknowledge and obtain new ideas from external sources (Afuah, 2000; Rowley et al., 2000; Uzzi and Gillespie, 2002).

On the other hand, weak ties can facilitate knowledge flow by providing opportunities and channels to access new knowledge. According to Granovetter’s (1973) ‘strength of weak ties’ hypothesis, the advantage of weak ties is to play the role of bridges which link members from different groups, thereby allowing people to access information from external groups. Burt (1992) further points out that weak ties are of importance for organisation to avoid redundancy and find new and non-redundant knowledge. Many studies have indicated the importance of weak ties to knowledge flow and innovation. For instance, Flap et al. (1998) find that weak ties can help to spread new ideas, thus facilitating the diffusion of innovation in an organisation. Studying inter-firm networks, research (e.g., Hansen, 1999; Sako, 1992; Uzzi, 1996; 1997) concludes that weak ties can benefit knowledge flow and innovation by connecting disconnected actors, and by enabling them to access non-redundant knowledge and information. However, weak ties also had negative effects on knowledge flow and innovation. For instance, weak ties are not effective in transferring tacit knowledge (Hansen, 1999), and might also lead to lack of cohesiveness (Gales and Boynton, 1992), thereby causing problems to innovation success.

Recognising the negative and positive effects of strong/weak ties, recent research (Delbridge and Mariotti, 2007; Dhanaraj and Parkhe, 2006; Parkhe et al., 2006) argues that the effective network structure for innovation should be the combination of both strong and weak ties, and that organisations should pay attention to the process of network development to foster trust and develop social capital with the inward focus of strong ties avoided at the same time. However, what are the factors which influence the
effectiveness as well as the development of network ties has not been clearly discussed by researchers.

2.2.2. Multiplexity

Multiplexity refers to the degree that individuals are linked by multiple role relations (Tichy et al., 1979): for example, two actors are not only friends, but also co-workers, and members of a chess club. The strength of ties between actors connected by multiple relations is stronger than that of those linked by a single relation (ibid), because one part of the multiplex ties might reinforce other parts of ties (Boissevain, 1974:30). Since strong relations between actors indicate a 'greater motivation to be of assistance' (Granovetter, 1982:113) and better development of trust and norms of reciprocity between actors (Dyer and Nobeoka, 2000; Gulati, 1995; Uzzi, 1997) which is of importance for the sharing or exchanging of knowledge, multiplex relations might benefit knowledge sharing by increasing the strength of ties.

Moreover, social relations between actors are often developed from participating in shared activities or having a shared interest (Boissevain, 1974:28); therefore, multiple social relations which link two actors also indicate that the two actors have a 'multiplicity of interests' (Barnes, 1979:412), and have ability and motive to communicate with each other. And all of these might increase willingness and the ease of knowledge sharing between the actors. For instance, two actors are friends, and also team members who have cooperated in many different projects. As team members, they need to cooperate and communicate with each other, in order to accomplish the task; as friends, they are willing to help each other to solve problems in their work; thus, knowledge sharing between them might be motivated not only by the task of the project, but also by the goodwill derived from their friendships. In addition, it is more likely that by participating in many different projects and social activities, the actors have developed a shared understanding and common knowledge about their practice, which enhances their ability to communicate with and understand each other. As a result, it is relatively easy for them to share knowledge.

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2.2.3. The Forms and Bases of Network Ties

There are many different types of networks ties. Generally speaking, network ties can be identified as intra- and inter-organisational ties, and as formal and informal ties (Pittaway et al., 2004:36). Knowledge shared through those network ties is important for innovation. First of all, innovation often requires internal collaboration and knowledge integration between staff from different functions and business units (Hislop, 2005; Tsai and Ghoshal, 1998), thus sharing knowledge through intra-organisational ties based on inter-departmental or inter-unit collaboration which is important for innovation. On the other hand, because innovation process becomes more and more complex, and because knowledge relevant to innovation tends to be scattered amongst a great number of organisations rather than being possessed by a particular organisation (Baldwin and Clark, 2000; Powell et al., 1996; Tidd et al., 2001), network ties across organisational boundaries become of importance for innovation. Many studies (Dyer and Nobeoka, 2000; Meeus et al., 2001; Powell, 1998; Powell et al., 1996; Rowley et al., 2000; Ragatz et al., 1997; Shan et al., 1994; Tell, 2000; Tidd et al., 2001; Uzzi, 1996, 1997, 1999) demonstrate that external ties which connect different organisations (including suppliers, customers, universities, research institutions, and even competitors) benefit innovation by helping organisations to access external resources.

Secondly, network ties based on intra- or inter-organisational collaboration can be seen as formal ties, while informal ties refer to the network ties based on personal relations or friendships. In the literature of social network, the important role that informal networks play in facilitating knowledge flow and benefiting innovation is well recognised. Informal network ties connecting people from different organisations are important for innovation success in generating new ideas and receiving essential information from external sources (Allen, 1977; Freeman, 1991; Shaw, 1993; Conway, 1995; Pittaway et al., 2004). Krackhardt and Hanson’s study (1993) also shows that informal networks across different functions and divisions play as important a role in sharing information, solving problems, and getting things done within an organisation.
Conway's (2001) research further explores the "benign" but "complex and often dysfunctional" nature of informal networks (i.e. informal organisations), and the relations between informal and formal organisations. His study suggests that the nature of informal organisations and relations between informal and formal organisations are of importance for understanding knowledge flow. He points out that "a key characteristic of informal and social organisation is their tendency to span organisational boundaries: team boundaries, functional boundaries, and even the organisational boundary itself" (p.97). However, since informal organisations are often regarded by formal organisations as having divergent goals and objectives, or even representing competing power bases within organisations, the potential tension between the formal and informal organisations might restrict informal interactions and even dismantle the informal organisations (Conway, 2001). In other words, the interactions between formal and informal organisations have either positive or negative effects on the development of informal networks and knowledge flow. However, the question remain, what factors influence the interactions between formal and informal organisations? Understanding the backdrop of the interactions offers a better grasp of the contingent effects of the interactions on knowledge flow and innovation.

2.3. Individual Level Concepts

At individual level, strategic locations of some individuals in social networks are important for knowledge flow. Conway (1997) categorises three important boundary-spanning links which are important for accessing innovation sources: liaisons, bridges, and link-pin. These three strategic links highlight the three key positions of individuals in networks, each of whom plays an important role in obtaining and transferring knowledge in internal and external networks. These strategic key roles are gatekeepers, liaisons, and link-pins.
2.3.1. Gatekeepers

Gatekeepers are defined as “individuals who maintain consistent, ongoing contact outside their organizations, who understand the way in which outsiders differ in their perspective from their own organizational colleagues, and who are able to translate between the two systems” (Allen et al., 1979:703). Studies (Allen, 1977; Tushman 1977; Macdonald and Williams, 1993a, 1993b) suggest that gatekeepers play an important role of obtaining knowledge from external groups, and of diffusing the knowledge internally in innovation processes.

Tushman and Katz (1980) claim that when organisations face a changing environment, direct contact tends to be more effective in the transfer of complex information than indirect contact mediated by gatekeepers. However, Macdonald and Williams (1993a) argue that Tushman and Katz’s statement underestimates the difficulty of transferring knowledge across the organisational boundaries which divide the world into two parts, internal and external. They argue that the difficulty of transferring information across the organisational boundaries was because organisations have different approach to deal with knowledge, external information might be disdained. They further suggest that a senior position of gatekeepers in formal organisations can benefit the boundary-spanning knowledge flow by allowing the gatekeepers to determine what information is worth procuring.

2.3.2. Liaisons

Liaisons refer to individuals who link two or more cliques by connecting the gatekeepers of those cliques (Conway, 1997). Liaisons’ network ties link organisations to the external world (Schwartz and Jacobson, 1977). Significance of the strategic locations of liaison individuals in facilitating knowledge flow can be seen in Burt’s (1992) ‘structural holes’ theory and Granovetter’s (1973) argument of strength of weak ties, as liaison individuals are in the essential position of accessing non-redundant information from external sources. For their network ties connect external groups which are otherwise disconnected
without such networks ties. Moreover, Tushman and Scanlan (1981a, 1981b) observe that technically competent individuals tend to be more effective in linking different groups or organisations. Lindsay et al. (2003) also notice that liaisons’ experience and knowledge have a positive impact on their boundary-spanning behaviour, because those individuals are able to recognise, absorb, and transfer relevant knowledge.

2.3.3. Link-pins

‘Link-pin’ describes a network position of individuals who have direct connection with different groups by possessing multiple memberships of each of those groups (Conway, 1997; Lincoln, 1982). Since link-pin individuals have multiple memberships in more than two groups, they have close interactions with other members from those groups; therefore, they are able to develop trust amongst members from those groups, which facilitates knowledge sharing and learning (Deng and Poole, 2003). Conway (1997) finds that the link-pins are of informal and reciprocal nature. This indicates that multiple memberships of link-pin individuals can facilitate knowledge exchange not only between formal organisations, but also between informal groups/communities.

2.4. Network Level Concepts

The size of networks refers to the number of contacts involved in networks. According to the resource-based view, a large number of contacts indicate a relatively big amount of resources (i.e. knowledge, social capital) resided in the networks. For instance, the study of Shan et al. (1994) shows that having a big number of collaborative relations with other organisations contributes to innovation.

However, Burt (1992) argues that diversity of social networks tends to be more important than the size of networks for knowledge flow and innovation. Burt (1992) states,

“Size is the more familiar criterion. Bigger is better. ... But increasing network size without considering diversity can cripple a network in significant ways. What matters is the number of nonredundant contacts. Contacts are redundant to the extent that they lead to the same people, and so provide the same information benefits. ...
The structural holes argument is about the chasm spanned. It is the latter that generates information benefits. Whether a relationship is strong or weak, it generates information benefits when it is a bridge over a structural hole” (p. 16, 17, 28)

According to Burt’s (1992) theory of ‘structural holes’, highly diversified social networks which contain many structural holes can generate positive effects on knowledge flow, because structural holes indicate non-redundant contacts which provide access to non-redundant information for innovation. The value of diversity of networks for knowledge flow and innovation is validated by research (Perez and Sanchez, 2002; Romijn and Albu, 2002; Uzzi, 1996, 1997).

2.5. Summary and Reflection

Above-mentioned elements of social networks help to explain the link between social relations and knowledge flow from different levels. While the structural and relational factors which impact knowledge flow and innovation are emphasised, however, generally speaking, social network approach has little discussion about how cognitive factors might influence knowledge flow and innovation. It should be noticed that not only the strength of contacts but also the cognitive difference between contacts has effects on the interpretation and absorption of information. For instance, Ciborra (1993) notices that lack of shared values amongst managers negatively affects the procuring of external knowledge.

There are still many questions left unanswered by social network theory. For instance, with given that network ties which span structural holes are often based on personal contacts, what is the motive to utilise personal contacts so as to generate collective benefits? What kinds of ties spanning the structural hole are more effective in facilitating knowledge flow and benefiting organisations? How cognitive difference and group identity might influence knowledge sharing through different network ties? Those questions might be answered by combining social networks with the concepts of COP and social capital. Following sections introduce the concepts of COP and social capital, and illustrate the relations between these three concepts which help to answer these questions and to shed more light on knowledge flow and innovation.
3. The Concept of COP

3.1. The Origins of the Notion of COP

The concept of COP is based on Lave and Wenger's (1991) situated learning theory. Lave and Wenger (1991) use "legitimate peripheral participation" to describe the relations between newcomers (i.e., apprentices) and old-timers (i.e., masters) in a community of practice, and the process of knowing and identity changing, as well. In the beginning, because of lack of knowledge and skills, newcomers are not able to fully participate in doing work. They need to learn by observing old-timers and practicing, and then gradually increase participation in practice. This process is called "legitimate peripheral participation" (ibid). The learning process is also the process of identity change: when newcomers have learned all the necessary skills and knowledge of doing work, they become young masters. They move from "legitimate peripheral participation" to "central participation" (ibid) in practice.

The most important concept underpinning 'situated learning' theory is that learning is "an integral and inseparable aspect of social practice" (Lave and Wenger 1991:31). For Lave and Wenger (1991), knowledge must be gained in the process of participating in the practice, and interacting with people in the practice. This concept becomes fundamental for the concept of COP.

The concept of COP is adopted by many researchers to investigate knowledge flow (e.g., Brown and Duguid, 1991, Boland and Tenkasi, 1995; Brown and Duguid, 1998; Dougherty, 2001; Liedtka, 1999; Mitsuru, 1999; Swan et al, 1999; Wenger, 1998; Wenger and Snyder, 2000; Wenger, 2000) whose work shows that communities of practice contribute to organisation innovations by facilitating knowledge flow and knowledge creation. As Newell et al. (2002:120) point out that

"Unlike other types of social network, communities of practice support the work process directly by allowing individuals to share experience about their work and
thus understand it better … many of the usual barriers to knowledge-sharing are lower.”

3.1. What Are Communities of Practice?

Communities of practice refer to informal groups of people who have work-related relations (i.e., having common knowledge, shared experience about and shared interests in a particular practice) which help them to learn from and exchange knowledge with others, and to create collective knowledge easily. Communities of practice are often socially assembled groups of people which might not be recognised or formalised by formal organisations (Brown and Duguid, 2000). Conventional communities (ibid) or project teams in which people have little time to develop shared understandings well (Lindkvist, 2005) might not be considered communities of practice.

Wenger (1998) points out that a community of practice must have three essential elements - “mutual engagement, joint enterprise, and shared repertoire”; and these three elements can be used to identify communities of practice, as Wenger (1998) puts it:

“People must know each other well enough to know how to interact productively and who to call for help or advice. They must trust each other, not just personally, but also in their ability to contribute to the enterprise of the community, so they feel comfortable addressing real problems together and speaking truthfully. Through receiving and giving help they must gain enough awareness of the richness of the community to expect that their contribution will be reciprocated in some way.” (p. 230)

3.3. The Essential Elements of the Concept of COP

The concept of COP shows that mutually engaged practice helps leaning and knowledge sharing in a community of practice. It suggests that identity, and cognitive and relational factors are important for learning and collective knowledge creation.

3.3.1. Identity

Members of communities of practice have a sense of shared identity (Brown and Duguid, 2001). Identity influences the members’ attitude toward being cooperative in their shared
practice, and their willingness toward knowledge exchange (Wenger, 1998; 2000). Hildreth et al. (2000) even find that identity based on the strong personal relationships facilitates knowledge sharing between members of a community of practice. In Orr’s study (1990), the shared identity of photo-copier repair technicians as ‘heroic troubleshooters’ positively impacted the willingness to learn how to fix machines, and to exchange information about how to repair machines (Conto and as Willmott; 2003; Orr, 1990).

However, because people from different communities do not have shared history and experience of working together, they may either have a weak sense of common identity, or may have distinctive and separate identities (Hislop, 2005: 76). Research finds out that strong identity of members of communities of practice impedes knowledge flow between communities not only by overlooking external knowledge (Alvesson, 2000; Child and Rodrigues, 1996), but also by excluding people from outside of the communities (Wenger et al., 2002). The boundaries which define a community also become impediments of knowledge sharing between communities, as they “can obviously create dangers of exclusivity and insularity. Communities might become inward-looking and unable to recognize the contribution and knowledge of other groups” (Newell et al., 2002: 120); as a result, the communities become poor in absorbing new knowledge and ideas from outside (Hislop, 2005: 69).

3.3.2. Shared Language and Shared Value

In communities of practice, shared practice and shared experience of community members develop a set of shared meaning and shared language (such as technical jargon) by which the members communicate with each other (Newell et al., 2002). Shared language and meaning facilitate knowledge sharing and knowledge creation. For instance, Orr’ study (1990) about the community of photo-copier repair technicians shows that technicians exchanged ideas and shared information freely by telling stories about machines, customers, how they solved problems, etc.; those stories became collective knowledge to help them to define problems and solve problem in their practice. However,
without shared experience and mutual engagement in practice, it is not easy to share knowledge with people from different communities of practice, because between communities “the know-how, know-what, and warrants embedded in practice must separate out for knowledge to circulate. … Different communities of practice have different standards, different ideas of what is significant, different priorities, and different evaluating criteria” (Brown and Duguid, 1998: 101).

Communities of practice develop shared values, shared interests, and a common ‘world-view’ among members (Hislop, 2005:60). Developing shared values and a common ‘world-view’, or in Boland and Tenkasi’s term (1995), perspective making and perspective taking, is important for sharing the contextual knowledge. On the other hand, lack of shared values might form cognitive barriers which impede knowledge sharing between communities, as Boland and Tenkasi (1995:355) notice that “if members of a community create a strong perspective and do distinctive and important knowledge work, it will of necessity approach becoming incommensurable with other perspectives”. In other words, because of distinct values and interests, knowledge developed in a particular context of practice might not be acknowledged or accepted by people from different communities of practice.

3.3.3. Trust and Reciprocity

The concept of COP also highlights that trust and reciprocity are the important factors underpinning knowledge sharing. Firstly, mutual engagement in communities of practice enhances trust. In a community of practice, people engage in their mutual practice, and feel that they belong to the community; this kind of mutual engagement and belongingness is the foundation of interpersonal trust which helps them to anticipate benefits of knowledge exchange.

Moreover, mutual engagement in a shared practice develops norms of reciprocity and norms of cooperation. In order to get things done – the common goals of communities of practice, community members are cooperative, and willing to help each other. Based on
the norms of cooperation and reciprocity, knowledge sharing within communities of practice becomes relatively easy:

"Communities of practice support the work process directly by allowing individuals to share experience about their work and thus understand it better. This knowledge-sharing is facilitated by the norms of reciprocity – 'you help me and I will help you' – and the levels of trust generated amongst the community." (Newell et al., 2002: 120).

3.4. Summary and Reflection

The concept of COP emphasises the close relations between knowledge, knowing, and practice. It highlights that a common identity, shared meaning, shared values, trust, and reciprocity are important factors influencing knowledge flow within and between communities. However, overemphasising the value of COP might render the approach of COP incompatible with other perspectives. This leads to the overlooking of some facts: first, because community members might differ in personal knowledge and experience, they might have different reactions to the changing environment (Hislop, 2005:68) which influence the way they interact and share knowledge with others; second, knowledge can be shared not only within or between communities of practice, but also through people’s personal contacts and social networks. Therefore, it fails to explain how structural positions of individuals influence the access to knowledge, how different relations between individuals affect knowledge sharing, and the motivation to share knowledge through personal contacts. Next section introduces the concept of social capital followed by the section discussing how COP can combine with other concepts to answer these questions.

4. The Concept of Social Capital

4.1. The Origins of the Concept of Social Capital

The origins of the concept of social capital may be traced to community studies done by Jacobs (1965) showing the importance of the networks of strong personal relationships in developing trust and cooperation in the communities (Nahapiet and Ghoshal, 1998: 243). With different focuses, two sociologists Bourdieu (1985) and Coleman (1988) make great
contributions in the early stage of the theoretical development of social capital. They demonstrate that social capital can bring benefits to people through strong social relations within a community (Coleman, 1988), and by trading recourses of social connections (Bourdieu, 1985). Their studies took the lead in exploring the benefits of social capital from internal and external ties (Adler and Kwon, 2002).

Social capital is a concept which is widely adopted by researchers to explain “actors’ relative success in a number of arenas” (Adler and Kwon, 2002) since the 1980’s, such as career success, job hunting, resource exchange, and product innovation (e.g., Gabbay and Zuckerman, 1998; Tsai and Ghoshal, 1998), and so on.

4.2. The Definitions of Social Capital

Social capital can be defined as “the goodwill available to individuals or groups” (Adler and Kwon, 2002: 23). Nahapiet and Ghoshal (1998) think that social capital is possessed by both individuals and organisations; therefore, it is possible for organisations to make use of potential resources embedded in both internal and external ties. Nahapiet and Ghoshal (1998) define social capital as:

“The sum of the actual and potential resource embedded within, available through, and derived from the network of relations possessed by an individual or social unit. Social capital thus comprises both the network and the assets that may be mobilized through that network.” (p. 243)

Social capital is different from other kinds of capital, such as economical capital - money (Bourdieu, 1985). Lin (2002) further distinguishes social capital from human capital and cultural capital. Lin (2002) points out,

“[H]uman capital reflects technical knowledge and skills. … Cultural capital contains values, rules, and norms sanctioned by the dominant institutional field. Social capital reflects the extent of social connections, where embedded resources can be used to maintain or gain resource.” (p.190)

In a word, social capital is resided in social relations and structure of social connections.
4.3. Understanding the Concept of Social Capital

4.3.1. The Different Dimensions of Social Capital

Nahapiet and Ghoshal’s (1998) framework is useful in understanding the link between knowledge flow and utilisation of social capital. It explains that intellectual capital is created by exchanging and combining knowledge resided in people’s social networks. Nahapiet and Ghoshal (1998) list four elements as a “prerequisite” for people to exchange and combine knowledge: opportunity of accessing knowledge, anticipation of benefits of knowledge exchange and combination, motivation of engagement of knowledge exchange and combination, and capability of combining knowledge (ibid).

Nahapiet and Ghoshal (1998) initiatively break down the concept of social capital into three dimensions (structural, cognitive and relational), which makes the concept of social capital an analytical tool to examine knowledge flow. These three dimensions of social capital affect the four elements to combine and exchange knowledge. Details are as follows.

4.3.1.1. Structural Social Capital

Nahapiet and Ghoshal (1998) point out that the structural social capital influences knowledge flow by affecting the access to parties for combining and exchanging knowledge. For them, network ties provide access to resources and knowledge. Social capital is resided in internal networks, because close interactions of internal ties allow people to exchange ideas through internal ties (Coleman, 1988), and social capital resided in external ties (both formal and informal ties) allows people to access external information and new ideas (Belliveau et al., 1996; Burt, 1992).

influences access to information. Here network closure refers to “networks in which everyone is connected such that no one can escape the notice of others, with in operational terms usually means a dense network” (Burt, 2000: 351). In other words, ‘network closure’ shows that within a clique all actors have direct ties with the other actors in the clique (Kilduff and Tsai, 2003:133). This indicates a high degree of accessibility which allows people to exchange knowledge within the clique.

Furthermore, the sparse network, which is rich in structural holes and has few redundant contacts, is structural social capital, because it allows people to access non-redundant knowledge through non-redundant contacts (Burt, 1992). High degree of diversity of social networks means that the social networks contains many non-redundant contacts which can broker the flow of information between people who are on two sides of structural holes (Burt, 2000). Since “people on either side of a structural hole circulate in different flows of information” (Burt, 2000:355), non-redundant contacts can help to access to new and novel information (Edelman et al., 2005). Conway’s study (1997) shows that social networks containing a variety of external groups can generate positive effects on innovation, because there are many unpredictable opportunities to gain innovation resources from those external groups.

4.3.1.2. Cognitive Social Capital

Cognitive social capital is directly associated with the access to parties for knowledge exchange, and with the ability to anticipate and combine knowledge (Nahapiet and Ghoshal, 1998). Firstly, shared language (e.g., technical jargon) and shared understanding are important for people to exchange knowledge, because both help people to have good communication, and to understand contextual knowledge (Boland and Tenkasi, 1995; Brown and Duguid, 1991; Fiol, 1994). On the other hand, lack of shared language and understanding can impede knowledge flow. For instance, Storey and Barnett’s study (2000) shows that lack of shared understanding about the knowledge management programmes impeded knowledge flow and led to the failure of the knowledge management initiative. According to Carlile (2002, 2004), because of lack of shared language and understanding, syntactic and semantic boundaries impede knowledge flow.
Syntactic boundaries arise because of lack of a common lexicon, itself a platform of common knowledge for the sharing of knowledge between different communities. Semantic boundaries represent "novelty [which] makes some differences and dependencies unclear or some meanings ambiguous" (Carlile, 2004:558).

Second, shared interests are essential in accessing and sharing knowledge (Carlile, 2004). When there are shared interests, people are willing to exchange knowledge and to accept knowledge generated in a different context. However, when interests are in conflict, that leads to 'pragmatic boundaries' at which costs for learning new knowledge and transforming 'current' knowledge being used (Carlile, 2004:559) are needed to share knowledge. As a result, people might be unwilling to make such a change and to accept ideas or knowledge developed in a different context. Furthermore, since innovation often needs the collaboration between different departments, business units, and organisations, shared cause/effect beliefs (Thompson, 1967) are important for information exchange between those parties to achieve coordination. When there are different understandings about the cause/effect relations, it might cause problems for people to exchange information or to accept ideas from a different department, unit, or organisation.

Although above-mentioned cognitive barriers can impede knowledge flow at syntactic, semantic, and pragmatic boundaries, research suggests that effective boundary objects (Bechky, 2003; Carlile, 2002, 2004) and shared practice can help knowledge sharing at those boundaries, as boundary objects create a common ground for the sharing and understanding of knowledge developed in a different context. And, shared practice can establishes common interests which help to exchange and transform contextual knowledge (Carlile, 2004).

4.3.1.3. Relational Social Capital
Relational social capital directly influences the chance, anticipation, and motivation to combine and exchange knowledge (Nahapiet and Ghoshal, 1998). Trust and norms are two essential elements of relational social capital. Firstly, trust is essential for gaining
benefits from social interactions, because “trust may both open up access to people for
the exchange of intellectual capital and increase anticipation of value through such
exchange” (Nahapiet and Ghoshal, 1998: 254-255). Without trust, people might not be
able to notice the value of others’ knowledge, and thus knowledge/information flow
might be impeded. There are also different types of trust. Luhmann (1988) thinks that
trust is about an attitude toward uncertainty, and willingness to risk. Based on different
sources and development process, trust can be divided into three different types –
companion trust, competence trust, and commitment trust (Newell et al, 2002).
According to Newell et al. (2002), companion trust is “based on judgement of goodwill
or personal friendships” (p. 58); competence trust is “based on perceptions of others’
competence to carry out the tasks that need to be performed and will be important where
the skills needed to perform a task are not able to be found within one person” (ibid);
commitment trust is based on formal obligations and contractual agreements to make the
effort to solve conflicts and complete the joint work (ibid).

Secondly, norms constitute “a powerful though sometimes fragile form of social capital”
(Coleman, 1988: s104). Fukuyama (1997) describes social capital as “the existence of a
certain set of informal values or norms shared among members of a group that permit
cooperation among them”. For instance, norms of cooperation help people to be
cooperative in their joint work; norms of reciprocity are a fundamental element of social
capital (Edelman et al., 2004). There are also other norms which are important for social
capital. Edelman et al. (2005) identify that the norms of professionalism affected trust
between different medical professionals, and so did the norms of control and compliance.
As they put it, “social capital can form unwritten norms of control and compliance among
actors in projects, thereby limiting beneficial innovative organizational activities in that
they deter individuals from deviating from established norms” (p.166). The study by
Edelman et al. (2004) suggests that relational norms are important to create a “helpful,
trusting, knowledge-sharing environment however, if abused they can induce individuals
to closely guard their knowledge and thus, be a disincentive to knowledge dissemination”
(p.S66). Therefore, norms could be “a significant influence on exchange processes,
opening up access to parties for the exchange of knowledge and ensuring the motivation to engage in such exchange” (Nahapiet and Ghoshal, 1998: 255).

4.3.1.4. Interactions between the Three Dimensions of Social Capital

Interactions between the three dimensions of social capital influence knowledge flow. First of all, relational social capital and structural social capital interrelate. A study by Tsai and Ghoshal (1998) about intra-firm networks shows that frequent and close social interaction - strong ties - can cultivate trust to facilitate innovation. Edelman et al. (2005) find out that strong norms of reciprocity and trust develop “both strong and multiple social linkages” (p.167) of a group. These strong links facilitate knowledge flow within the group, but, on the other hand, impede the group members to gain information from outside of the focal group.

Second, cognitive social capital and relational social capital interact with each other. For instance, shared language and shared experience foster competence trust (Newell et al., 2002); shared cause/effect beliefs (Thompson, 1967) cultivate commitment trust (Newell et al., 2002); and, shared values assists the development of trusting relationship (Tsia and Ghoshal, 1998: 466). On the other hand, lack of trust affects the cognitive social capital. Edelman et al. (2005) show that lack of trust between healthcare professional groups in different professional disciplines (i.e., consultants and optometrists) impeded the inter-group communication and the development of new cataract procedures. But once consultants broke their norms of professionalism and trusted the optometrists’ ability to work by following the new procedures, inter-group communication became easier.

In addition, cognitive social capital influences structural social capital, and then affects knowledge flow. For instance, people would like to “interact with others who are similar to themselves in important and salient respects” (Kilduff and Tsai, 2003:49). Since people might prefer to make friends with those similar to themselves, the extent of personal social networks might be restricted by their preference for those possessing similar beliefs and world-views.

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4.3.2. The Contingent Effects of Social Capital

Researchers notice that there are different purposes behind the utilising of social capital. For instance, Lin (2002:29) regards social capital as “resources embedded in a social structure that are accessed and/or mobilized in purposive action”. This indicates that social capital is resided in both formal and informal social networks, and people may make use of social capital intentionally. Knowledge exchanges between actors are purposive actions. The purposes of exchanging knowledge might not correspond with organisational goals. Therefore, social capital might not always generate positive effects for organisations, as Portes (2000) mentions about the uncertainty of the outcome of social capital:

“The ready attribution of positive effects to social capital, be in its individual grab as social networks or in its collective one as civic spirit, is premature because observed effects may be spurious or because they are compatible with alternative explanations arising from different theoretical quarters.” (p.10)

Corresponding with the view of ‘purposive action’ (Lin, 2002) to mobilise social capital and with uncertain positive effects of social capital (Portes, 2000), Adler and Kwon (2002) go further, arguing that social capital has benefits, risks, and contingencies feature. In other words, different structure and content of social relations might generate positive and/or negative effects of social capital. Adler and Kwon (2002) discuss social capital from the assumption that the behaviour of social exchange can be explained in terms of three elements: opportunity, motivation, and ability. And social relations have both positive and negative influence on these three elements. Adler and Kwon (2002:18) think that social relation, in which favours and gifts are exchanged, constitutes the dimension of social structure underlying social capital. Like other resources, knowledge is exchanged as favours or gifts. Because individuals have different motivations and purposes in exchanging knowledge, the outcome of their actions might benefit some people while doing harm to others. Therefore, individuals’ intentional action to mobilise social capital might be beneficial as well as risky to organisations.
Focusing on both ‘structure and content of the actor’s social relations’ (Adler and Kwon, 2002:23), Adler and Kwon suggest that internal and external ties, and the closure of the network structure affect the opportunity of social capital transactions, and that norms of ‘communities’ influence the motivation to exchange resources. Therefore, social capital could be beneficial, risky, and contingent. Edelman et al. (2004) also suggest that social capital have “benefits” as well “pitfalls”. Their empirical evidence supports their argument that social capital has both bridging and bonding effects for knowledge/information flow:

“[O]ur findings indicate that social capital can be a positive force for accessing information. However, organisational contextual factors, such as restructuring, barriers between disparate groups within the organisation as well as the prevailing normative structure can lead to disincentives to knowledge dissemination” (p. 62).

In a later study, Edelman et al. (2005) further examine the interactions of three dimensions of social capital in relation to knowledge flow. They state that “the structural, cognitive, and relational dimensions of social capital interact. These interactions’ effects magnify the benefits and the drawbacks of utilizing social capital.” (p.168)

4.4. Summary and Reflection

The concept of social capital explains not only the opportunities offered by social networks, but also the capacities, and relational and cognitive factors which influence the utilisation of those social connections for knowledge exchange. The three dimensions of social capital provide a useful framework for examining the factors which affect knowledge flow and innovation.

However, the idea of the structural social capital tends to focus on the type of network ties and configuration of networks, but ignores the influence of the structural position of key individuals and strength of ties. Strength of ties is related to the different content of knowledge flow (Hansen, 1999; Uzzi, 1997) required at different stages of innovation (Nooteboom, 2000), and strategic positions of key individuals are clearly related to the access to external resources (Conway, 1997). Ignoring these two points fails to appreciate
how the structural social capital influences knowledge flow and benefits innovation in
different ways.

In addition, without considering the identity and memberships of people in different
communities of practice, the contingent effects of social capital can not be fully explored:
what causes lack of shared language and meaning? How different norms and trust are
developed, and influence knowledge flow between and within groups in different ways?
Therefore, there is a need to combine the concepts of social networks, COP, and social
capital to investigate knowledge flow and innovation. The next section discusses how
these three concepts are interrelated, and present a holistic understanding of knowledge
flow and innovation.

5. The Interrelated Elements of Those Three Concepts

5.1. The Direct Link between Structural Social Capital, Social Networks, and COP
Social networks and the concept of social capital are correlative and inseparable. First,
social networks are structural social capital (Burt, 2000; Nahapiet and Ghoshal, 1998),
because social networks contain different resources (including knowledge) which can
benefit individuals or organisations. Social networks determine the access to internal and
external resources. As mentioned in Section 4.3.1.1, social networks and the different
configuration of social networks (size and diversity of networks) are the essential
elements of the structural social capital.

Second, there are other elements of social networks which complement the concept of
social capital. For instance, multiple connections indicate the presence of strong ties
between actors (Tichy et al., 1979), and the strong ties are effective in the sharing of
complex and contextual knowledge (Hansen, 1999), but strong ties might also lead to
redundant knowledge, and restrict searches for new ideas from external world (Uzzi,
1997; Uzzi and Gillespie, 2002). Furthermore, strong ties between members of
communities of practice might also develop strong and distinct identities which exclude
people from outside of the communities (Wenger et al., 2002), thus impeding knowledge
flow between communities of practice. Meanwhile, weak ties are effective in searching for explicit knowledge and new ideas, but ineffective in facilitating tacit knowledge (Hansen, 1999; Uzzi, 1997). Therefore, strength of ties has both positive and negative effects on knowledge flow and innovation.

In addition, the strategic positions of key individuals are implicit in any discussion of social capital. Because key individuals (gatekeeper, liaison, and link-pin) play an important role in accessing non-redundant knowledge (Conway, 1997) and transferring knowledge (Allen, 1977; Tushman, 1977), it is important to understand how their structural positions and characteristics generate different benefits to social capital.

Therefore, combining the elements of social networks and COP with social capital allows a comprehensive investigation of knowledge flow from the level of individual, ties, and network. It explains how communities of practice can benefit from some members (i.e. gatekeepers and link-pins) for their access to new knowledge. It also helps to appreciate the contingent effects of social capital on knowledge flow.

5.2. The Link between Cognitive Social Capital and COP

The concepts of COP and the cognitive social capital are mutually supported. Both the concepts of COP and the relational social capital talk about shared language and meaning. COP explains the causes of lack of shared language and meaning. As mentioned in Section 3.3.2., by participating in their shared practice, community members develop a set of shared language and meaning, and shared values (Boland and Tenkasi, 1995). The shared language and meaning not only help community members to have better communication to facilitate learning and knowledge sharing amongst the members, but also help the creation of collective knowledge (Brown and Duguid, 1991, 1998; Orr, 1990).

However, because knowledge is developed in different context of practice, members from different communities of practice might not have shared language and meaning, and shared values (Brown and Duguid, 1998; Boland and Tenkasi, 1995). Lack of shared
language gives rise to syntactic boundaries and semantic boundaries (Carlile, 2002, 2004); and lack of shared values and interests causes pragmatic boundaries (ibid), thus negatively influencing the cognitive social capital. On the other hand, when communities of practice overlap, joint work and close interactions help the ‘perspective taking’ (Boland and Tenkasi, 1995) to develop a common understanding of the practice amongst members from different communities. In addition, the multiple memberships of individuals in different communities indicate that those individuals have something in common with people from those communities in terms of shared language and values, thus reducing the difficulty in sharing knowledge.

Therefore, since COP suggests that shared language and meaning be related to interactions in practice, it can help to explain how cognitive factors influence knowledge sharing through different types of network ties (weak/strong ties). Moreover, because COP emphasises the inseparable relation between knowing, knowledge and practice, and the concepts of COP helps to understand the cause of lack of shared language and meaning, and why the cognitive social capital has different effects on intra- and inter-group knowledge flow.

5.3. The Link between Relational Social Capital and COP
The concept of COP and the relational social capital can reinforce each other. First, COP helps to explain why trust can generate different effects on utilisation of social capital and knowledge flow. Mutually engaged practice and frequent interactions between members of communities of practice foster companion trust and competence trust (Newell et al., 2002) amongst them. However, without shared history of working together, people from different communities might have little companion trust and competence trust, and lack of trust impedes knowledge sharing between them. Therefore, COP helps to explain the contingent effects of relational social capital in relation to intra-group and inter-group knowledge flow.

Second, COP suggests that reciprocity and norms of cooperation are important for knowledge sharing. However, the relational social capital suggests that there are different
norms influencing knowledge sharing, such as norms of professionalism, and norms of control and compliance. Those norms influence the interpersonal relations as well as relations between communities. Therefore, the relational social capital helps to explain the difficulties and ease of knowledge sharing between communities of practice.

5.4. Summary and Reflection

Social networks ties and social network configuration are essential parts of the structural social capital. Taking into account the strength of ties and structural positions of key individuals, understanding of the contingent effects of structural social capital on knowledge flow and innovation can be furthered. Revealing the inseparable relations between knowledge and practice, COP explains how shared language and meaning are developed in mutually engaged practice. Meanwhile, shared practice and close interactions also develop trust and norms of reciprocity. Those explain the contingent effects of cognitive and relational social capital regarding intra- and inter-group knowledge sharing.

In a word, the elements of social capital and COP can reinforce Nahapiet and Ghoshal’s framework (1998) of the three dimensions of social capital to examine the factors influencing knowledge flow and innovation. Table 3-1 summarises the theoretical elements of those three concepts.

However, it is still insufficient to investigate knowledge flow simply by combining these three concepts without discussing power relations. For instance, structural positions in social networks are related to power (Brass and Burkhardt, 1992); since the strategic links are based mostly on informal ties or personal relationships, rather than on organisational roles (Conway, 1997), the questions remain: what is the motivation behind the utilising of personal contacts to increase organisational social capital, and what kind of connections can bring more benefits to organisations? And when there are conflicts between individuals/communities, how will knowledge flow be affected? Next chapter will discuss why power issues are important, and how the relations of power are related to knowledge flow and utilisation of social capital.
Table 3-1: Summary of the elements of the three concepts

<table>
<thead>
<tr>
<th>Elements</th>
<th>Social Networks</th>
<th>COP</th>
<th>Social Capital</th>
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<tbody>
<tr>
<td>Strength of network ties</td>
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<td>✓</td>
<td></td>
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<tr>
<td>Multiplexity</td>
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<td>✓</td>
<td></td>
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<tr>
<td>Formal/Informal ties</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Internal/External ties</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Key individuals (gatekeeper, liaison, link-pin)</td>
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<td></td>
<td></td>
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<tr>
<td>Diversity and size of networks</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Trust</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Reciprocity</td>
<td>✓</td>
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<tr>
<td>Other Norms</td>
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<td>✓</td>
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<tr>
<td>Identity</td>
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<td>✓</td>
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<tr>
<td>Multiple membership of communities of practice</td>
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<td>Shared practice</td>
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<td>Shared values and interests</td>
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<tr>
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<tr>
<td>Contingent effects of social capital</td>
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6. Chapter Summary

This chapter reviews the history of theoretical development and the key elements of social networks, the concepts of COP and social capital regarding knowledge flow and innovation. These three concepts present their own unique angles to view knowledge flow and innovation, but also reinforce each other. Social network ties, network configuration, strength of ties, strategic position of key individuals, and strong but exclusive identities of members of communities of practice influence the effects of the structural social capital on knowledge flow. The shared practice develops shared language and meaning, trust, and norms of reciprocity among members of communities of practice. Different norms affect intra- and inter-group knowledge sharing. Those help to explain the contingent effects of the cognitive and relational social capital. Multiple memberships of communities of practice can lower the cognitive barriers to generate positive effects of the cognitive social capital. In addition, while combining the elements of the three concepts can strengthen Nahapiet and Ghoshal’s framework (1998), there is still a need to discuss the influence of power relations on knowledge flow and innovation.
Chapter 4

The Influence of Power on Knowledge Flow

1. Introduction

As discussed in the last chapter, the elements of social networks, and the concepts of COP and social capital can complement each other in examining knowledge flow and innovation, but there is still a need for taking power relations into account. The aim of this chapter is to discuss why power is an important issue for understanding knowledge flow, and how it influences knowledge flow.

The discussion is split into three sections. By reviewing the literature on social networks, social capital, and COP, Section 2 shows that power relations are important, but are not fully explored for the understanding of knowledge flow and innovation. Section 3 introduces different frameworks in power literature. Section 4 employs Hardy’s framework (1994; 1996) to discuss how different dimensions of power are related to knowledge flow and the utilisation of social capital.

2. Relatively Unexplored Issues of Power in the Literature

In the knowledge sharing and learning literature, power issues have gradually been recognised as being important for understanding knowledge flow, but remain relatively unexplored. Hislop (2005:87) points out,

“One of the defining characteristics of the vast majority of the writing on knowledge management is that any discussion of power is typically absent, … Thus, understanding the relationship between power and organizational knowledge processes is of fundamental importance, and the task of doing so is magnified by the general absence of such an analysis.”
As discussed in the previous chapter, the elements of the three concepts (social networks, social capital, and COP) bring forth a better understanding of knowledge flow. Therefore, it is necessary to review how the power issues present in the literature are related to these three concepts. So doing can help in understanding, firstly, why power issues are important for the understanding of knowledge flow and innovation; and secondly, how a partial discussion of power in the literature leaves untouched questions about how to explain knowledge flow, and calls for further investigation on power issues.

2.1. Power Influence Discussed in the Literature on Social Networks

The connections between power and elements of social networks are made evident in the literature on social networks. Firstly, social networks and structural positions are linked to power sources. For instance, Brass (1984) suggests that informal and formal networks are important bases of power. Conway's research (2000) shows that while formal networks have legitimate power, informal networks have power derived from knowledge. Meanwhile, positions in different formal and informal networks are seen not only as the important factors influencing knowledge sharing, but also as sources of power for controlling resources (Brass, 1984; Brass and Burkhardt, 1993). For example, betweenness centrality is considered as having power to control information and manage dependency (Brass and Burkhardt, 1992). Betweenness centrality of an actor refers to "the extent to which an actor serves as a potential 'go-between' for other pairs of actors in the network by occupying an intermediary position on the shortest paths connecting other actors" (Kilduff and Tsai, 2003:132). High level of betweenness centrality offers individuals many alternative resources, and other people might depend on those highly centralised individuals to quickly access information and resources. Similarly, the structural positions of gatekeepers (Allen, 1977; Tushman and Katz, 1980) and liaisons (Tichy, 1981; Conway, 1997) between gatekeepers become power resources of those individuals, because other individuals might rely on those strategic links to access non-redundant information from external sources.
Second, it is suggested that the development of social networks is influenced by the exercise of power. For instance, research (Conway, 2000; Jones and Beckinsale, 2001) shows that political issues influence the mobilisation of informal network ties through which knowledge is shared for solving technical problems. Swan and Scarbrough’s study (2005) suggested that power can be used to control resources, processes, and meaning to influence networking and ‘networked innovation’. Moreover, power relations not only influence the development of networks, but also affect the effectiveness of networking in innovation (Coles et al., 2003; Harris et al., 2000).

By and large, the social network literature shows that social networks, knowledge flow, and power are closely interrelated. In the social network literature, however, the discussion about the influence of power on knowledge flow and innovation is still unsatisfactory, especially with regard to the discussion of the power embedded in institutional and national context – what Hardy (1994) refers to as ‘the power of the system’. For instance, while research shows that the institutional environment influences inter-firm networking and innovation (Furtado, 1997; Nooteboom, 2000; Rothschild and Darr, 2005), the question remains unanswered – how does the power of the system embedded in a wide context influence the development of social networks, knowledge flow, and innovation? As Meyer-Stamer (1995) notices, applying the idea of inter-firm networking to innovation in different countries yielded different results, so it might be inferred that cultural context has an underlying influence on networking and innovation. The importance of investigating the influence of the power of the system for the understanding of knowledge and innovation will be fully discussed in Section 4-4.4.

2.2. Power Influence Discussed in the Literature on COP

Many researchers, especially those taking practice-based approaches (i.e., Hislop, 2005), have been aware of the importance of power issues related to knowledge management. In the literature on COP, Prichard (2000:193) criticises that the weakness of COP theory in that it does not address power issues in its analysis of the learning process. Fox (2000) also thinks that power issues are ignored in the theory of COP, and clearly points out that
when communities of practice face a changing environment, there are power conflicts within communities of practice. On the one hand, newcomers face dilemmas of learning and identity – they need to learn from masters by engaging in existing practice, but also to establish their own identity by developing new knowledge in the changing environment (Lave and Wenger, 1991: 115); on the other hand, “different masters may compete with each other in leading the way to the future. Alliances between masters and young masters can be crucial to the outcome of such struggles.” (Fox, 2000: 856)

In a recent study, Contu and Willmott (2003) investigated power relations in COP. They critically review the arguments made by Lave and Wenger (1991) in the theory of ‘situated learning’ which is the foundation of the notion of COP. It is argued that power relations were the centre of situated learning theory, but have been “largely unheeded by those eager to appropriate Lave and Wenger’s thinking for other purposes” (Contu and Willmott, 2003:286). To support their argument, they quote from Lave and Wenger’s book, Situated learning, that legitimate peripherality is “a complex notion implicated in social structures involving relations of power”, and “can be a source of power of powerlessness, in affording or preventing articulation and interchange among communities of practice” (Lave and Wenger, 1991:36). They further state that the notion of communities of practice “highlights the power-invested process of bestowing a degree of legitimacy upon novices as a normal condition of participation in learning processes.” (Contu and Willmott, 2003:285)

Contu and Willmott’s discussion of power focuses on employment relations. Contu and Willmott (2003) point out that the hierarchical positioning and identities of employees affect knowledge sharing significantly. In order to illustrate their argument, they use Orr’s case study (1990) about photo-copier repair technicians as an example to examine how power relations influence the willingness to share knowledge in the community of the technicians. For them, the power relations embodied in employment relationships influence knowledge sharing. As they put it:
"A contradictory effect of management’s efforts to introduce prescribed procedures was to strengthen and defend the technicians’ sense of identity as heroes, which also had the unintended beneficial consequence, from a managerial standpoint, of enrolling technicians’ commitment to fixing the machines, and thereby minimizing machine downtime with positive outcomes for customer services and profitability.

The contradictory organization of the employment relationship ... is of direct relevance for understanding why, for example, there is frequently overt or covert resistance to management’s priority of sharing knowledge within and between workplace ‘communities of practice’.” (p.293)

Contu and Willmott’s study (2003) demonstrates that knowledge sharing is closely related to power relations. However, their discussion about the influence of power is very limited in scope. It has been disregarded by them that, firstly, hierarchical power is only one among various forms of power affecting knowledge sharing; and that, secondly, hierarchical power not only is used to control work procedures, but also has other effects which might influence knowledge sharing indirectly. For instance, hierarchical power might influence relational social capital (i.e. norms) which restricts the way people interact with each other; it might also affect structural social capital, such as the communication networks through which people exchange ideas. In addition, conflicts may exist not only at the hierarchical level, but also among members within communities of practice, and between communities of practice, and between organisations. And those conflicts might lead to negative effects on knowledge sharing.

One reason for Contu and Willmott’s limited discussion of power (2003) might be because they rely heavily on the secondary data from Orr’s study, collected for a different purpose. This reminds us that there is a need to further the investigation of power issues, both theoretically and empirically.

2.3. Power Influence Discussed in the Social Capital Literature

In the social capital literature, the link between power and social capital has been explicitly discussed. Social capital is clearly linked to the use of power and power resources (Burt, 1997; Portes, 1998). In their recent study, Willem and Scarbrough (2006)
explore the link between social capital, knowledge sharing and power relations. Their findings about the benefits and drawbacks of social capital suggest that while power relations can enhance knowledge sharing, they also inhibit the sharing of knowledge. Considering control of power source, political actions and opportunistic behaviours lead to selective knowledge sharing. In the social capital literature, the power issues are also seen in the discussion of the effects of structural and relational social capital.

The study of Szreter (2002) shows that the effects of social networks (structural social capital) are related to power and politics. Bonding effects of social capital is found in powerless people's controlling information and resources embedded in their social networks. Empowering those who are powerless, and gaining political support from them, is the way to benefit from 'bridging' effects of social capital - utilising information and resources embedded in those networks. Moreover, legitimate power, to some degree, responds to the emergence and/or decline of informal communication networks (see Conway, 2000). When informal communication is supported by formal organisations, legitimate power can produce positive influences on the utilisation of the structural social capital. Legitimate power can also produce negative influences on the utilisation of the structural social capital by restricting informal communication. In addition, because of their legitimate power, senior members who act as gatekeepers tend to be more powerful in internal and external knowledge exchange (Macdonald and Williams, 1993a); thereby, it is more likely for them to bring in the benefits of social capital. Lin (2002) also links hierarchical position with social capital. People in high hierarchical positions are powerful and are able to access/exchange resources embedded in hierarchical positions.

Power relations are also associated directly with norms – one of the essential elements of relational social capital. On the one hand, different power relations have different impacts on norms. For instance, resource interdependency relations (Hardy, 1994) between actors can generate norms of cooperation. Based on norms of cooperation, people are willing to exchange information and offer help, because cooperative behaviour is expected by the norms (Kramer and Goldman, 1995). Hierarchical norms reflect the power relations of employment (see Contu and Willmott, 2003). Hierarchical norms can enhance the
utilisation of social capital by facilitating knowledge sharing. On the other hand, the concept of Lukes’ (1974) third dimension of power suggests that the power of norms influence people’s behaviour. Symbolic power can influence preference and promote shared norms (Hardy, 1994). Social norms in a particular society define the way people interact with others, thereby influencing the utilisation of relational social capital. For instance, Japanese’s values of viewing “self and others as two sides of one coin” (Nonaka and Takeuchi, 1995) are the backdrop of norms of cooperation found in Japanese companies. The norms facilitate knowledge sharing in Japanese companies.

However, there is still a need to further address the above interactions between power and social capital. Without explaining power relations, the questions remain unanswered – what determines the opportunity to generalise benefits from social capital? What kind of structure of social networks and relations can facilitate knowledge flow and innovation more effectively? And, how does cultural context influence knowledge flow and innovation?

To sum up, although the influence of power relations on knowledge flow and innovation has not been fully explored in the literature on social networks, social capital, and COP, previous research reveals that power and knowledge flow are closely interrelated, and that power relations are important for a better understanding of knowledge flow and innovation. This calls for a comprehensive and systematic study of power issues. The next section introduces different frameworks of power, and discusses why Hardy’s framework (1994; 1996) is employed in this research to investigate the influence of power on knowledge flow and innovation.

3. Brief Introduction of Different Frameworks of Power

Power has been labelled as one of the most complex concepts (Clegg, 1989; Hardy, 1994). In the literature on power, various objects and a broad range of focuses have been included in the debate on power. Generally speaking, there are two different views about
power in relation to knowledge management: power as resources, and power as multi-dimensional forces (including Foucault’s concepts of power). The following two subsections discuss the different concepts of power and how they are related to knowledge flow.

3.1. Power as Resources

Sources of power explain where power comes from. Different sources of power have been discussed in the power debate. For instance, research (French and Raven, 1959; Raven, 1965) suggests that the bases of power can be categorised as coercive power, legitimate power, reference power, expert power, legitimate power and informational power. For French and Raven, power comes from structural position, and personal reputation and knowledge (Brass, 1984). French and Raven’s typology of power (1959) is criticised by those who view power as resources (e.g., Bacharach and Lawler, 1980; Hales, 1993; Handy, 1981). They think that French and Raven’s framework (1959) confuses power resources with the use of power resources, and that legitimacy should not be seen as a distinct type of power, but a dimension of all forms of power (Hales, 1993) - the use of different mechanisms includes the use of certain ideas, values, and demands (Pettigrew, 1977) to create legitimacy to serve one’s own interest. By taking the perspective of power dependency, Hales (1993:22) suggests that power resources can be divided into four categorises: physical, economic, knowledge, and normative power resources. Hislop (2005) further suggests that social capital should be considered an important source of power.

In spite of the controversy about typologies of sources of power, there is a consensus among those taking the ‘power as resources’ approach that knowledge/expertise is considered one of the important power resources. For them, power relations in an organisation involve the use of different power resources (i.e., money, relevant knowledge, ideas and values) so as to influence others, and control and use of knowledge is an importance way to serve one’s interests (Hales, 1993; Pettigrew, 1973; Pfeffer, 1981).
However, there are limitations in taking the ‘power as resources’ approach to view the relations between power and knowledge flow. By taking the ‘power as resources’ approach, knowledge sharing/hoarding behaviour is interpreted as political action to control knowledge with an eye to protecting/pursuing one’s benefits and serving one’s interests. However, the ‘power as (knowledge) resources’ approach takes a ‘commodified’ view of knowledge that is to disagree with the practice-based perspectives on knowledge (Hiplop, 2005). Moreover, taking this approach makes it difficult to explain the effects of process power (see Contu and Willmott, 2003) and symbolic power (Lukes, 1974) on knowledge flow. The next subsection dwells upon Hardy’s framework (1994; 1996) of four dimensions of power - a hybrid framework which can be used to examine the relations between power and knowledge flow from multiple dimensions.

3.2. Different Dimensions of Power

The concepts of four different dimensions of power are included in Hardy’s framework (1994, 1996). Those concepts explain power relations and what power does from different angles. Foucault’s concept of power is also included in Hardy’s framework. The hybrid framework has strengths as well weaknesses in studying knowledge flow. Details are as follows.

The first dimension of power is based on Dahl’s concept (1958, 1961) of ‘one face of power’ (Clegg, 1989). Dahl (1958, 1961) points out that power is the interdependent relations between different groups/individuals, and that different groups/individuals have unequal power and are able to participate in the political decision-making process. Dahl’s concept of power challenges the concept that power is in the hand of few individuals or a particular group. For Dahl, power is exercised when there is overt conflict. That is, because different groups and individuals have different preferences regarding political issues, they use power to influence decision-making for their own preferred outcomes. In fact, the concept of ‘one face of power’ still views ‘the power as resources’.
The ‘one face of power’ concept is criticised by the later research. For instance, Bachrach and Baratz (1962) discover that the concept of ‘one face of power’ veils the fact that because some people are excluded from decision-making process, they are unable to get involved in the decision-making process. There is covert conflict when some people are excluded from the decision-making process. Bachrach and Baratz (1962) argue that power can be used not only to make something happen, but also to stop other things from happening. In other words, that some people are unable to get involved in the political decision-making process is because dominant groups use power (e.g., regulations, rules, and other political means) to diminish the opposing groups’ capability of resisting their decision so as to prevent the opposing people from accessing the decision-making arena. This kind of power is another ‘face’ of power in relation to Dahl’s ‘one face of power’.

Therefore, Bachrach and Baratz’s (1962) concept of power is called ‘two faces of power’ – the second dimension of power. The contribution of the concept of the second dimension of power is that power is identified as being “manifested not only in doing things but also in ensuring that things do not get done” (Clegg, 1989: 11).

The power debate about the first and the second dimension of power is extended to the third dimension of power by Lukes (1974). Lukes (1974) suggests that while the first and the second dimension of power are used to influence people’s behaviour directly, the third dimension of power is used to influence people’s behaviour indirectly by working on people’s attitudes and beliefs (Hardy, 1994). The third dimension of power indicates that power can be exercised in an implicit way. Unlike the first and the second dimension of power which are used to deal with overt and covert conflict respectively, the third dimension of power is used to affect people’s will to resist (Hardy, 1994). Clegg (1989) concludes that Lukes’ (1974) conception of the third dimension of power shows that power can influence and shape people’s “consciousness about the existence of inequalities through the production of myths, information control, ideologies, etc.” (p. 110). The mechanisms of using the third dimension of power, “political language, symbols and rituals” (Hardy, 1994:229), “legitimize desired outcomes in advance” (p.229), such as the use of language, rituals, myths, and organisational culture and structure (Hardy, 1994: 226-9).
The third dimension of power is described by Hardy (1996) as the power of meaning which “involved using symbols. … the desired strategy was imbued with meaning – as legitimate, rational, desirable or (failing that) unavoidable” (Hardy, 1996: S8). For Hardy, the first dimension of power reveals resource interdependence relations. People deploy different power resources on which others rely to influence decision-making and bring about desired behaviour (Hardy, 1996: S7); therefore, the first dimension of power is the power of resources (p.S7). Hardy points out that the second dimension of power reflects process interdependence relations. It is the power which “resides in organizational decision making processes which incorporate a variety of procedures and political routines that can be invoked by dominant groups to influence outcomes by preventing subordinates from participating fully in decision-making” (Hardy, 1996: S7) (emphasis in original). Hardy maintains that the French philosopher Michel Foucault’s concept of power is important for understanding power relations in organisational studies, as it “lies in the unconscious acceptance of the values, traditions, cultures and structures of a given institution” (Hardy, 1996: S8). In her framework, Hardy (1994; 1996) considers Foucault’s conception of power as the fourth dimension of power – the power of the system. Hardy (1994) thinks that Foucault’s concept of power exposes a different dimension of power in relation to the other three dimensions of power. As she puts it:

“The three dimensions of power … all involve deliberate, conscious strategies on the part of organizational actors to mobilize power, thereby achieving their objectives either by defeating or circumventing opponents. There is, however, another aspect of power in the way it works to produce certain advantages and disadvantages for organizational members without being consciously mobilized. It lies in the power of the system – in the unconscious acceptance of the values, traditions, cultures and structures of a given institution or society.” (Hardy, 1994:230) (Emphasis in original)

However, Hardy simplifies Foucault’s concept of power. In her framework, the power of the system is only considered as the power embedded in institutional and social contexts. This left this framework with limitations in fully exploring the complex relations between power and knowledge, and with strengths in contrasting the different perspectives of power and exploring the research questions of this research.
Firstly, in Hardy’s framework, the pervasiveness of relations of power is not discussed, so that her framework is inadequate in addressing the relations between the power of the system and other three dimensions of power. The central ideas of Foucault’s concepts of power are surveillance and embodiment (Clegg, 1989). For Foucault, a panopticon (an architectural device consisting of a central, elevated watch-tower) represents the ideal type of the disciplinary power (Clegg, 1989: 173). As in a panopticon, an observer can watch every prisoner from the watch-tower without being noticed. A mechanism, like ‘panopticon’, can produce disciplinary practice, because “the threat of surveillance may be adequate to produce self-disciplining behaviour by the subject of the panopticon, as they can never be sure when or even if they are being observed” (Hislop, 2005: 99).

Disciplinary power resides in “a network of relationships which are systematically interconnected” (Burrell, 1998: 20). It influences people’s behaviour in social relations, and is also produced by such relations. In other words, the silent discipline of a community or an organisation influences people’s behaviour, and people’s behaviour reinforces the existence of the discipline. According to Foucault, disciplinary practices exist, and are broadly disseminated everywhere in the world (Clegg, 1989), such as in various professional groups. Foucault’s concept of power captures the pervasive nature of power (Clegg, 1989). For Foucault, relations of power exist everywhere,

“...in human relationships, whether they involve verbal communication such as we are engaged in at this moment, or amorous, institutional, or economic relationships, power is always present. ... (Power relations) exist at different levels, in different forms; these power relations are mobile, they can be modified, they are not fixed once and for all.” (Foucault, 1994: 291-292)

This shows that power is not only pervasive, but also relational and productive (Foucault, 1984). In human relationships, the control of knowledge/resource and process (1st and 2nd dimensions of power) and using of meaning (3rd dimension) are part of the power matrix, and reflect the power of the system.

The lack of discussion of the relations between the power of the system and the other three dimensions of power in Hardy’s framework may be due to the fact that Hardy does
not address the ‘incompatibility’ between Foucault’s concepts of power and others’. Foucault’s concepts of power proceed from a very different ontological and epistemological position whereas others adopt the approach of structuralism. The first three dimensions of power examine how power is exercised in an objective context. On the contrary, for Foucault, one’s subjectivity means that we should not presume the existence of context in which power is exercised. Social phenomena are examined and explained in terms of how power is exercised, because power relations shape the given context (Foucault, 1984). Understanding the fundamental disparity between Foucault's power and others’ three dimensions of power opened up the possibility to have a much more in-depth investigation of the influence of power relations on knowledge flow.

Another weakness of Hardy’s framework is that it does not reflect the close relations between power and knowledge, thereby ignoring the value of Foucault’s concepts of power/knowledge in understanding of knowledge flow. For Foucault, there are inseparable relations between power and knowledge. Power is knowledge. Discipline is power, and also the knowledge of monitoring, controlling and shaping people’s behaviour. Moreover, discipline is also the power relations in which self acts upon itself and resists itself (Deleuze, 1988:103). For instance, learning in practise can be understood as the process that people force themselves to feel the stress from the outside world, to inspect the need of leaning, to memorise and internalise what they saw and learned in the practice, and to establish their identities (Fox, 2000). The close relations between practice, knowledge, and power suggested by Foucault’s concepts of power/knowledge are supported by practice-based view on knowledge. Thereby, Foucault’s concepts of power contribute to the exploring of the factors influencing knowledge flow.

Although Hardy’s framework has the above-mentioned limitations in discussion of the power of the system, my exploratory study does not allow me to examine all the effects of power of the system on knowledge flow and utilisation of social capital, a task which requires a more detailed study of a large number of cases. As a result, Hardy’s framework (1994, 1996) is employed by this research in my investigating the relations between
power and knowledge flow, as it helps to examine the influence of power on knowledge flow and innovation on different levels. By contrasting different perspectives of power, Hardy's framework teaches us how different perspectives of power treat the relations between power and knowledge flow from different aspects. More importantly, Hardy's framework allows us to go beyond the 1st and the 2nd dimension covered by the existing study in the literature of knowledge management and innovation (e.g., power as network centrality, and power as embedded in employment relations) to deeper aspects of power - how knowledge flow is affected by the power embedded in shared meaning (3rd dimension) and in relational norms (4th dimension) – both of which are crucial aspects too of how social capital and COP work. Since this research combine the concept of social networks, social capital and COP to investigate the relations between power, knowledge, and utilisation of social capital, Hardy's framework has value in exploring the research questions of this research. The next section uses Hardy's framework to discuss the relations between power, knowledge flow, and utilisation of social capital.

4. Knowledge Flow Is Embedded in the Context of Relations of Power

This section discusses the relations between power and knowledge flow by using Hardy's framework (1994, 1996). The discussion is decomposed into four sub-sections according to four different dimensions of power.

4.1. The Influence of the Power of Resources on Knowledge Flow

The concept of the power of resources illustrates the power relations based on resource dependency (Hardy, 1994). This kind of power relations can either directly or indirectly influence knowledge flow.
4.1.1 Direct Influence

The power of resources can directly facilitate knowledge flow. Different groups/organisations and individuals have unequal power of resources. Knowledge is seen as power of resources. Knowledge exchange can be the results of resource exchange between groups/individuals (see Tsai, 2000). On the other hand, resource interdependency relations can also inhibit knowledge sharing, because knowledge might be controlled by groups or individuals to increase others’ dependency on the knowledge (Pettigrew, 1973; Pfeffer, 1981; Pfeffer and Salancik, 1978). For example, when there are disputes between different organisations over the distribution of commercial gains and losses (Marshall and Brady, 2001), or when different departments and groups compete with each other for limited resources (Tsai, 2002), or when there is inter-competition and conflict which leads to less support and help between group members (Nadler et al., 1979), having knowledge under control becomes a means to increase one’s power and thwart others’ gain in power. Again, scarce and desired knowledge can give employees bargain power to secure their job or bring them financial benefits; thus, there is overt or covert resistance to giving out knowledge or sharing knowledge with others (see Willman et al., 2001).

In addition, knowledge flow further affects the distribution of the power of resources between actors. For instance, Gray’s study (2001) shows that when employees’ knowledge was codified and stored in knowledge repositories for everybody’s use, employees’ power was reduced, while managers’ power to control employees increased.

4.1.2 Indirect Influence

The power relations based on resource dependency might have indirect influences on knowledge flow by affecting social networks and structural social capital. For instance, resource interdependency relations have positive effects on the building up of new linkages between units (Tsai, 2000) and between firms (Ahuja, 2000); Elg and Johansson’s study (1997) shows that, based on resource interdependency relations,
interaction between powerful firms and those less powerful in decision making led to structural change of inter-firm networks, such as extending inter-firm networks by encouraging new suppliers to enter the networks. Likewise, in a study by Swan et al. (1999), different professional groups were able to gain access to decision making regarding the offering of educational programmes which helped to develop professional networks. Since networks are associated with access to parties for knowledge exchange (Nahapiet and Ghoshal, 1998), this kind of change of the inter-firm networks has effects on knowledge flow between those firms. Therefore, this indicates that the power relations based on resource interdependency indirectly affect knowledge flow by influencing structural social capital.

On the other hand, power interdependency relations can undermine social networks and structural social capital, thus resulting in negative effects on knowledge flow. For instance, management’s decision-making power can influence the emergence of formal and informal networks (see Conway, 2000; Jones and Beckinsale, 2001, Swan and Scarbrough, 2005); since the networks are channels for knowledge flow, the exercise of decision-making power might indirectly impede knowledge flow by restricting the development of formal/informal networks.

Furthermore, power interdependency relations might also impede knowledge flow by affecting relational social capital (i.e. norms and trust). For instance, because of resource interdependency relations, different departments and organisations are able to get involved in the decision-making process. Because knowledge/information is an important source of power (Pfeffer, 1981; Pfeffer and Salancik, 1978), some departments and organisations might use the power of resources to control knowledge/information to increase others’ dependency. In this kind of situation, norms of control information are developed for controlling information flow. In addition, the inter-group competition undermines trust among the groups (Tsai, 2002). Since norms and trust are essential aspects of the relational social capital, and can influence knowledge flow, power interdependency relations have a negative effect on knowledge flow by developing norms of control knowledge, and by undermining trust.
4.2. The Influence of the Power of Processes on Knowledge Flow

The concept of the power of processes describes the power relations that opposing groups or individuals influence outcomes by controlling decision-making processes (Hardy, 1996). The power of processes might directly influence knowledge flow or indirectly affect knowledge flow by influencing social networks and social capitals. Details are as follows.

4.2.1. Direct Influence

The power of processes can influence knowledge sharing directly. First, the power of processes might be used to encourage knowledge sharing behaviour to serve management's interests. Studies (Hansen et al., 1999; Yahya and Goh, 2002) have shown that the power of processes has direct and positive effects on knowledge flow: for the sake of improving productivity, employees were rewarded for codifying their knowledge or sharing knowledge with others; and training was provided to develop IT skills or interpersonal skills, which facilitate knowledge sharing. Furthermore, although the results of exercising the power of processes depend on employees’ acceptance of ‘legitimate power’, management may try to use the power of processes to set up policies to facilitate knowledge flow, such as allowing “all employees easy access to colleagues who can help them carry out tasks quickly and efficiently, regardless of their status or area of jurisdiction” (Krackhardt and Hanson, 1993: 111). Thus, the power of processes is used to promote knowledge sharing and/or create opportunities for knowledge sharing.

On the other hand, because people might respond differently to the power of processes, the exercise of non-decision-making power yields unexpected effects on knowledge flow. For instance, Kim and Mauborgne (1998) find that workers refused to cooperate with others by hoarding ideas, and were reluctant to implement strategic decisions, when they felt that strategic decision-making processes are unfair. Again, Contu and Willmott’s
study (2003) shows that managements used the non-decision-making power to exclude photocopier technicians from the decision-making process by introducing tight work procedures, and that such a tight control happened to contradict with the technicians’ self-image as “useful, heroic trouble-shooters rather than docile, compliant robots” (p. 291), thus provoking the technicians’ resentment and further frustrating their willingness to develop and deploy their knowledge of how to remedy machine breakdowns.

In addition, employees’ response to management’s control of decision-making processes (compliance or covert and overt resistance) further confirms the power relations based on process dependency.

4.2.2. Indirect Influence

The power relations based on process interdependency have indirect effects on knowledge flow by influencing social networks and different dimensions of social capital. First, the process interdependency relations can influence knowledge flow by affecting social networks and structural social capital. On one hand, from the standpoint of promoting innovation, management can use the power of processes to influence the breadth of networks and the direction of information flow by controlling the co-ordination of network activities, such as having an expansive range of groups get involved in network activities (Swan and Scarbrough, 2005: 932) in order to facilitate knowledge flow between various groups/organisations to contribute to innovations. On the other hand, the power of processes also affects the development of informal networks. For instance, as shown in Conway’s study (2000), management can mobilise informal networks to encourage informal interaction to facilitate knowledge sharing; and the power of processes can also be used to dwindle the informal interactions (ibid).

Secondly, the power of process can affect knowledge flow by influencing relational social capital (i.e. trust and norms). For instance, the power of processes can be exercised by management to assemble people from different departments as a project team. This helps the development of commitment trust, because commitment trust is based on the
obligation that team members need to be cooperative to accomplish the tasks of the project (Newell et al., 2002). And commitment trust has positive effects on people’s willingness to share knowledge.

The power of processes can influence knowledge sharing by affecting norms. Edelman et al.’s study (2005) shows that norms of professionalism restricted medical professionals from learning from one another. But, by using the power of control process to reengineer cataract diagnosis and treatment process, and by developing networks between different NHS Trusts, the norms of professionalism were broken (Newell et al., 2003; Edelman et al., 2005); as a result, knowledge flows among different professionals were facilitated.

Finally, the interaction between the power of processes and identity also influences knowledge flow indirectly. The power of control process helps to produce a strong identity of a ‘community’, and then facilitate knowledge sharing between members of the ‘community’; as Newell et al. (2002) point out, “highly rigorous selection may create a strong elite identity amongst particular groups, which is reinforced by performance-based reward systems. Such shared identities enhance employee’s willingness to share knowledge” (p.79). Identity might also be an unexpected result from community members’ opposing management’s power of control process. For instance, in Orr’s study (1990), management used the power of processes to standardise technicians’ work, which has potential negative influence on technicians’ willingness to share and learn knowledge from their practice (Contu and Willmott, 2002: 291); but, on the other hand, the management’s control, along with the psychological reward for fixing machines, helped to fashion technicians’ identity as “skilful, improvising trouble shooters” (ibid). And, in turn, this kind of identity weakened the negative effect of management’s tight control (ibid) to facilitate learning and knowledge flow.

Utilising social capital also effects the power of processes. Swan and Scarbrough (2005) point out that networking helps to generate new sources of power to underpin the further development of networks.
“[T]hrough effective network co-ordination, new sources of power – notably at the level of process and meaning – are created, which further reinforce the kinds of networking and knowledge integration which contribute to successful innovation outcomes.” (p. 939).

4.3. The Influence of the Power of Meaning on Knowledge Flow

The power of meaning is about symbolic power and creating legitimacy (Hardy, 1994). It can directly influence knowledge sharing; indirectly, knowledge flow by affecting utilisation of social capital.

4.3.1. Direct Influence

The power of meaning can directly influence knowledge flow. First, as one mechanism of the power of meaning, organisational culture influences people’s knowledge sharing behaviour. Since organisation leaders have some influence on the shaping and developing of organisational culture (Martin, 1992; Schein, 1992), the power of meaning resided in organisational culture could be used by dominant groups (e.g. managers) to influence others’ behaviour. For instance, by symbolically and materially recognising and rewarding employees, a corporate culture can be formed, which can influence employees’ values to meet the organisation’s purpose - to improve organisation productivity and quality of products (Willmott, 1993). Likewise, the power of meaning can also be used to develop a knowledge-sharing culture which programmes employees’ values to ensure that creating and sharing knowledge is seen as a responsibility of all employees (Newell et al., 2002). On the other hand, the symbolic meaning embedded in ‘anti-innovative culture’ (Bate, 1994) might also restrict knowledge flow in an unintended way.

Second, structure is seen as another mechanism of using the power of meaning (Hardy, 1994: 229), as it shapes people’s consciousness about what is seen as legitimate. The power of meaning resided in structure might influence knowledge flow. For instance, management can choose and construct or reconstruct structure to ensure the performance of departments in the direction of the managers. A flat structure allows people to access
information and exchange ideas with others easily, while a hierarchical structure restricts information flow from exceeding the rules of communication defined by the structure. In a word, the power of meaning resided in structures influences knowledge flow by making people accept the ways of communicating, and sharing knowledge, both of which are seen as legitimate in the structures.

4.3.2. Indirect Influence

The power of meaning might influence knowledge flow through effects on social capital and other factors. Take Barker’s ethnographic study (1993) as an example. In self-managing teams, the power of meaning influenced people’s perception to achieve a substantial consensus about values and high-level coordination among team members, as the team members “must identify strongly with their team’s values and goals, its norms and rules” (Barker, 1993:436). This negatively influenced the utilisation of social capital, as there was a potential danger for team members to experience ‘groupthink’. Consequently, it affected team members’ knowledge sharing behaviour because it was more important for team members to follow their team’s norms and rules, rather than finding out better solutions by communicating with people outside the team and the organisation.

As a mechanism of the power of meaning, organisational culture can influence knowledge flow by influencing relational social capital (i.e. trust and norms). For instance, a knowledge-sharing culture can promote trust among people which is fundamental for knowledge sharing. A cooperation culture develops norms of cooperation, and in turn, facilitates knowledge exchange and cooperation between different departments/individuals. On the other hand, a segmentalism culture can affect norms of cooperation, leading to lack of support between various departments and professional groups (Bate, 1994); as a result, inter-departmental knowledge flow is restricted.
It is also possible that the power of meaning influences cognitive social capital, which further influences knowledge flow. The power of meaning might affect cognitive social capital in an unintended way, leading to lack of shared values and interests, and then, cause negative effects on knowledge flow. For instance, in Bate's study (1994) of British Rail, because of the conservatism culture, people had different interests with regard to making change. And lack of shared interests can impede knowledge flow, because people do not accept different opinions from others.

The power of meaning also influences knowledge flow by affecting structural social capital. For instance, in Swan and Scarbrough's study (2005), the power of meaning was used to develop the discourse of 'community of care' so as to integrate knowledge from both inside and outside of a multinational biosciences company, and thus helped to develop cross-profession networks. This kind of innovation networks became very important for people to obtain innovation sources.

On the other hand, utilisation of social capital might reinforce the power of meaning. Swan and Scarbrough's study (2005) shows that, utilising innovation networks helps to generate a new form of power of meaning, which further facilitates the development and utilisation of innovation networks.

4.4. The Influence of the Power of the System on Knowledge Flow

Hardy (1994, 1996) simplifies Foucault's concepts of power, and suggests that the power of the system exist in the cultural and structural context of a given institution or society. As discussed in Section 4-3.2., while the simplified concept of the power of the system has limitations, it is still useful in exploring the relations between power, knowledge, and utilisation of social capital. The power of the system resided in cultural and social context can influence knowledge flow either directly or indirectly.
4.4.1. Direct Influence

The direct influence of the power of the system on knowledge flow can be observed from how knowledge sharing is influenced by the development of technology and by a particular institutional and social context. First, with the development of technology, the use of Information and Communication Technologies (ICTs) to manage knowledge is increased. While the use of ICTs to some degree facilitates knowledge sharing in stockpiling knowledge and renders it accessible to others in the organisations (e.g., Alavi and Leidner, 1999; Cole-Gomolski, 1997; Ruggles, 1998), research (e.g., Hayes and Walsham, 2000; Mckinlay, 2000; 2002; Zuboff, 1988) finds that, ICTs play the role of ‘panopticon’ which produces disciplinary effects in knowledge process. On the one hand, ICTs have negative surveillance effects. For instance, the surveillance effects can lead to lack of diversity and participation in knowledge management activities (see Hayes and Walsham, 2000; Zuboff, 1988): since employees understand that their interactions and discussions on the Intranet or groupware are monitored by management, they avoid articulating or proposing their ideas which might be deemed contradictory to management’s perspectives, or irrelevant from managers’ standpoint. On the other hand, it is also possible for people to resist panoptic surveillance of ICTs by interacting and communicating in a greater scope (Mckinlay, 2002).

Second, the power of the system embedded in wide institutional and social context can directly influence knowledge flow and learning. For instance, in a competitive market, organisations are all under the market pressure of providing customers with better products and services. Likewise, each individual is also under the labour market pressure of improving personal knowledge and competence for securing one’s job. Therefore, the power of the system embedded in a competitive social environment becomes the force of stimulating learning as well as controlling scarce knowledge. One the other hand, these forces can be harnessed symbolically by individuals and organisations to create dominant local discourse, such as acknowledging the importance and necessity of learning and innovation to gain power source through knowledge sharing in a competitive environment (Dyer and Hatch, 2004; Tallman et al., 2004).
In addition, research also finds out that different national cultures directly influence people’s knowledge sharing behaviour (Michailova and Hutchings, 2006) as well as the way of managing knowledge (Murray and Myers, 1997).

4.4.2. Indirect Influence

The power of the system can also influence knowledge flow indirectly by influencing utilisation of social capital. For instance, the power of the system influences knowledge flow by influencing the development of social network ties. Swan and Scarbrough (2005) claim that, technology underpins the development of external ties based on inter-organisational collaboration, thus providing the opportunities to obtain and exchange knowledge through those network ties.

The power of the system embedded in an institutional context also influences the occurrence of inter-organisational networks, and then affects knowledge flow. Swan and Scarbrough (2005: 938) propose that different institutional contexts might influence networked innovation differently by influencing the development of innovation networks. Research also finds out that that there is institutional influence on innovation networking (Furtado, 1997; Nooteboom, 2000) and the personal networking (Robertson et al., 2003). Moreover, different national systems of innovation also influence the innovation networks (López-Martínez and Piccaluga, 2000), thereby influencing knowledge flow through those networks.

The power of the system resided in a social context also influences knowledge flow by influencing identity. Robertson et al. (2003) discover that professional context shaped employees’ identities as professionals. Since identities can have either positive or negative effects on knowledge flow (see Section 3-3.3.1), the power of the system might influence knowledge flow by having effects on identities.
The power of the system might also influence knowledge flow by affecting relational social capital. For instance, using ICT system reduces friendship and leads to lack of companion trust amongst employees (Zuboff, 1988: 337). Because companion trust is important for developing personal networks, it is possible that knowledge flow is restricted for lack of informal contacts.

On the other hand, as reactions to the institutional context, knowledge flow and utilisation of social capital confirm the power of the system. Robertson et al. (2003) indicate that managerial and organisational strategies reflect and reinforce the institutional influence. Similarly, sharing knowledge between departments and organisations ensures survival in the competitive market, which confirms the pervasive influence of the power of the system.

4.5. Summary

To advance the understanding of knowledge flow and innovation, this section employs Hardy’s framework (1994; 1996) to discuss the relations between power and knowledge flow. The four dimensions of power can directly influence knowledge flow and indirectly through effects on social networks and social capital. And those influences could be either positive or negative (see Table 4-1 for the summary). This indicates that knowledge flow is influenced not only by power of resources or employment relationships, but also by symbolic power and the power of system resided in the institutional and national context. In other words, knowledge flow is embedded in the relations of power.
Table 4-1: The Influence of Power on Knowledge Flow

<table>
<thead>
<tr>
<th>Dimensions of Power</th>
<th>Direct Influence</th>
<th>Indirect Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st dimension</td>
<td>Facilitating or impeding knowledge flow; knowledge flow further affects distribution of power of resources</td>
<td>Facilitating knowledge flow by creating connections; impeding knowledge flow by restricting emergence of networks, developing norms of control knowledge, and undermining trust</td>
</tr>
<tr>
<td>2nd dimension</td>
<td>Having contingent effects on knowledge flow depending on the response to the exercise of the power; utilising social capital affects the power</td>
<td>Facilitating knowledge flow by affecting the development of formal/informal networks, commitment trust, norms, and identity; impeding knowledge flow by restricting informal network</td>
</tr>
<tr>
<td>3rd dimension</td>
<td>Embedded in knowledge sharing culture and flat organisation structure facilitating knowledge flow; embedded in 'anti-innovative culture' impeding knowledge flow</td>
<td>Facilitating knowledge flow by developing norms of cooperation, trust, and networks; impeding knowledge flow by affecting norms of cooperation and different interests</td>
</tr>
<tr>
<td>4th dimension</td>
<td>Contingent effects of surveillance power of ICTs; competitive environment becoming a learning force; national culture influencing knowledge sharing behaviour</td>
<td>Facilitating knowledge flow by affecting the development of innovation networks and identities; impeding knowledge flow by undermining trust</td>
</tr>
</tbody>
</table>

5. Chapter Summary

This chapter illustrates that in the literature of social networks, social capital, and COP, power issues are considered important, but have not been fully discussed. This chapter also discusses the different frameworks of power, and why Hardy’s framework (1994, 1996) is used here to investigate the relations between power and knowledge flow is explained. While Hardy’s framework has limitations in exploring the effects of power of the system, it is very useful for understanding how the relations between power and knowledge flow can be explained in different ways by taking different approaches of power. By examining the effects of the power of meaning and the power of the system, Hardy’s framework sheds light on the complex relations between knowledge, power, and utilisation of social capital.
By using Hardy’s framework, the influences of the four dimensions of power (the power of resources, the power of processes, the power of meaning, and the power of the system) on knowledge flow are discussed. It is proposed that power relations have positive and/or negative effects on knowledge flow. And the different dimensions of power can influence knowledge flow directly or indirectly by producing effects on social capital. The next chapter is the methodology chapter which discusses related issues about the methods used to collect date and to find empirical evidence to evaluate these above-mentioned ideas.
Chapter 5

Methodology

1. Introduction

This chapter explains what kind of data this research gathered, theoretical assumptions, strategies and actions undertaken to collect and analyse data, and the strength and limitation of the research’s design and methods. The structure of this chapter is as follows. Section 2 clarifies the epistemological assumptions, the reason for choosing case study as the research method, the connection between the theory and the selection of particular cases, and the generalisability of this research. Section 3 concerns itself with the process of data collection: it explains the methods and the strategies adopted for gathering qualitative data, and the strengths and weaknesses of the research methods. It also discusses the validity and reliability of this research. Section 4 presents the data analysis of this research - the process of data reduction, data display, and conclusions drawn by the research.

Briefly, this research compared a product innovation project with a process innovation project in a foreign invested high-tech company in China to investigate the factors which influenced knowledge flow. Semi-structured interview and observation were used as the main methods of collecting primary data. Snowball-sampling technology was employed to identify interviewees. Qualitative data analysis method was used to analyse the data.

2. Case Study as a Research Method

2.1. Interpretive Approach

The interpretive perspective has been taken by this research. That means social phenomena can be understood and interpreted in terms of researchers’ unique angles. To understand the social phenomena researchers should participated in the social and cultural context. The knowledge gained from doing this research was by getting involved within the context, and through attempt to understand it. This perspective has been taken,
which means that there is a need to keep open-minded to emerging issues in the process of data collection and data analysis.

The interpretive perspective was useful for investigating the relations between knowledge flow and power in the Chinese cultural context. Language and the culture of interviewer and the interviewee are two important issues in dealing with meaning (Broadfoot, 2000:54). I am a Chinese, and I had experience of working in a foreign-invested company in Shenzhen for more than 3 years. My experience helped me to communicate and interact with my informants to obtain more information. Speaking the same language and sharing the same culture allowed me to understand the meaning of the information offered by my interviewees, and to appreciate why and how knowledge was shared or hoarded in the particular context.

As a researcher, I also realised the limitation of taking the interpretive perspective. As Miles and Huberman (1994:8) put it, “if researchers use few preestablished instruments, it will be difficult to separate out “external” information from what they themselves have contributed when decoding and encoding the words of their informants”. Therefore, it was important to keep this in mind in the process of data collection and data analysis - to ensure the researchers’ openness, and commitment to be naturalistic.

Taking the interpretive perspective, I used qualitative data to answer the research questions because the “richness and holism” of qualitative data (Miles and Huberman, 1994:10) can provide adequate information about the context. While quantitative studies pay little attention to context (Bryman, 2000: 139), in qualitative research qualitative data are useful for understanding the context of the research and the results derived from the context. Therefore, qualitative data could help understand why people shared their knowledge and why they did not.

This research adopted the case study method, because this research investigated the relatively unexplored issues of power, and case study is an appropriate method to be used to answer explanatory research questions (Yin, 2003:6). The case study method offers an
in-depth investigation of the relations between knowledge flow and power by focusing on the particular cases, and by supplementing each case with sufficient context information. In addition, by illustrating particular cases, case study can offer an elucidation to help people make sense of it (Stake, 1995:3). This research intended to obtain insights into the relations between power and knowledge flow by investigating the particular cases.

2.2. Case Selection

This research investigated a product and a process innovation project in a foreign invested high-tech company in China (the introduction of the company is in the next chapter). The selection of cases and projects was based on the purpose of (1) exploring the factors influencing knowledge flow and innovation, and (2) examining the generalisation of knowledge sharing theory in the cultural context of China. Details are as follows.

2.2.1. Case Selection: The Link between Knowledge Flow and Innovation

With Yin (2003:41) suggesting that one rationale of ‘a single case is the representative or typical case’, Stake (1995:4) points out that the first criterion of selecting cases should be to maximise what we can learn. Based on it, the fieldwork of this research was conducted in CTI, a US invested middle-sized high-tech firm which produced power amplifier systems and other telecommunication products.

CTI was a high-tech firm which designed and produced products for its clients. It faced a quickly developing market as well as increasing competition. CTI paid lots of attention to the product innovation and process improvement. The product design was carried out by different groups of engineers, while the process improvement involved almost every department of the organisation. The product and process innovation required knowledge sharing between individuals, between groups/departments, and between organisations. This provided many opportunities for the research to witness the ways in which knowledge was shared/hoarded, and in which power relations facilitated/impeded the
knowledge flow. Therefore, CTI was an ideal site to study the relations between knowledge flow and power.

Eisenhardt (1989) points out that theoretical sampling can help build theory from case studies. In the literature, the close link between innovation and knowledge flow has been identified by a great deal of research (e.g., von Hippel, 1988; Chesbrough and Teece; 1996; Conway, 1995, 1997; Hislop et al., 2000). While both product and process innovations require knowledge sharing, the two types of innovations differ in the location of innovation resources and required continuity (Tidd et al., 2001). These differences indicate that knowledge is shared in various ways in process innovation and product innovation, and power relations in relation to the knowledge flow are also different. In CTI, the process innovation project (ERP) and the product innovation project (3G) had different innovation resources and processes, as well outcomes. Contrasting and comparing these two innovation projects disclosed the relations between knowledge flow, innovation, and power, because choosing different types of cases inevitably tests and extends theory (Eisenhardt, 1989).

2.2.2. Case Selection: The Importance of the Chinese Cultural Context

Quintas (2003) points out that cultural difference is important for understanding knowledge sharing. People within different culture backgrounds might have different ways of sharing knowledge (see Inkpen and Pien, 2006). For instance, Nonaka and Takeuchi’s work (1995) shows that Japanese companies are different from western companies in their unique innovation processes and attitude toward knowledge-sharing. Therefore, it was assumed that Chinese cultural context also has impact on knowledge flow and innovation. In CTI, the foreign-invested company in China, the knowledge sharing related behaviours of most of its employees (i.e., local managers, engineers, and workers) might be influenced by the Chinese culture. Studying the innovation projects of CTI is conducive to the understanding of the influences of Chinese culture on knowledge flow.
This research investigated knowledge sharing in the Chinese culture context, not only because Chinese culture is different from western culture, but also because China plays an important role in the world. From a historical point of view, the East and the West are "structurally and cyclically dependent on each other as inextricably interrelated parts of a single global economy" (Frank, 1998:276). "China has been the centre of the world", and also "will be the future unifier of the world" (Toynbee, 1989, cited from Nolan, 2004).

To date, China has been the largest recipient of foreign direct investment in the world (Nolan, 2004:62), and becomes more deeply tied to global economy through both investment and trade (Weil, 1996:76).

What's more, the development of China's economy not only made China closely linked to the rest of the world, but also led to social change in China. For instance, the rise of the economy deeply undermined traditional communist values (Nolan, 2004:45). The atmosphere of "money by any means" was rapidly becoming so all-pervasive (Weil, 1996:142), and "Get rich" became the personal goal of people in Southern China (especially the state-established specific economic regions, such as Shenzhen), into which a large influx of people rushed from everywhere of the country in hope of better salary in foreign invested companies (see Weil, 1996: 54).

Because cultural issues, knowledge flow, and innovation are closely interrelated, studying the innovation projects in the company in Shenzhen, China, sheds light on how the contemporary Chinese culture and social change might influence knowledge flow and innovation. In addition, whereas most studies of knowledge sharing have been conducted in the UK/US context, this research investigated knowledge flow in the high-tech firm in China. Studying the case helps to examine the generalisations of the theories, mostly developed in the UK/US context, in the special culture context of China.

2.3. The Generalisability of the Research

There are different arguments about the generalisability of case studies. Stake (1995:8) claims that a case study should emphasise 'uniqueness' and 'particularization', and 'thick
description' (Geertz, 1973, cited from Stake, 1995:42) can help the readers make their own judgment and optimise their learning opportunity.

On the other hand, Yin (2003:10) thinks that the goal of doing a case study should be to generalise theories rather than enumerate frequencies, because choosing a typical site does not guarantee that the case can be generalised universally because ‘what is typical on one dimension may not be typical on another’ (Schofield, 2000:78). Gomm et al. (2000) further suggest that generalisation of case study findings can be facilitated by collecting and presenting data with theoretical guide, selecting cases systematically, and within case generalisation. Combining theoretical sampling with rich description can increase the potential applicability of a particular case (Schofield, 2000:78).

In order to increase the theoretical generalisability (Yin, 2003) of the findings, this research focused on the innovation-emphasised company and the innovation projects which were “knowledge-sharing-intensive” to examine the relations between knowledge flow and power. This research compared two different types of innovation projects, trying to increase the potential applicability of the results of this research, because comparing different types of cases forces researchers and readers to look beyond initial impressions and to see evidence through multiple lenses (Eisenhardt, 1989). This research realised that to a degree every case has its uniqueness. In order to help readers to relate the results of this research to other innovation cases, this research tried to choose the methods of data collection carefully and present the results of data analysis systematically in hope of improving the potential applicability of the findings. For instance, related theories were used to guide the data collection, as well as data analysis. Multiple data collection methods were used to achieve triangulation of evidence, thereby reinforcing the grounding of theory (Eisenhardt, 1989). Finally, in data presenting, similar and conflicting results were discussed, and linked to the existing literature, which increased the generalisability of the results.
The following two sections describe and explain the process of data collection and data analysis of this research, in order to provide more useful information for understanding power’s influence on knowledge flow through this particular case.

3. Data Collection

To show how the qualitative data were gathered, this section explains what methods and strategies were used to collect data, details the processes of doing the fieldwork, and, finally, evaluates the validity and reliability of the research.

3.1. Methods and Strategies Adopted to Collect Data

The network mapping approach (Conway and Steward, 1998) was adopted by this research to guide the data collection. Conway et al. (2001) indicate that the network approach can be applied with different orientations: metaphorical (network as metaphor), graphical (network mapping), and mathematical (network analysis). Among these three, the network mapping approach tends to be more qualitative, and to focus on the representation of relational data (Conway et al., 2001). It does not need to collect complete network data which are required by mathematically featured social network analysis (ibid). The network mapping approach can be used to encode a variety of qualitative and quantitative data (ibid), and to investigate innovation from a limited selection of cases (Conway and Steward, 1998). The network mapping approach (Conway and Steward, 1998) was adopted here, because it allowed the researcher to identify the actors and patterns of social network ties related to knowledge flow from the innovation projects.

Based on the network mapping approach, snowball sampling was adopted by this research to identify interviewees. The purpose of snowball sampling strategy was to “identif[y] cases of interest from people who know people who know what cases are information-rich” (Miles and Huberman, 1994:28). In taking the network mapping approach, snowball sampling helped obtain qualitative data in relation to the innovation networks and its components: actors, links and flows (Conway and Steward, 1998).
In this research, the snowball sampling started from the project members to trace the shared knowledge (flows) and to identify the social relations (actors and links) which facilitated the knowledge sharing. This way, why and how knowledge was shared or hoarded might be understood. In the first round, the project team members were asked to nominate the persons whom they had shared knowledge/information with or learned new things from, and to talk about the knowledge/information which enabled them to make contribution to the project innovations. In the second round, I interviewed those people nominated by the team members, and asked them with whom they had shared knowledge in order to identify the potential interviewees in the next round, and so on.

Semi-structured interview was the main method used to collect data. Semi-structured interview was adopted here because “the issues discussed, the questions raised and the matters explored change from one interview to the next as different aspects of the topic are revealed” (Hussey and Hussey, 1997:156). Semi-structured interview helped explore and identify new issues, because with a focus on the main theoretical schemes, I could flexibly adapt the questions to the answers given by respondents. It was realized, however, that there were potential limitations of interview-based studies; as Bryman (2000:159) points out, “the reliance on interviews in interview-based ... studies might be taken to indicate that the degree of penetration of, and fidelity to, the perspectives and interpretations of those studies is less pronounced than in total and semi-participant studies”. Therefore, with the aim to present as much “fidelity” (ibid) as possible, my fieldwork in CTI was not confined to the conducting of the semi-structured interviews. I spent my days there as if I were an employee of CTI; in doing this fieldwork, in other words, I might also be considered a participant.

This research was not an ethnographic study, but had ethnographic elements because it investigated the cultural influence on and the interpersonal relations with knowledge flow. Observation is a good method for understanding people in a cultural context. Being treated as an “apprentice in knowledge management”, I spent more than three months in the company talking with people and observing them in various settings (such as in
canteen, office, and warehouse, and during office hours, lunch time, and overtime at nights and in weekends). In addition, company documents, meeting memos, and work records were collected to gain knowledge about the context and to achieve data triangulation.

3.2. Fieldwork

3.2.1. Gaining Access to the Organisation

From December 2003, I started to seek any possible access to a high-tech company in Special Economic Zones in China. I tried to contact several companies through relatives, friends, and friends’ acquaintances. I also sent application letters outlining the purpose and plan of my research. In the application letters, I made it clear that anonymity was acceptable, as Stake (1995:57) points out that a brief written description of the intended casework and expression of expected anonymity can help gain the permission of access. In March 2004, two positive replies were received: one from CTI, and the other from an electronic company in a city near Shenzhen. Finally, access permission from the management of CTI was obtained with the help of ERP project leader, and I could access two ‘current’ innovation projects at that time in CTI: the ERP project (Enterprise Resources Plan) and the 3G project (3G power amplifier platform). As a result, I did not go to another electronic company because it was a small private company without putting much stress on innovation. On top of that, the distance between CTI and the small electronic company required too much traffic time. Considering the limited research time, energy, and expenses, conducting the fieldwork in both companies was impossible.

3.2.2. Interview Question Design and the Pilot Interviews

The interview questions were developed to cover the key issues of related theories (e.g., social connections, learning and knowledge sharing, interpersonal relationships, identity, and the barriers of communication) (The outline of the interview questions is in Appendix 1). For instance, because of the tacit nature, it is difficult to identify the shared
knowledge. But knowledge also can be defined as knowing and the capacity of doing something; therefore, knowledge becomes visible when it is in use. In order to identify shared knowledge, people were asked whether they solved problems by discussing with each other and/or by seeking help from others. It was also realised that there might be no knowledge sharing at all. In order to minimise inaccuracy of data, before those interview questions, more general questions were asked to identify whether or not there was knowledge flow. For instance, interviewees were asked to talk about their experience and feeling about their work; and then, according to the answer they gave, they were further asked how they solved problems when they mentioned about problems that they encountered in work.

The original outline of the interview questions was in Chinese. A copy of the outline was handed out to interviewees before each interview, as Stake (1995:65) suggests that it can evoke good responses by getting description of an episode, a linkage, and explanation related to the questions. Meanwhile, I browsed the company’s website, and did some reading about ERP system and telecommunication to familiarise myself with the company and the projects.

In the beginning, ERP leader and a planner in PMC (Product & Material Control) department were interviewed to pilot the interview questions. The purpose of the pilot interviews was, first, to find out if the interview questions were able to gain useful and enough information from the interviewees with different status and knowledge background; and, second, to gain the experience and boost my confidence by practicing the interview skills, as Stake (1995:49-59) says that the experience of qualitative researcher is the key to obtaining good data.

The pilot interviews helped me to improve the interview questions. For instance, ERP leader gave the feedback that some questions were too general for him to answer. After the pilot test, several questions were modified, and some new questions were designed for the coming interviews. For instance, I added the questions: how did they (the interviewees) feel about the difficulty/ease of communicating with others, and whether or
not they felt a need to update their knowledge to work in their professions and in the
company? As a matter of fact, judging from the answer of the respondents, these
questions helped understand the motivation of learning as well as the impediment of the
utilising of social capital (see the data chapters for details). Meanwhile, the experience of
piloting interview and the post-interview communication with the respondents also gave
me confidence in doing this research. Since these two pilot interviews offered a lot of
useful information, both were used in my data analysis.

3.2.3. The Interview Process

The fieldwork in CTI-Shenzhen was conducted from June 2004 to September 2004.
Before the fieldwork started, I had informal meetings with ERP leader. In which, my
research plan was explained to him, and the possibility of interviewing and observing
people was discussed. I was invited to visit the open-plan office, warehouse, assembly
lines, and aging house. I also attended the ERP training meeting organised by ERP leader,
and met some key operators of the ERP system who were working in different
departments in CTI. I was allowed to stay in the company and observe their work, and to
access any documents related to the ERP project, such as meeting memos, the contracts
of buying software and related services, the work records of the ERP project progresses,
regulations of PMC and warehouse’s daily operation, and so on. Meanwhile, I managed
to contact R&D people, and gathered data from the product innovation project.

Totally, 26 semi-structured face-to-face interviews were conducted. All interviews were
recorded by a digital recorder, and transcribed and translated afterwards. The length of
most interviews was about one hour, except for two short interviews, about 30 minutes
each, and two long interviews, nearly two hours each. Among which, 9 interviews were
from the 3G project, including two individuals outside the organisation, and 17 from the
ERP project, including one individual outside the organisation. The process of identifying
interviewees by snowball sampling was as follows.
Regarding the 3G project, firstly, the four team members in R&D department were interviewed, and were asked to nominate people whom they have shared or exchanged knowledge with; in the second round, five individuals nominated by the team members were interviewed (two individuals in CTI-Shenzhen, one person in CTI-USA, and another two individuals outside the organisation). It was impossible to interview all those people mentioned by the team members, so the third round came to an end because some potential interviewees were out of reach (some individuals were in other provinces in China or even in the US); because some people mentioned by the informants were too busy to accept my interview in spite of my reaching them; and because some interviewees did not want me to contact the clients that they have nominated in view of the issue of technology confidentiality (see Crane, 1972; Allen, 1977) and potential competition between organisations. For instance, the R&D leader mentioned that he had learned something from his clients during their cooperation in developing 3G products, but he reminded me in particular of not mentioning his name if I contacted the engineer that he nominated.

As for the ERP project, in the first round, I interviewed two main team members: ERP leader and the IT support engineer. ERP leader nominated 7 persons as the key users of the ERP system in different departments in CTI-Shenzhen, and 3 persons outside CTI-Shenzhen who provided useful information/knowledge to the project. The IT support engineer nominated the ERP leader and a key user in Warehouse. In the second round, 7 of 8 key users were interviewed (another one was too busy to have enough time for interview, and did not allow the interview to be recorded), and also interviewed was one individual working in another electronic company in Shenzhen. Except the overlapped nominations (the same individuals nominated or people already interviewed in the first and the second round), those 7 key users nominated 6 persons in CTI. Other two persons nominated by ERP leader were not interviewed because they were in other cities. In the third round, all 6 individuals nominated by the 8 informants in the second round were interviewed. From the third round, only 1 person was identified as interviewee in the next round, as some people were mutually nominated and interviewed. In the fourth round, only one person was interviewed. The snowball sampling was stopped because the
nominated individuals were already interviewed. In other words, except the interviewees nominated by the ERP leader, all interviews were located in CTI-Shenzhen. In addition, many interviewees nominated the same people or nominated each other. There was an impression that in the ERP project the communication tended to be more internal rather than external.

Since people in CTI-Shenzhen were very busy with their work, it was difficult to arrange time and to find a proper place to conduct interviews. They always had lots of things to do even when working at nights or in weekends; there were always unexpected calls from the bosses or production lines which interrupted interviews. Being flexible and fostering interviewees’ goodwill became very important. Staying in the company at nights and in weekends was necessary. I also offered help once there was such a need, such as helping them to find a component, entering data into the ERP system, and so on.

Doing all those things also gave me the opportunity to observe them in different situations, and helped me to understand their real work and life. Eventually, many interviewees were so cooperative that they arranged a proper time when they were not that busy, such as at the lunch break, and on Sunday; they also helped me to persuade other people to accept my interview, and borrowed offices in warehouse or from the senior engineer for interview. Building up a good relationship with interviewees helped me know more about them and understand the meaning of their words. In addition, it also helped the interviewees have an idea of what I was going to do with my research, and, in return, they were able to talk more in interview to offer more information to my research.

More importantly, some individuals would like to share their thinking and feeling with me. They would like to talk about their work and life informally. For instance, they did not mind talking about some sensitive issues to me, such as conflict between colleagues. Those kinds of information were used to test the information gained from interviews and observations.
3.3. Validity and Reliability

Hammersley (1990: 57) defines validity as “truth” which might be “interpreted as the extent to which an account accurately represents the social phenomena to which it refers”. Yin (2003: 34) suggests that the validity of the results of case study can be improved by several tactics in the process of research design, data collection, and data analysis. The tactics include using theory in single-case studies in the process of research design, using multiple sources of evidence in data collection, doing explanation-building, and addressing rival explanations in data analysis. This research used multiple methods to obtain qualitative data. The data triangulation was conducive to the validation of the results of this research, because date triangulation is an effort to see “what we are observing and reporting carries the same meaning when found under different circumstances” (Stake, 1995:113). In addition, comparison between the two different innovation projects also helped the validity of the results of this research, since within-case comparison in qualitative data analysis helps test the validity of the results (Silverman, 2001:179).

Reliability of the results of a research is referred to as “replication” (Hussey and Hussey, 1997:57; Yin, 2003: 32). Although well-documented case study research procedures can secure the reliability of the results (Yin, 2003:38), it was understood that the reliability of the results of this research might be questioned when the extent of research and the interpretation of the data analysis were considered. After all, it was possible to use different methods to contact more individuals, such as conducting telephone interviews or sending questionnaires. In addition, there might also be some personal elements in the interpretation of meaning and the setting of the boundaries of data analysis about what information was relevant. In order to improve the reliability, the researcher consistently made efforts to check respondents’ view and remain self-critical in collecting and analysing data, and in presenting the findings. Moreover, the details of the processes of data collection and data analysis were provided, and spelt out were all the possible interpretations in data analysis which can help the readers make their own judgments.
4. Data Analysis

Miles and Huberman (1994:10) suggest that qualitative data analysis contain three major flows of activity: data reduction, data display, and conclusion drawing and verification.

4.1. Data Reduction

Data reduction is the process of “selecting, focusing, simplifying, abstracting, and transforming the data that appear in written-up field notes or transcriptions” (Miles and Huberman, 1994:10). The data reduction of this research started with the data collection and ended with the data analysis. As seen in the view of Miles and Huberman (1994:50), early analysis which interweaves data collection and analysis from the start, such as making summary after interview, is very helpful for field workers to cycle back and forth between contemplating the existing data and generating strategies for collecting new, often better, data (ibid). During the empirical research, preparation was made before interview, such as predicting any responses from interviewees and preparing additional questions for different interviewees. Almost after every interview, a ‘contact summary form’ was made for reflection. The summaries were composed of main issues identified in the interviews and emerging issues, and identified new target questions for the next interview. In so doing, the researcher was constantly reminded of focusing on key issues during the interview while maintaining open to any emerging issues.

A coding frame was used to guide the data reduction. The coding frame was developed based on the understanding of knowledge sharing literature (see Appendix 2 for the coding frame). It helped make connections between theory and the empirical evidence found in the case. The coding frame was refined and improved by reading related literature and by coding the interview data in the first stage of coding. The coding frame split the data into six big categories: social networks and structural social capital, relational social capital, cognitive social capital, communities of practice, identity, and power relations. The theoretical elements were listed under each category.
The coded data were tabulated in the form of three columns: theoretical elements, quotes from interviews and stories told by informants, and related theoretical concepts. The design of the coding tables helped discard the irrelevant data, select relevant information with theoretical focuses, and show connections between different concepts. The coding tables were useful for analysing the data; as Miles and Huberman (1994:11) put it, “data reduction is a form of analysis that sharpens, sorts, focuses, discards, and organizes data in such a way that “final” conclusion can be drawn and verified.”

4.2. Data Display

Miles and Huberman (1994:11) define data display as “an organized, compressed assembly of information that permits conclusion drawing and action”. In other words, the aim of data display is to show the understanding of theory as well as the data, and the connections between them. Therefore, data display needs to show what was going on, and to spell out the causes and the consequences.

Bernard (1988) suggests that description and explanation are two effective ways in understanding data by reducing the complicated things into components and by showing how they fit together according to some rules. Stake (1995:75) says, “The qualitative research concentrates on the instance, trying to pull it apart and put it back together again more meaningfully – analysis and synthesis in direct interpretation.” This research described and explained what was going on in the focal projects by quoting interviewees’ words directly, along with my explanations and interpretations. In the quotations, the words in square brackets were explanations added by the author. This research organised the quotations and interpretations in accordance with the theoretical elements: social networks, structural social capital, cognitive social capital, relational social capital, and different dimensions of power. This way, the data display can be more clear and systematic, and help the understanding of the case.

This research also used matrices to display findings. In the data chapters, the matrices were used to summarise the key points of the chapters. Since the long narrative text contained many details about different theoretical concepts and elements, summarising
the findings and putting these into the matrices can help the reader capture the key points. In addition, the matrices also helped contrast and compare the data from the two different projects.

This research used graphs to facilitate description and explanation as well. Conway and Steward (1998) use graphs to map out the innovation networks and to represent their findings. A single graph can provide rich information by means of using different “visual variables” (Bertin, 1983) (e.g., position, size, value, texture, colour, orientation, and shape) to represent different types of actors, links, and flows (Conway and Steward, 1998; Steward and Conway, 2000). This research borrowed the idea of using a “focal action-set” (Conway & Steward, 1998) to represent the networks related to the project innovation. For example, in Figure 9-1 (Chapter 9), a template with four segments was used to show the external environment of the project team: suppliers, clients, competitors, and other social connections (such as friends outside the organisation); different types of lines represented different types of relationship (the dotted lines referred to informal relations, and solid lines without dots, formal relations); arrows of line showed the directions of knowledge flow (double arrow lines meant that there was a two-way flow).

In addition, organisation chart and diagram of work process were also used to illustrate the cases. In writing the thesis, the names of the focal company, projects, and people were changed in keeping with the principle of anonymity.

4.3. Conclusion Drawing and Verification

The last step of qualitative data analysis was to draw the final conclusion, and to verify the conclusion. Miles and Huberman (1994:11) suggest that conclusion drawing is the process which goes through the whole processes of data collection and data analysis:

“[F]rom the start of data collection, the qualitative analyst is beginning to decide what things mean … the competent research holds these conclusions lightly, maintaining openness and skepticism, but the conclusion are still there, inchoate and vague at first, then increasingly explicit and grounded.” (ibid)
That means drawing and verifying the conclusion is the process of interpreting social phenomena and verifying the findings from collecting data to analysing data. Researchers should carefully choose the methods of data gathering, and be sensitive to newly-emerging issues. Researchers also need to select data carefully, and organise and display the data systematically. The verification of conclusion also relies on the consistent self-reflection in the process of ‘presenting the stories’.

This research is not just a descriptive study; it explored the relations between knowledge flow and power. It was realised that there may be multiple meanings of a situation so that interview responses should be treated as actively constructed narratives involving activities that themselves demand analysis (Silverman, 2000). In other words, the information provided by the interviewees reflected their cultures and political positions. Therefore, in this research, interpreting the interview data was not merely quoting from interviewees, but also showing the understanding of the meaning behind the words. Not only the respondents’ opinion, but also the data from different sources were checked to improve the accuracy of the interpretation. Meanwhile, the data were systematically presented to discover and illuminate the connections between social capital, knowledge flow and power.

5. Chapter Summary

Taking the interpretive perspective, this research adopted case study method to answer the research questions, to be specific, to explore the connections between knowledge flow, the effects of social capital, and power relations. By choosing an innovation-focused foreign-invested high-tech firm in China, by using related theories to guide data collection and analysis, and by comparing and contrasting two different innovation projects, this research tried to draw general conclusions and to provide an insightful understanding of the influence of power relations on knowledge flow.

The fieldwork of this research was conducted in a foreign invested high-tech company in China to compare a product and a process innovation project. The case selection was
based on, first, the close connections between innovation and knowledge flow; second, the importance of studying knowledge flow in the special cultural context of China.

The network mapping approach was taken to study knowledge flow in a small number of innovation cases (Conway and Steward, 1998). In taking the network mapping approach, snowball sampling strategy was adopted to identify informants; and semi-structured interview was the main method used to gather qualitative data. In order to analyse data systematically, a theory-orientated coding frame was used to guide the data reduction and display. Qualitative data analysis method was used to reduce, display, and draw conclusions.

The results of data analysis are followed in the next chapter. Chapter 6 is the case overview; Chapter 7 focuses on the results of the 3G project; Chapter 8 pays attention to the results of the ERP project; Chapters 9 and 10 are about the case comparison and in-depth analysis which centre on effects of social capital, and power influence respectively.
Chapter 6

Case Overview

1. Introduction

It is difficult to understand the results of this research without considering the context from which the results were derived. The aim of this chapter is to provide necessary background information about the firm, the cases, and people studied by this research, in order that the results of data analysis, presented in following chapters, might be better appreciated.

What follows is divided into 5 sections. Sections 2, 3, and 4 are devoted to background information about the firm, its organisational structure, and strategies related to innovations. Sections 5 and 6 focus on the product and process innovation projects respectively, and each section further describes the projects, the process of the innovations, and the interaction of people in relation to the projects.

2. Background Information of CTI

The telecommunication industry in China has been booming recently. For example, Huawei, a Chinese enterprise headquartered in Shenzhen, was placed among the top five optical system vendors worldwide in 2003, with nearly $1 billion in sales, close to a 10% market share (Richards, 2004:12). Since 1998 the average compound growth rate in exportation of telecommunication equipment made in China was up to 41.2% (RACCEM, 2005). In addition to such a performance, the huge telecommunication market of China has attracted many investors, thereby more and more telecommunication related products being manufactured in China.

Communication Technology Innovations Limited (CTI) was founded in January 1999 in California, USA. The board was composed of John, Ben (General Manager for technology), and several shareholders who invested money to install the assembly line
and testing line. John and Ben had specialised knowledge in the wireless communication area, especially about the manufacturing of power amplifiers. Previously, they worked in the same communication company in the US.

CTI made radio frequency power amplifier products and coverage/capacity systems – Repeaters – and sold them to wireless communication industry in China as well as around the globe (source from the company’s introduction). Nonetheless, the primary target market of CTI was China. Two major network equipment manufacturers in China and the major telecommunications service providers in China, such as Motorola, and China Unicom, purchased its power amplifier products.

CTI had one subsidiary – CTI-Shenzhen – located in Shenzhen, China, and one distributor in Hong Kong to help deliver its materials and products across the Pacific. It also had many suppliers in both Guangzhou and Shenzhen in China to manufacture and process components that it needed. The production lines in CTI were used to assemble components, fittings, and parts of apparatus to produce power amplifier products and Repeaters.

“I think our company is not working on manufacturing, is on assembling, as most of processing was assigned to and done by the outside.” (Director of Production, CTI-Shenzhen)

The subsidiary – CTI-Shenzhen – was established in 2000 when CTI chose China as its major target market. Shenzhen became CTI’s first footing for its further development in China, because Shenzhen was the first special economic zone in China in which many big telecommunication equipment manufactories were located. Though a middle-sized enterprise in the telecommunication industry in China, CTI-Shenzhen, in the very beginning, was simply a commission-based sales agent of CTI in China with only around 8 to 9 employees in total. With the development of the power amplifier market in China, price became the key for enterprises to competing with rivals. In order to reduce the cost of production and transportation, the production of CTI was moved from the US to Shenzhen in July 2002 (General Manager of CTI-Shenzhen, cited from CTI’s meeting
memo 25/07/2002). In August 2004, there were about 130 employees in CTI-Shenzhen: more than 70 workers in production line, and the rest in R&D and other functional departments. Because the unit price of the power amplifier products and Repeaters was high, CTI gained huge profits. From 2003 to 2004, the sales volume of CTI was about 20 million dollars.

3. Organisational Structure of CTI

CTI’s headquarter in the US (CTI-USA) had 13 engineers and 30 workers (in an assembly line and a testing line). CTI-USA was mainly responsible for the research and development of new power amplifiers, the sales in the US, together with the small-scale assembling of power amplifier products. It also supplied some special materials for the production in CTI-Shenzhen. John, Ben, Paul (Chief engineer), and several senior engineers of CTI-USA travelled between CTI-Shenzhen and CTI-USA to supervise and support the R&D and production in these two places. (See Figure 6-1 for the chart of the organisational structures)

Figure 6-1: Organisational Structure Chart - CTI-USA

![Organisational Structure Chart - CTI-USA](source from the company’s documents - organisational chart of CTI -2003)
CTI-Shenzhen expanded quickly after 2002. It rented the ground floor and the third floor of a building in the M industry district of Shenzhen for use as its offices and workshops. General Manager, Ted, was responsible for the overall affairs of CTI-Shenzhen; two Vice-general Managers, marketing and financial respectively; Chief engineer, Paul, the technology part of CTI-Shenzhen. There were 11 departments in CTI-Shenzhen which can be categorised into three parts (technology part, administration part, and production part) in accordance with its functions (see Figure 6-2).

Figure 6-2: Organisational Structure Charts CTI-Shenzhen

(Source from the company’s documents)
The offices of the administration part were on the ground floor, together with the offices of General Manager and two Vice-general Managers. The administration part included Marketing department, Purchasing department, Financial & Personnel department, and a facility group composed of securities, chauffeurs, cooks of the canteen, and cleaners. On the third floor were the technique part and the production part. The technique part included R&D department, and Engineering department which was mainly responsible for after-sales service - returned products’ repairing, and small-scale assembling (e.g. one or two machines). The production part included Quality department, production lines (two assembly lines and one testing line), PMC (Production and Material Control department), Warehouse, and PIE (Production Improvement Engineering) - a newly-assembled group supporting production lines.

4. The Marketing Strategies and Competitive Advantages of CTI

Entry barrier of the power amplifier manufacturing industry was at a high level. Firstly, highly specialised knowledge was crucial for this area. Secondly, it took capital to afford production lines. The price of an assembly line with the capability to produce 10 pieces power amplifier products was more than 1 million dollars (ERP leader and PMC manager, CTI-Shenzhen). However, there was still intense competition in the telecommunication industry in China.

“There were many domestic (competitors), and also many foreign competitors entering the market. … The competition is very fierce. The profit is less than before. Before, we could make 3000-4000 Yuan [¥] profit per machine, but now only around 1000 Yuan.” (Senior hardware engineer, R&D, CTI-Shenzhen)

Therefore, CTI-Shenzhen paid much attention to product innovation.

One of the competitive advantages of CTI was derived from its specialised knowledge in making power amplifier products, such as radio frequency with big power, small signal receiver, digital control, digital signal processing, and related software. Especially, its
technology about digital linear was in the leading position of the world (Chief engineers, cited from CTI-Shenzhen’s meeting memo 25/07/2002).

The second advantage of CTI was its capability to sell products. CTI focused on a niche market. CTI had contracts for selling products to its clients, such as Huawei and Zhongxin, the two biggest network equipment manufacturers in China. To attract and satisfy its clients was very important to improve and maintain CTI’s profits.

“At present, the big manufacturers of telecommunication systems are all our customers, such as Zhongxing, and Huawei. … The amount of products they required is relatively huge.” (Chief engineer, CTI-Shenzhen)

The mission statement of CTI was “develop market with our innovative technology; serve customers with our superior quality; strive for growth with our talented people” (cited from the company’s documents). The marketing strategy of CTI was “to be alert to the market” (Director of Production, CTI-Shenzhen). That is, CTI paid attention to the speed of designing new products, manufacturing and delivering products, and providing after-sales service to its customs. As Director of Production mentioned,

“One (advantage of CTI) is the speed of launching new products. The second is that the time of delivering products is shorter than (needed by) our rivals.” (Director of Production, CTI-Shenzhen)

5. The Product Innovations in CTI-Shenzhen

The growth of CTI benefited from its product innovations which supported its marketing and sales. Because the clients’ requirements for products were various, CTI needed to be innovative in designing and producing amplifier products and Repeaters that met its clients’ needs,

“The principle (of making a power amplifier product) is very simple … but in order to concretely meet (the customers’ requirements), you still need to do lots of work to improve the products, making them more suitable for the customers’ use. This work is our innovation”. (Chief engineer, CTI-Shenzhen)
The products needed to satisfy different product parameters (such as the power, the coverage of signals, noise, and so on) in accordance with the particular circumstances in which the machines were installed and used. The task of product innovations in CTI was to design and make machines at the lowest cost and with the best performance, which satisfied its clients, and which guaranteed its own margins.

"By using (new components), the things we made can have good performance at low cost, and then our profit is high. … If you always make old things, your competitive strength will become weak." (Senior hardware engineer, R&D, CTI-Shenzhen)

In the past, many different product innovation projects were undertaken by engineers in CTI-USA, and R&D in CTI-Shenzhen, such as the designing and producing of many different types of power amplifiers and Repeaters for their clients. The design of power amplifier products, especially those with big power, was done mostly by engineers in CTI-USA, while engineers in R&D in CTI-Shenzhen worked on the small power amplifiers and Repeaters – the subsystems.

5.1. The 3G Power Amplifier Platform Project

The aim of launching the 3rd generation power amplifier platform (3G) project was to develop the 3rd generation power amplifier products to gain competitive advantages for the company.

"The competition is very fierce. … With the development, everyone knows how to make (the machines), then the market becomes smaller and smaller. Hence, we are making 3G now. … The license of 3G things hasn’t been released by the government, but there is a trend that it must be released in the future. … Once we make the machine, (we) can join the (telecommunication) net, and then, we can lead others. … In fact, this (machine) hasn’t been made by others.” (Senior hardware engineer, R&D, CTI-Shenzhen)

Compared with the 2nd generation power amplifier products, the 3G products featured high efficiency, flexible mechanical layout, smaller size, and high reliability at a
competitive cost (source from the introduction of the products of CTI). The task of the 3G project was to research and develop the ‘front-end’ equipments (including low noise amplifier, lower temperature apparatus, and so on), the power amplifiers (called the back-end), and the Repeaters placed in their client’s networks in Beijing, and Shenzhen, China.

The 3G project was carried out by following the process of product innovations in CTI (see the next section). TUS-China, a subsidiary of a big international firm, was the client and co-operator of CTI in this project. That is, the products of the 3G project were provided to TUS-China as parts of their own projects. The R&D department of CTI-Shenzhen was responsible for the design of the ‘front-end’ and Repeaters of the project; the engineers in CTI-USA, the design of the power amplifiers of the project.

The 3G project began from December 2003, the making of sample machines was completed in February 2004, and small-scale manufacturing started from May 2004. The improvement of the 3G products was still in the process during the period of this field research.

5.2. The Process of Product Innovations in CTI

The process of product innovations in CTI was normally carried out in the following way. Firstly, the process commenced with contract negotiation in terms of products’ designing and manufacturing. The company identified its clients’ potential demands through personal social networks of the top-layers of management and marketing people. The top-layers of management (including John, Ben, Ted, Paul, and Vice-General Manager in Marketing) discussed the possibility of securing the orders, and the feasibility of producing the products. Once mutual agreement was reached on the designing and manufacturing of products, the engineers on the clients’ part and Chief engineer and few senior engineers in CTI started to discuss the products’ design plans and main parameters.
Secondly, Chief engineer (Paul) divided the design tasks into different parts, and distributed the work to engineers along with the parameters and requirements of each part. Differently specialised engineers were responsible for the work on different concrete models, such as software, hardware, and so on. Once the engineers completed their own part of work, they integrated their work, and started to adjust and test the products. For example, the software engineer programmed, and installed the programme afterwards. The hardware engineer designed electro circuits, and then tested the hardware along with the installed software to see whether these are compatible. Several modifications of their work still had to be made in order to perfect the functions of the whole machine. And then, the machine needed to pass some technical tests, such as aging test, performance test in different types of terrains, in high and low temperature, and in dry and humid environment, and so on. The major parameters of the sample machine were measured again after those tests. Until the machine was considered qualified by meeting the target parameters, further modifications were carried on over and again. There were always discussions among engineers in order to solve problems during the processes.

From the designing to the manufacturing of a product, it took only a short time for CTI to complete those tasks. Normally, the time spent was less than one month. As a senior engineer stated,

"The time of designing a power amplifier on our USA part was relatively short, because we are more experienced in doing these things... before we made lots of drafts; for many (new) tasks, we just needed to modify (these drafts)." (Senior software engineer, CTI-USA)

5.3. People Related to the Product Innovations

The company had some specialised professionals. One of its founders, John, held a doctorate from an American institution in communication area. Chief engineer and some senior engineers, especially those in CTI-USA, had more than ten to twenty years’ work experience in the field. The R&D in CTI-Shenzhen was composed of four engineers, each working on different aspects: software, hardware, radio frequency, and models. Because there were not enough engineers, sometimes they had to work on several
projects at the same time. Without doubt, they often worked overtime. Their specialised professional knowledge brought competitive advantages to the company by developing product innovations.

“Our profession, the entry barrier is relatively high, because … (knowledge about) radio frequency technology took many years to accumulate. … We have our own unique technology in the aspects of power control and attenuation.” (Chief engineer, CTI)

The cooperation between engineers went smoothly. Chief engineer, engineers in the R&D, CTI-Shenzhen and engineers from CTI-USA often discussed together to solve technology problems. In CTI-Shenzhen, except some new comers, most of the engineers, including Chief engineer, used to work in the same company before joining CTI. This made them know each other well, and made their cooperation easier.

There were interfaces of work among engineers in the R&D, and between engineers in R&D and in CTI-USA. The interfaces provided the opportunity for the engineers in the R&D, CTI-Shenzhen to access more advanced technology and to learn from people coming from CTI-USA. For instance,

“(You) must learn from the experts, such as John in the USA. They knew problems once they saw a thing. … You did not even need to explain to them. Just solve the problems by following their suggestions.” (Senior hardware engineer, R&D, CTI-Shenzhen)

The knowledge flow within R&D and between departments helped the product innovations.

In addition, because some power amplifiers were designed by CTI-USA, but had to be manufactured in Shenzhen, engineers in CTI-USA sent to CTI-Shenzhen some documents detailing the manufacturing process. Some senior engineers and the production manager in CTI-USA also came to Shenzhen, and stayed there for a certain period to supervise the manufacturing.
“(We) come here and bring something of the manufacturing processes of the USA (part) to here. ... That is to say, you couldn’t make your documents so detailed and solved all the problems.” (Senior software engineer, CTI-USA)

Meanwhile, engineers in Engineering department in CTI-Shenzhen gave feedback to the USA side when customers returned some products for repairing: because the power amplifiers were designed by CTI-USA, engineers in the USA were able to offer better solutions. In the formal way, clients contacted Engineering department for machine repairing. When Engineering department failed to solve the problems, they needed to report to Chief engineer directly, and then went to the relevant engineers in CTI-USA to discuss about the solutions. In addition, engineers in R&D and in Engineering department also helped each other to deal with some technology problems through their personal relations.

However, the internal and external knowledge flow was limited for several reasons, such as lack of interest to learn from people in other professions. For instance, the R&D leader who was specialised in radio frequency had little contact with engineers in CTI-USA, because he did not “do the power amplifier”. Therefore, boundary-spanning knowledge flow was restricted. There were also other factors affecting knowledge flow, such as redundant knowledge, and different sub-cultures between R&D and CTI-USA. The factors which facilitated or/and impeded knowledge are to be discussed in details in Chapter 7.

6. The Process Innovations in CTI-Shenzhen

There were also process innovation projects being launched in CTI-Shenzhen, such as the ERP (Enterprise Resource Planning Software) project, and the ISO 9000 project (in 2003). The aim of launching the process innovation projects was to improve CTI-Shenzhen’s management, and to support its production & R&D. With CTI-Shenzhen growing quickly,
“R&D, production and sales must achieve a relatively balanced standard. It cannot be very weak in each aspect.” (Chief engineer, CTI)

“When (types of) your products became more and more, and your problems occurred more and more, the customers would be irritated more and more. That is, sometimes, they were not satisfied. Even your time of delivering goods (was short). Then, at this moment, the quality needed to be considered” (Director of Production, CTI-Shenzhen).

In fact, there was such a situation requiring CTI-Shenzhen to improve its work process. For instance, a client of CTI – Motorola-China – checked the qualifications of its suppliers. It asked CTI-Shenzhen to improve its management integration by using ERP system (ERP leader and PMC manager, CTI-Shenzhen). Therefore, the aim to launch the ERP project was to help the further growth of CTI, because management became an important issue for attracting and keeping big clients.

In 2002 and 2003, the situation of CTI-Shenzhen was that there wasn’t any integrated management system to combine forces from every department of CTI.

“(CTI) was a very young company at that time [2002 and 2003]. There wasn’t a management system at all at that time.” (Director of Production, CTI-Shenzhen)

Even in 2004, before the ERP project was launched, there were many problems in management and in coordination between departments.

“Without planning work as a whole, how to say that, it was unavoidable that there were (conflicts) between departments.” (Director of Production, CTI-Shenzhen)

“Before, we didn’t have ERP; the situation was relatively messy, especially in two aspects: the material flow and the capital flow. ... We did not even know the cost.” (ERP leader and PMC manager, CTI-Shenzhen)

6.1. The ERP Project
The ERP project was to standardise the work procedures of each department of CTI by using the management system software. There were about a dozen modules which had different functions in the ERP system. These modules recorded the current work situation
of each department, and their work was linked in the form of a chain. For instance, with one contract, a ‘bill of sale’ was input into the ERP system by operators in Marketing department. According to the ‘bill of sale’, a ‘production sheet’ was filled by operators in Production, and then a ‘production materials preparation sheet’ was issued by PMC. All the work procedures and conditions were monitored and recorded by the ERP system.

Generally speaking, ERP is a management system applying the modern information technology and based on the concept of supply chain management (Chen, 2001:3). ERP “attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments’ particular needs” (Koch, 2002). To some degree, in CTI the ERP system was helpful for material and capital control, and made each department’s operation more regular and standardised by following the new work procedures of the system. Therefore, the ERP system improved the overall quality of people’s work in CTI-Shenzhen, and the quality of its products.

“(Before the ERP) some screw was out of stock. ... If the short ones were out of stock, (we) just used the longer ones and added two more gaskets. ... But it was not permitted according to some quality control and strict technical requirements. Maybe it was OK, but if some customers were strict, there would be a trouble. ... After the ERP (system) was set up, once we noticed that the safety stock was not enough, we purchased (the materials) without being reminded.” (Senior planner 1, PMC, CTI-Shenzhen)

Although the ERP project bought and used the standardised ERP software, the work procedures needed to be changed in keeping with the internal and external environment of the firm, such as competition and market pressure, employees, organisational culture, management style, financial problems, and so on. How to find a proper way to improve the work process was the key to the process innovation. Many problems and lot of resistance occurred in the course of promoting the project. There might not be ‘standardised’ solutions to these problems, because they were not ‘the kinds of ‘Yes’ or ‘No’ questions” (ERP leader and PMC manager, CTI-Shenzhen). Those problems affected knowledge flow as well as implementation of the process innovation. The details are presented in the next two subsections.
6.2. The Process of Launching the ERP Project

The process of launching the ERP project was as follows. In October 2003, the decision of launching the ERP project was made by the board and General Manager of CTI-Shenzhen, Ted. Immediately, the ERP project team was formed. According to the company's documents, Ted was the team leader; Louis, PMC manager, was authorised as the vice team leader (called ERP manager); and the managers of each department, together with the IT support engineer responsible for the work of maintaining the IT system of CTI-Shenzhen, were team members, as well. In fact, it was Louis who made most decisions for all actions about the ERP project. Other department managers, even the IT support engineer, were not involved in the project.

"From the very beginning, it was Louis who was responsible for the core (issues), and how to keep it going. For my part, I only participated in when there were some problems related to the Net, computer and some setting. Usually, I didn't participate in when (they) adjusted how material should flow." (IT support engineer, CTI-Shenzhen)

The second step of the ERP project was to decide if to buy the software. Regarding this purchase, there were divided opinions in the top-layers of management, so there were conflicts and resistance in the course of launching the project later on. For example, some BOM (Bills of Material) were not confirmed by CTI-USA, so that those BOM were not input into the system; as a result, installation and test run of the system were affected. (Source from the CTI-Shenzhen ERP project work record CTI-V-R-001)

In November 2003, CTI-Shenzhen signed a contract with software company, Win@ware to purchase its ERP software and related service, such as training, installation and test runs. The price of the ERP software was more than one hundred thousand RMB Yuan, which was much cheaper than other ERP software used in some big companies (up to ten million RMB Yuan).

"Very good ERP (software) costs a lot. The company did not have a plan for that much (cost)." (IT support engineer, CTI-Shenzhen)
Although it might not be the top ERP software, it did improve the management and work process of CTI-Shenzhen to some extent.

“It is difficult to say it [the ERP system] greatly helped R&D department. At least, it helped the BOM and standard sheets, making these processes more clear. ...it (integrated) the whole material flows, information flows, and capital flow.” (ERP leader and PMC manager, CTI-Shenzhen)

“Before, (the production construction lists) were handwritten, and changed greatly time to time. Now they were locked up in the ERP system in computer. If you wanted to make a change of it, everyone’s signature was required. ... Now the chance of messing things becomes small.” (Senior planner 2, PMC, CTI-Shenzhen)

The third step of the ERP project was to install software on the computers, update the system, input the data base into the system, and, finally, give the software test runs. Most of the work was done by Win@ware with Louis’ assistance, especially in the part of inputting the data base. The original data were provided by related departments. Those data included stocks, related information about CTI’s clients and suppliers, purchasing price and contracts, BOM, standards of quality check sampling, and so on. Win@ware also gave Louis training about the logic and operation of the modules of the system. This work began from February 2004, and was done in April 2004.

The next step was to integrate the ERP system into work procedures of every department. Each department assigned a ‘key user’ to operate the system. Louis gave instructions to the “key users” after opening accounts for them to use the system. Louis decided how and when to promote related modules in every department’s daily work, and to make the new system function well - in their words, “to adjust the work of different departments”.

The work of integration lasted a long period of time. That was because, firstly, there were conflicts when people were not used to using the new system; and cooperation between departments did not go smoothly:
"Each time I filled the sheet of 'applying for material purchasing', I needed to check the standard codes of material in the ERP. It was very troublesome because you did not know the rules of coding the materials when (you) check the standard codes.” (Assistant leader, testing group, CTI-Shenzhen)

Secondly, not every department followed the new procedures.

“You had to skip the ERP to meet the requirement of delivering goods. This was (because) you can earn money (by doing so). (But) You were in trouble at this moment. This was not about one or two departments, but the whole company’s management model, even the boss’s values. Saying this might not be very specific, but actually it was true.” (ERP leader and PMC manager, CTI-Shenzhen)

Thirdly, the ERP system operated in every department was not coordinated. For instance,

“Warehouse received goods, but the IQC [incoming material quality check] work did not catch up – (they) did not check quality (of the good). There was not a reply occurring in the system if the quality check had not been done. So, Warehouse had to leave (the goods) there, because they could not put them into store without passing the quality check. … Then, Production could not take material (from Warehouse). Therefore, the problems occurred: as Production urgently needed the material, it could not be taken out from the store in the system.” (IT support engineer, CTI-Shenzhen)

Not until September 2004, when Louis left CTI, did the IT support engineer and the new Director of PMC & Warehouse take over, and the work of integrating was still in process.

6.3. People Related to the Process Innovation

Two training lectures were given to the key users by Louis, in order to let them know how to operate the new system. And then, those key users taught or guided their colleagues to operate the system in their departments when necessary. Louis answered enquiries and helped them to solve problems about operating the system. Meanwhile, the key users communicated with Louis about their needs and problems. For instance,

“In the very beginning, we adopted one method of ‘material transferring’ (to return unqualified goods to our suppliers). … I found that nobody knew if those items were sent back or not, but we still paid the suppliers money. Then I went to
Louis. ... He had a look at the setting of the ERP. Then, he proposed to use 'the planned return material'.” (Official, Warehouse, CTI-Shenzhen)

There were interactions between people in different departments, which influenced knowledge flow. For instance,

“Because (people of PMC) work on the part of ‘stocks’, they are more clear about it. I asked them how to check ‘stocks’ (in the ERP system), then they told me ...how to check it. ... We always learned from each other”. (Junior clerk, Purchasing department, CTI-Shenzhen)

On the other hand, because CTI was short-staffed, employees always worked overtime. Therefore, there were few opportunities for people to exchange ideas with each other.

“We don’t have time to talk about this [information about purchasing raw materials] in working hours. ... Everyone was busy with his/her own work; we don’t chat.” (Official, Marketing department, CTI-Shenzhen)

Whereas there were many other factors impeding learning and knowledge flow in the ERP project, there were also elements facilitating internal and external knowledge flow. And, those factors which affected knowledge flow in the ERP project will be fully discussed in Chapter 8.
Chapter 7

Results of Data Analysis from the 3G Case

1. Introduction

Since the data were collected from two separate but related cases, the results of the data analysis are split into two chapters: Chapter 7 and Chapter 8. In order to clarify the storyline of each case and minimise repetition, this chapter presents the results of data analysis from the 3G power amplifier platform project (3G); Chapter 8 displays the results of data analysis from the ERP project (ERP). The results of the data analysis are followed by the case comparison, and in-depth discussion of the results (Chapters 9 and 10).

This chapter has four sections. Section 2 explains the effects of social capital on knowledge flow. It has five subsections. Each subsection focuses on the following themes separately: content of knowledge, social networks and structural social capital, cognitive social capital, relational social capital, and interactions of the three dimensions of social capital. Section 3 focuses on the influence of power on knowledge flow and utilisation of social capital. Section 3 has four subsections in accordance with four different dimensions of power (Hardy, 1994). Section 4 is the chapter summary.

2. The Positive and Negative Influence of Social Networks and Social Capital on Knowledge Flow

2.1. Content of Knowledge Related to the Product Innovation

In the 3G case, two kinds of knowledge were related to the product innovation. The first kind of knowledge was about how to integrate different works done by engineers working in different units, organisations, and professions. This kind of knowledge can be called knowledge related to integration. For example, in R&D, every engineer had his or her own specialised knowledge, and worked on different technical parts of the project. They had interfaces in which they adjusted and integrated the work done by engineers
other than themselves. They needed to communicate with each other to identify problems that occurred in the innovation process and find out solutions.

“If I did not communicate with him/her about something, I might be able to accomplish (my) work, but he/she might not; or he/she accomplished their work, but I could not.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

This kind of knowledge was important for the product innovation, because it helped engineers to coordinate with others and improve the design.

“I felt that another key of doing R&D was that, (you) needed to digest other’s (thought) easily. You needed to understand and accept what others said quickly (and) to propose how to solve (problems).” (R&D leader and radio frequency expert, CTI-Shenzhen)

In addition, at the early stage of the product innovation, Chief engineer (Paul), Ben, and R&D leader often went to TUS-China to discuss about the technology parameters and designing plans which were related to the 3G products of TUS-China.

“(We) cooperated with them [engineers in TUS-China], so we always discussed with them from the beginning, from making a plan, to drafting (the plan), and laying down parameters, and so on. ... To discuss, “Is it possible to do this in this way? Or is it possible to do this in that way?”” (R&D leader and radio frequency expert, CTI-Shenzhen)

Therefore, this kind of knowledge was shared not only across the departmental boundaries, but also across the organisational boundaries.

Meanwhile, the highly specialised professional knowledge helped to improve the product design; thereby, it was also essential for the product innovation. It was related to engineers’ capability to be innovative and to solve problems that occurred in the process of product development.

“Knowing how to solve the problems, after looking at them. It was this kind of savvy.” (R&D leader and radio frequency expert, CTI-Shenzhen)
However, it was not always easy to share these two kinds of knowledge. The following subsections discuss how sharing these two kinds of knowledge was facilitated or/and impeded from the angles of the social networks and social capital.

2.2. Social networks and the Structural Social Capital
This subsection discusses the effects of social networks and structural social capital on knowledge flow at three levels: ties level (different network ties), individual level (the role of key individuals), and network level (the size and diversity of the networks).

2.2.1. Different Network Ties

2.2.1.1. Internal Ties within COPs
Although R&D department consisted of 'diversely skilled individuals' (Lindkvist, 2005), it can still be seen as a community of practice, because R&D people developed shared understanding about their mutually engaged practice by cooperating and interacting with each others in the practice. Details are as follows. Firstly, engineers had 'joint enterprise' (Wenger, 1998). They had shared responsibility for developing new products. They cooperated with each other in the process of developing new products.

"The work was not divided in a very detailed way. I worked on this part; he/she worked on that; everyone had interface and negotiation with others. Everyone helps each other, then the work can be done relatively fast." (R&D leader and radio frequency expert, CTI-Shenzhen)

Secondly, engineers shared history of cooperation in which they developed shared understanding about the work. Therefore, they were able to understand each other.

"We are familiar with each other. At least, you won't misunderstand his/her thought. This could improve the effectiveness of our work." (Senior machine structure engineer, R&D, CTI-Shenzhen)
Thirdly, they were willing to participate in formal and informal discussions to exchange ideas, and to help each other to solve problems. Through discussions, they combined their individual wisdom to develop collective knowledge.

“Many people would propose their own ideas in the discussions. Then, these ideas enlightened and helped me. All people solved problems together when (we) encountered some technological problems. Sometimes, maybe another person came up with a method which was better than mine. In the team, this kind of communication was definitely mutual.” (Chief engineer, CTI)

As argued above, it is safe to regard R&D as a community of practice.

Similarly, CTI-USA was also a ‘community of practice’, engineers in CTI-USA had shared interests and shared history of cooperation; they were engaged in knowledge sharing activities to develop collective knowledge. For example,

“We [engineers in CTI-USA] relatively know each other. For example, I am relatively clear about his/her knowledge construction, and he/she is relatively clear about my knowledge construction, too; and then, sometimes (the communication) took the form of discussions. …When we encountered a problem, (and) did not have a mutual understanding, then we discussed together to help each other to find out ‘why’.” (Senior software engineer, CTI-USA)

Within the COPs, engineers had frequent communication and interactions; therefore, the strength of the internal ties among them was strong. For instance, according to observation and interview data, engineers in R&D often had formal and informal meetings to discuss problems that they encountered in work.

“If (we) encounter problems … several persons discuss together. What causes the problems, and then which methods are adopted to solve it.” (Chief engineer, CTI)

The strength of the internal ties was strong also because of ‘multiplexity’ (Barners, 1979) – those engineers were connected by multiple relations. Except for the newly-recruited software engineer in R&D, all engineers in R&D department worked together in another company before joining CTI.
“Most people in our R&D department ... were all in the R&D department in SEL Communication before. We joined here one by one. ... In fact, we (worked) together before and were familiar with each other. For example, Peter, Kenny, and I, we have been working together since eight years ago.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

The multiple connections between engineers increased the strength of the internal ties, and enhanced the group cohesion. Furthermore, they facilitated internal knowledge sharing, especially the knowledge related to integration. Through discussions and negotiations, knowledge was shared through the internal ties.

“In the process of designing (new products), (we) discussed with each other (to see) whether (the design) is feasible or not. In this way, we could make (the design) relatively perfect.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

Those internal ties had work interdependence nature. The engineers who had interface in their work had more and frequent communication than those who did not. For instance,

“There are relatively more discussions in some areas. For example, the design of circuit board is much more related to the final positioning of the product. (People who) design circuit board always discuss with (people who design) structure. For me, a person working on software would discuss relatively more with (people who work on) hardware...(because) my software needs to follow his/her requirements. ... I don’t have any connection with structure (design).” (Newly-recruited senior software engineer, R&D, CTI-Shenzhen)

However, there were also negative effects of the internal strong ties. First, because of the shared history of cooperation, the strong internal ties often provided the team members with redundant knowledge.

“We know each other. It is not saying that we are proud of ourselves. Maybe everyone (thinks that) others know what I know, and I know what others know, too. ... It seems that there is noting new here. I have also done the things which you have done.” (Senior hardware engineer, R&D, CTI-Shenzhen)
The redundant knowledge offered by the strong internal ties, on the other hand, highlighted the importance of external ties, because external ties provided non-redundant knowledge which was of importance for the product innovations. This issue will be handled later.

Second, the strong internal ties developed strong and distinct identities of people in different COPs. For instance, two groups of people (engineers in CTI-USA and those in R&D) had strong and separate identities.

“There is enough professional dedication here. … You can see these people who come from our USA part. Once you compare (them), you will know (the difference). It’s obvious.” (Senior software engineer, CTI-USA)

To some degree, the strong and separate identities impeded knowledge sharing between COPs. Sharing highly specialised professional knowledge between these two groups of engineers became particularly difficult.

“People who came from the USA part…they won’t tell you something (you wanted to know). They were relatively more cooperative in introducing information. But they wouldn’t tell you when you asked them questions. We can only observe them when they were making things.” (Senior hardware engineer, R&D, CTI-Shenzhen)

2.2.1.2. Formal Ties between Departments
As mentioned before, engineers in R&D and in CTI-USA worked on different parts of the 3G project. They had interface in which they needed to integrate the work done by these two units. Knowledge related to integration was shared between these two COPs through the formal connections.

“Because (some parts of) the research and development work were done in the USA, then, we often communicated with them about some problems.” (Chief engineer, CTI)
There were also formal ties between engineers in Engineering department, R&D, and CTI-USA. Engineering department was responsible for after-sales service (repairing machines) and some technical problems in production. Engineers in Engineering department needed to discuss some technical problems of the machines with the designers – engineers in R&D and in CTI-USA, because those designers were able to offer useful information about the machines.

“We would communicate with them [CTI-USA] about some things which were feedbacks from the customers’ side.” (Chief engineer, CTI)

Engineers from CTI-USA were also able to gain knowledge through the formal ties. For instance,

“Because I do design in the USA, I am not clear about the domestic material flows. I asked him [Manager of Engineering department] (for help); he helped me to search (for information) about that.” (Senior software engineer, CTI-USA)

More importantly, those formal ties provided engineers non-redundant knowledge.

“When (engineers) came here from the USA part, we paid much attention to observing them, (because of) the new things they have.” (Senior hardware engineer, R&D, CTI-Shenzhen)

“They [engineers in CTI-USA] introduce the technology (to us). They are doing the “R - return” technology. This is a kind of new technology of control.” (Senior hardware engineer, R&D, CTI-Shenzhen)

The non-redundant knowledge shared through the formal ties contributed to the success of the product innovation.

2.2.1.3. Formal Ties between Organisations

The formal ties based on inter-organisational cooperation facilitated knowledge sharing between organisations, especially knowledge related to integration. As mentioned before (see Section 7- 2.1), The supplier-client-based partnership developed the formal ties
between CTI-Shenzhen and TUS-China, and the formal ties helped knowledge exchange between engineers from these two organisations.

The formal ties between CTI and its suppliers provided additional channels for knowledge flow. This kind of formal ties helped some engineers in R&D to obtain useful information from the suppliers. For instance, a senior machine structure engineer in R&D had contact with the technicians from the suppliers for processing particular materials and components. This kind of formal ties provided opportunities for him to exchange knowledge with those technicians.

"Sometimes when I went to factories to (ask their technicians to) make something, sometimes I would ask (them) "Is there any other method or relatively new method (to solve the problems)?"... Although some methods (of theirs) might not be new, the result (of consulting them) was that (they) would let you know more about the methods through which you could make better products." (Senior machine structure engineer, R&D, CTI-Shenzhen)

However, those formal ties tended to be more effective in facilitating the sharing of knowledge related to work integration rather than highly specialised professional knowledge.

"Everyone would keep something secret, including my clients" (R&D leader and radio frequency expert, CTI-Shenzhen)

Competition between organisations was one of the impediments to the sharing of specialised professional knowledge through the formal ties between organisations. There were also other factors which were related to the limited knowledge flow via those formal ties. Those factors will be discussed later in terms of cognitive and relational social capital, and power relations.

2.2.1.4. Friendship Ties

The informal ties provided additional channels for knowledge flow across departmental and organisational boundaries. Firstly, friendship ties were substituted for formal ties
when engineers in R&D and in Engineering department did not have interface in their work. The friendship ties between these engineers facilitated knowledge sharing between them. For example,

“Peter, an engineer in Engineering department, and I are very familiar with each other; sometimes I needed a component for adjustment, or he had problems adjusting in his part of the work, then he would ask me how to adjust it, which step of adjustment should be done first. ...we did these completely through our personal relationships.” (Senior hardware engineer, R&D, CTI-Shenzhen)

Second, informal ties connected people from different organisations when there were no formal ties between organisations; and those informal ties helped engineers to access new knowledge/information from external sources. And the new knowledge/information obtained through those informal ties contributed to the product innovation.

“In the USA, Ben has many friends who work on amplifiers, or optical fibre, or some installations whatever.... Ben made phone calls to them; Ben brought information materials (from his friends) to here; sample products were provided for us.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

Knowledge was also shared through those informal ties. For instance, some engineers exchanged knowledge with their friends who were working in the same, similar, or related profession in other firms. In discussing or offering advice, knowledge was shared through the friendship ties, and helped engineers to solve problems that they encountered in the process of product innovation.

“We would talk about ‘What you have done recently?’. Sometimes, you couldn’t figure out one thing; for example, you couldn’t lower the noise, although you adjusted the whole parameters. They [friends] might give you suggestions, such as changing the locations of electronic components or switching to a small distance. And then, it worked.” (Senior hardware engineer, R&D, CTI-Shenzhen)

On the other hand, lack of friendship produced barriers to knowledge sharing, especially inter-organisational knowledge sharing.
“To maintain one’s own benefits, the competition between organisations is fierce...except friends, normally it is difficult for you to know some (new things) from others.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

2.2.2. The role of key individuals

There were several individuals playing important roles in facilitating knowledge flow. Firstly, Chief engineer and Ben acted as link-pins, because they provided the direct link between two groups of people (engineers in R&D and CTI-USA) by virtue of their membership of these two groups (Conway, 1997; Lincoln, 1982). According to Wenger (2000:232), memberships of a COP must ensure that the focus of the community is not diffused and participation does not fail to grab people’s identities. In other words, shared practice and shared identity are essentials for memberships in a COP. As mentioned before, Chief engineer and Ben spent about half of their work time in each of these two COPs. Moreover, they were fully involved in the development of new products in those two COPs; they considered themselves as members of CTI-Shenzhen and CTI-USA without showing predilection for either group. For instance, unlike engineers in CTI-USA who always said ‘people in our USA part’ and ‘people in their side’ drawing a line of demarcation between two groups of engineers, Chief engineer used words like ‘we’ and ‘our’ to refer to engineers in both CTI-Shenzhen and CTI-USA. Therefore, Chief engineer and Ben had multiple memberships in each of these two groups. Through multiple memberships, they had direct connection with engineers in both COPs, and were able to share knowledge with engineers in both COPs.

“Among engineers, it seems that every one is relatively open-minded...that is to say, if there is anything (you want to know), (they) would all do their best to tell you. That is to say, they do not have a very conservative attitude.” (Chief engineer, CTI)

Furthermore, Chief engineer and Ben were also gatekeepers who sought non-redundant knowledge from external sources and distributed the knowledge internally. They had connection with external groups through informal ties. Those connections made it
possible for them to access non-redundant knowledge from external sources. For example, Chief engineers were able to access new knowledge about ‘Network design’:

“Because we do this profession, I know many people in this profession, maybe not in this company, in other companies. Some of (them) may do the similar job as I; some may not be very similar. Sometimes, all people frequently meet together for a chat. We always gain (knowledge) from each other. ... Some of them [his friends] do work of Network design. Because we have little experience of doing things (in those aspects) ... when we have some problems, (I) ask them for advice, too.” (Chief engineer, CTI)

And then, through discussions, Chief engineers shared the knowledge about ‘Network design’ with engineers in CTI. Likewise, Ben was also able to obtain non-redundant knowledge/information from external sources through his friendship ties (see Section 7-2.2.1), and then shared it with related engineers in CTI-Shenzhen and in CTI-USA. Knowledge obtained through Chief engineers and Ben’s ‘gatekeeping’ behaviour became the important innovation source.

Secondly, David, a senior software engineer in CTI-USA, also played an important role in ‘brokering’ knowledge. He had close connection with engineers in CTI-Shenzhen and in CTI-USA. He acted as a gatekeeper rather than a link-pin, because he did not have membership in CTI-Shenzhen. As mentioned in Section 7-2.2.1, he came to work in CTI-Shenzhen to solve some problems of work integration. This gave him the opportunity to share knowledge, gained in the practice of CTI-USA, with engineers in CTI-Shenzhen.

“I directly look at the problem for him/her to find out the problems. Then, he/she can see the process of how I find out the problems. Next time, he/she might be able to do it by himself/herself. (The knowledge) was (transferred) dribs and drabs in the daily work, in the process of cooperating and communicating with each other, or in the process of designing (the products).” (Senior software engineer, CTI-USA)

He was a gatekeeper of CTI-USA who had various connections with external sources. He went to different places to create connection. He gained non-redundant
knowledge/information through those connections, and then shared it with his colleagues in CTI-USA. For instance,

“In our USA side, I was the person who always went out to attend seminars...I would like to go out to have a look when there are some new things outside (of the company). ...when I was in the USA, I always shared my knowledge with many colleagues...about new technology, such as some things, especially about logic, or many (other) new things. It was I who always prompted them to use these (new things) in work.” (Senior software engineer, CTI-USA)

The knowledge he sought and gained from outside of the organisation contributed to the product innovation.

In addition, David was not the gatekeeper of CTI-Shenzhen, but he provided a liaison link between engineers in CTI-Shenzhen and others in some external groups, as he acted as an intermediary between CTI-Shenzhen and his friends (Conway, 1997). The product innovation was benefited by the knowledge gained through Hu’s personal contacts. For instance,

“(The software engineer in CTI-USA) installed a kind of software for us this time when he came back (from the USA). The software was introduced to him by one of his friends in the USA. The software is very helpful for us.” (Senior hardware engineer, R&D, CTI-Shenzhen)

2.2.3. The Size and Diversity of the Networks

Since there were few engineers working in R&D department in CTI-Shenzhen, the size of internal communication networks of R&D was small. The small size of the internal communication networks was conducive to group cohesion, because there were frequent and close interactions among the members. However, it was not without negative effects, as there were limited knowledge resources embedded in the internal networks.

“(There are) relatively more people in some specialised designing companies, unlike our company in which just one person does (one kind of work) of the project from the beginning to the end. ... They discussed together about the
designing plan. Everyone proposed their own ideas. In this way, (they) drew on the wisdom from the masses. And then, they could acquire more reasonable (suggestions). But, (we) can only rely on our own experience to make (the design) more reasonable." (Senior machine structure engineer, R&D, CTI-Shenzhen)

However, engineers in R&D had many external ties, and the external ties increased the size of communication networks. As mentioned in Section 7-2.2.1, there were formal ties between R&D, and its clients and suppliers, and also informal ties connecting people in R&D and in other departments and organisations. Because of the embeddedness of network ties, some senior members, especially Chief engineer and some senior engineers, had a relatively big-sized friendship network.

“I have worked for so many companies; and there are many people (who are my friends) in every company (I have worked for).” (Senior hardware engineer, R&D, CTI-Shenzhen)

Therefore, the size of communication networks was extended by those external ties which provided channels for obtaining non-redundant knowledge for innovations.

The diversity of networks is important to evaluate structural social capital in relation to knowledge flow and innovations, because a higher degree of diversity of social networks indicates more innovation sources resided in the networks. As mentioned Section 7-2.2.1 and 7-2.2.2, the communication networks of the team members contained various formal ties (internal ties, external ties between departments/units, and external ties between CTI and its clients and suppliers) and informal ties.

By and large, the diversity of the communication networks was high in the 3G case because it contained many formal and informal ties and various external groups connected by those ties. This indicated that engineers were able to access non-redundant knowledge from a wide range of different external groups through formal and informal ties.
2.2.4. Summary

Various formal and informal ties provided channels for sharing knowledge between individuals, between departments/units, and between organisations. The frequent interaction and multiple connections increased the strength of the internal ties of the COPs. Those strong internal ties facilitated knowledge sharing within the ‘community’. On the other hand, they also led to redundant knowledge and distinct identities which impeded inter-departmental knowledge flow. Nevertheless, the multiple membership of key individuals and shared practice in inter-unit cooperation helped knowledge sharing between the ‘communities of practice’. Several key individuals played the important roles in transferring knowledge between ‘communities’, and in accessing non-redundant knowledge from various external groups. Various formal and informal networks increased the size and diversity of networks which were the important structural social capital.

2.3. The Cognitive Social Capital

The cognitive dimension of social capital is essential for people to recognise the value of shared knowledge, and to understand and absorb shared knowledge (Nahapiet and Ghoshal, 1998). As mentioned before, knowledge was shared through the various network ties. It seemed to be difficult to share specialised professional knowledge rather than knowledge related to work integration. This section discusses how different elements of cognitive social capital influenced this kind of ‘conditional’ knowledge flow.

2.3.1. Different interests and preferred outcome

Different interests impeded knowledge flow through formal ties. As mentioned before, whereas knowledge related to work integration was shared through formal ties, certain kind of specialised professional knowledge was hoarded by engineers who worked in different organisations. One of the reasons was because that the organisations (CTI, its suppliers and clients) paid attention to their own development in the future rather than a long-term cooperation with others. And monopolising certain specialised knowledge was the way the organisations guaranteed their own competitive advantages and reduced their
dependence on others. For instance, an engineer described the conflicts between CTI, and
its suppliers and clients:

“(If) I told you (the key knowledge), you might beat me in the future. … You
would make things by yourself (and) solve some (problems) by yourself. … If I
gave the technologies to you, you would become (strong), and I couldn’t beat
you.” (Senior hardware engineer and adviser, Engineering department,
CTI-Shenzhen)

Therefore, because of the conflicts of interests, sharing specialised knowledge across
organisational boundaries became difficult.

2.3.2. Shared Cause/Effect Beliefs

As mentioned in Section 7-2.2.1, within COPs, engineers were willing to share their
knowledge to integrate the work done by others. Having shared understanding about the
causes and consequences of their cooperative action in getting things done facilitated
knowledge sharing within COPs.

“It was impossible to complete the whole work of the projects by one person.
Definitely several persons discussed together. … Everyone helped each other,
then the work could be done fast.” (R&D leader and radio frequency expert,
CTI-Shenzhen)

The shared cause/effects beliefs (Thompson, 1967) also facilitated knowledge flow
between departments. As mentioned before, the two groups of people (Engineers from
R&D and those from CTI-USA) worked on different technology parts of the 3G project.
They needed to integrate their work. Understanding the consequence of cooperative
action was of importance for the integration as well as the success of the product
innovation.

“I did this, and he/she did that. It did not work when put the two things together
which were done by these two persons. Maybe both of the two things needed to
be modified. So, it won’t be all right, if these two persons did not want to make
modifications” (R&D leader and radio frequency expert, CTI-Shenzhen)
Engineers understood the importance of being cooperative in the process of developing new products. Based on the shared understanding about the cause/effects relations of cooperative actions, engineers in these two departments/units were willing to share the knowledge related to integration (see Section 7-2.2.1).

### 2.3.3. Shared Language and Common Knowledge

Firstly, shared experience and language facilitated knowledge sharing within COPs. As mentioned before, engineers in R&D worked on many new product development projects for CTI. They also had cooperation experiences in the company where they previously worked together. The shared history of cooperation helped them to develop shared language and understanding, which made it easy for them to share the knowledge related to integration. For instance

“(We) have cooperated for a relatively long period of time. ... I, relatively, easily understand what he/she thinks in his/her mind; therefore, it is more convenient for us to do the work.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

On the other hand, lack of shared language and experience made it difficult for engineers to exchange the knowledge related to integration. For instance,

“According to my experience, sometimes if these several engineers were not familiar with each other, and didn’t have this kind of tacit understanding among them, it was easier to cause dissensions in the cooperation process because of the various understandings they had.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

This kind of cognitive barriers were called ‘semantic boundaries’ (Carlile, 2002; 2004). That was because some engineers had not cooperated with each other long enough to develop ‘shared meaning’ (Dougherty, 1992). Therefore, lack of shared understanding about work caused difficulty to knowledge sharing at semantic boundaries.
Furthermore, working in different technology areas, some engineers had highly specialised knowledge. On that account, they did not have a common language regarding their specialised professional knowledge. This became an impediment to sharing the specialised professional knowledge among the engineers in R&D.

“I don’t ask for advice from my colleagues…because they and I are not in the same profession.” (R&D leader and radio frequency expert, CTI-Shenzhen)

Because the engineers spent lots of energy and time developing their specialised professional knowledge, they prized their profound professional knowledge. Sometimes, knowledge from other professions was considered irrelevant to their work and professional development; therefore, they did not show any interest in exchanging ideas with those people.

“I also chat with them, talk with them. But our professions are different. Therefore, that is to say, if we could not talk about the professional things, the chat would be meaningless.”(Newly-recruited senior software engineer, R&D, CTI-Shenzhen)

Second, shared language and common knowledge was essential for knowledge flow between COPs. For instance, having the knowledge about computing and programming helped engineers in R&D to use the technology transferred from CTI-USA:

“(CTI-USA) introduced the ‘R-return’ technology (to R&D). This technology was advanced in controlling. It would be very difficult for those people without computing background and skills of programming at certain levels.” (Chief engineer, CTI)

However, since some engineers worked in different technology domains, they used different perspectives to solve problems in work. This became a ‘semantic boundary’ (Carlile, 2002; 2004) which impeded knowledge flow. For instance, due to different perspective taken, a mechanical engineer and an engineer whose speciality was electronics had different opinions about how to solve a problem.
"He suggested using 'opposite intersecting'. …we could not work that out. Finally, (we) said to use the simplest (method), such as a kind of 'he-lu qi', and told him the principle…but he could not understand it." (Senior hardware engineer and adviser, engineering department, CTI-Shenzhen)

Since they worked in different technology domains, they did not have a shared understanding about the nature of problems and the way of solving them. Lack of shared understanding made it difficult to share knowledge across different technology domains.

Thirdly, platform of expertise was important for inter-organisational knowledge flow. As mentioned before, there were interactions between engineers in CTI and in its client – UTS-China. Having the basic knowledge about telecommunication technology was essential for exchanging the knowledge related to work integration.

“(We) all have the basic knowledge (about the area); (knowing) some particular kinds of (knowledge) is the key.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

On the other hand, some engineers in CTI and in TUS-China were specialists in different technology areas. Lack of common knowledge in some highly specialised fields made it difficult for those engineers to share the specialised professional knowledge.

“Cooperating with TUS-China, no one could absorb lots of (knowledge from them). … Your knowledge is limited in a scope. You couldn’t absorb knowledge from another area. For example, you work on website; and you work on missiles. How could he/she communicate with you?” … We could not understand (each other) when there was a gap between us.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

Finally, lack of shared language was the main impediment to sharing knowledge through friendship ties. For engineers with some friends who worked in other organisations and different professions, the context-related knowledge that they accumulated in their practices differed. This led to lack of shared language and common knowledge between them, which became an impediment of knowledge flow. For instance,
“The character of their (work) was different from that of ours. It was impossible for me to go to him for technology things. (That) would be meaningless. … He spoke his language, so we did not have a common language.” (R&D leader and radio frequency expert, CTI-Shenzhen)

Because of lack of shared language, a friend’s professional knowledge was seen as irrelevant and useless by others. Thus, they had no intention of learning from others. Knowledge flow between those people was impeded due to lack of shared language.

“His technique is completely unrelated to mine. I don’t have the interest in learning his technique now. … Our specialities are completely different.” (Senior construction engineer, an estate investment company)

On the contrary, when engineers and their friends worked in the same profession, and had shared experience, they had shared language which facilitated knowledge sharing among them. An example has been given in Section 7-2.2.1 about a hardware engineer and his friend working in the same profession and in the same company before. Their common knowledge and understanding about electro circuit design enabled them to give advice to each other so as to solve problems that they encountered in work.

2.3.4. Boundary Objects and Shared Narratives

Effective ‘boundary objects’ (Carlile, 2002; 2004) facilitated knowledge flow, because they were able to help engineers in R&D to overcome the difficulty of sharing knowledge at ‘semantic boundaries’ (ibid). For instance, sample machines became ‘boundary objects’ in facilitating knowledge flow between engineers in different department/units. On an electro circuit board, the choice and the disposition of electronic components were the concrete means embodying the ideas of engineers in CTI-USA. Those ideas gave inspiration to engineers in R&D, and were used by them as a point of reference for the design of electro circuit in new products.

“We had a look at the power amplifier which was brought to here from the USA part. To have a look at the electro circuit or other (things), we were able to learn something from that. … Some designs of electro circuit done by them were really
wonderful. When you saw those, you would think, “You never imagined that they
could do it in that way”; and then, you could learn from that.” (Senior hardware
engineer, R&D, CTI-Shenzhen)

The sample machines were effective boundary objects because they embodied and
reflected engineers’ ideas and understanding about how to make good products; therefore,
they were able to “provide a concrete means for individuals to specify and learn about
their difference and dependencies across a given boundary” (Carlile, 2002)

“The sample machine was made by specialists. … Once you had a look at it, (you)
might get a clue, a method to solve problems.” (R&D leader and radio frequency
expert, CTI-Shenzhen)

Some documents were effective in transferring knowledge from CTI-USA to
CTI-Shenzhen, because they provided clear and detailed information for people to
understand the work processes.

“There were lots of documents which detailed the manufacturing processes. …
Through the documentation … the knowledge related to design and
manufacturing was transferred from the USA part (to CTI-Shenzhen).” (Senior
software engineer, CTI-USA)

In addition, shared narratives provided rich information about the content of knowledge
embedded in a different practice, which helped engineers to overcome ‘semantic
boundaries’. Shared narratives helped engineers to create a common ground for them to
understand and share knowledge developed in a different context.

“He experienced many actual situations in his work, such as assembling or
whatever. My work tended to be relatively theoretical. … He told me some
concrete situations he has met. … I felt that I was illuminated.” (Senior machine
structure engineer, R&D, CTI-Shenzhen)
2.3.5. Summary

Whereas having basic knowledge about telecommunication technology facilitated people’s sharing knowledge related to integration between organisations, different interests and lack of shared language in relation to highly specialised fields impeded people’s sharing specialised professional knowledge through the formal ties between organisations. Shared cause/effect beliefs had positive effects in facilitating knowledge flow within and between COPs, especially the sharing of knowledge related to integration. Shared language and shared experience were essential for the sharing of knowledge through formal and informal ties, while lack of shared language impeded knowledge flow. The effective boundary objects (i.e. sample machines and documents) and shared narratives (i.e. story-telling) facilitated inter-departmental knowledge flow.

2.4. The Relational Social Capital

Norms and trust are two basic elements of relational social capital (Nahapiet and Ghoshal, 1998). Norms and trust were interrelated, and had both positive and negative effects on knowledge flow in the 3G project. Details are as follows.

2.4.1. Hierarchical Norms & Norms of Specialisation

Except for the conditional knowledge flow between the technology departments (R&D, Engineering department, and CTI-USA), knowledge was also shared between the technology departments and other functional departments. Because telecommunication technology was highly specialised, most people in the functional departments (including department managers) knew little about the specialised knowledge. So, engineers in the technology departments needed to help them to solve some problems which occurred in the process of assembling and testing machines. For instance,

“...That was because there were very few people doing electro circuit in other departments, and they didn’t know it very well. So, they asked me, such as (people) in Production and Purchasing, when they didn’t know some components. ... To test the power amplifier in the testing (group), if they could not adjust the setting of
instalments to meet the parameters, I helped them.” (Senior hardware engineer, R&D, CTI-Shenzhen)

This kind of knowledge flow was not only based on norms of specialisation, but also related to hierarchical norms.

“I must give them instruction to let them know how to adjust (machines). It was arranged by my superior. It was my job. ... I don’t have the right and the obligation (to help people) across departments, except for there being work-related relations.” (Senior hardware engineer, R&D, CTI-Shenzhen)

However, this kind of knowledge flow between the technology departments and other functional departments was few, and often very basic. One of the reasons for the restricted knowledge flow between the technology departments and other functional departments was that people in the functional departments lacked specialised knowledge as a platform of expertise to communicate with engineers. In addition, that exclusiveness of identities also negatively affected the knowledge flow (this issue will be dealt with in Chapter 8, Section 8-2.2.1).

2.4.2. Norms of Professionalism & Norms of Control Knowledge

Norms of professionalism together with norms of control knowledge negatively affected inter-departmental and inter-organisational knowledge flow. Especially, sharing highly specialised professional knowledge was impeded.

“Between people in the same profession, sometimes there is a kind of exclusion. There is no way to go. We are doing the same profession. There is a job here. If you did it, then he/she lost it.” (Senior software engineer, CTI-USA)

Highly specialised professional knowledge helped engineers to secure their positions in organisations and in the labour market. Sharing the specialised knowledge meant the danger of losing the competitive advantages by possessing the knowledge. Therefore, based on norms of professionalism and norms of control knowledge, engineers tended to hoard their specialised professional knowledge rather than share it unconditionally with
people who worked in the same or similar profession. This helped to explain why the senior hardware engineer in CTI-Shenzhen said that engineers in CTI-USA were willing to introduce information to R&D to improve the cooperation, but unwilling to share their specialised knowledge (see Section 7-2.2.1).

2.4.3. Norms of Reciprocity

Norms of reciprocity facilitated intra-departmental knowledge flow. Based on norms of reciprocity, the members of R&D were willing to help each other and exchange knowledge. For instance,

“Everyone thinks that if I can help you, then I will help you to do your work well. Maybe someday I will ask you (for help) too when I have some problems, right? Keeping technology a secret, there is no such a thing among us.” (Senior hardware engineer, R&D, CTI-Shenzhen)

Norms of reciprocity also helped inter-departmental knowledge flow. As mentioned before, engineers in CTI-USA introduced new technology, and installed advanced software to help to improve the work efficiency of R&D department. In fact, engineers in CTI-USA were also able to learn new things from R&D people. Norms of reciprocity helped them to acknowledge the importance of knowledge exchange, and fostered their willingness to do so. For instance,

“It is not saying that I am more brilliant than they [engineers in CTI-Shenzhen]. (I) can only say that I know some things they don’t know, and they know some things I don’t know. I would ask them, too, if I don’t know some things and I know they know these things. I won’t feel embarrassed or .... We would discuss together to solve (problems).” (Senior software engineer, CTI-USA)

Norms of reciprocity also had to do with competence trust (Newell et al., 2002). They interacted, and together facilitated knowledge flow between COPs. For instance,

“Every one has his own specialised strong point. ... I have experienced many things, and then I may have some knowledge that others don’t have. They might
have lots of knowledge that I haven’t had. Then, (we) can learn from each other.”
(Senior software engineer in CTI-USA)

Therefore, norms of reciprocity, and competence trust helped people in different COPs to anticipate the benefits of knowledge exchange, and motivated them to share their ideas and knowledge.

On the other hand, lack of reciprocity impeded knowledge flow. For instance, the senior software engineer in CTI-USA told a story about a software engineer who came from CTI-Shenzhen. The former was reluctant to share knowledge with the latter, because the latter only wanted to learn from others rather than exchange knowledge with others.

Norms of reciprocity also facilitated knowledge flow through friendship ties. Based on norms of reciprocity, engineers were able to exchange knowledge with their friends, and to access non-redundant knowledge from outside of the organisation. For instance,

“I also have several friends, (such as) Dr. Wing. He is an authority in this area [fibre]. (You) can always ask him (questions). ... He is working on fibre; (he) studied this kind of things. (But) he did not know electronics very well. We gave him our knowledge about electronics.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

In addition, norms of reciprocity not only facilitated knowledge sharing, but also helped to develop companion trust (Newell et al., 2002) among friends. And companion trust improved the interpersonal relations, and in turn, further underpinned the reciprocity behaviours between friends. For instance,

“When other people needed (help) to solve problems, definitely, I helped them to sort that out without saying something or asking (them to) pay me money. The interpersonal relations would be harmonious. I asked him for help; he would give his help without conditions. He would try hard to (help you), even stopping (doing) his own things for a while. ... This relation was not (built up) in one day or two days. I gave my affection to them; and so did they.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)
2.4.4. Norms of Cooperation

Norms of cooperation were the important rule underpinning knowledge sharing within COPs. As mentioned before, engineers had interface in their work. They needed to integrate their work to produce the new products. In order to achieve that, engineers needed to be cooperative, and helped each other to solve problems in the process of integrating their work. Based on norms of cooperation, engineers exchanged knowledge and helped each other to solve problems in their work.

"In doing products, you need to consider others’ (work), to communicate with others…It won’t be all right to pass the buck. It is better that two people sit down, and discuss with each other to see how to find out a better method to solve the problems." (R&D leader and radio frequency expert, CTI-Shenzhen)

Norms of cooperation and ‘competence trust’ (Newell et al., 2002) were interrelated. Competence trust helped to develop norms of cooperation; as a result, knowledge sharing was facilitated within R&D. For instance,

“For the communication related to technology things…one should understand that you can not always make things perfect. Other people may have their own strong point…. If today you don’t help others, tomorrow others won’t help you.” (Senior hardware engineer, R&D, CTI-Shenzhen)

Norms of cooperation were also important for inter-departmental knowledge sharing. As mentioned before, R&D people worked on the subsystem of the project; CTI-USA worked on the design of power amplifiers; the work done by these two different departments/units needed to be integrated. Based on norms of cooperation, knowledge was shared between engineers in these two departments. Examples were given before, such as engineers in CTI-USA introducing advanced technology to R&D to improve their work efficiency (see Section 7-2.2.1.2).

Norms of cooperation also facilitated inter-organisational knowledge flow. Based on norms of cooperation, engineers in CTI and in its client TUS-China discussed the design
plan and other related problems (see Section 7-2.1.2.1.3). Likewise, norms of cooperation also facilitated knowledge flow between CTI and its suppliers.

“They wanted to sell the products; (they) would give you the products as well as the technique support, in order to let you work on your product.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

2.4.5. Summary

Hierarchical norms and norms of specialisation helped knowledge to flow from technology departments to other functional departments, but this kind of knowledge flow was often limited and superficial. Because of norms of professionalism and norms of control knowledge, engineers in CTI-USA were willing to share knowledge related to integration, but tended to hoard their highly specialised professional knowledge. Norms of reciprocity and competence trust were interrelated, influencing knowledge flow. Norms of reciprocity were the fundamentals of knowledge exchange through formal and informal ties. But, lack of reciprocity impeded knowledge flow. Norms of cooperation along with competence trust facilitated knowledge sharing (especially knowledge related to integration) within COPs, and across departmental and organisational boundaries.

2.5. The Interaction among Three Dimensions of Social Capital

As discussed above, the structural, cognitive, and relational social capital had both positive and negative effects on knowledge flow. In fact, those three different dimensions interacted with each other, influencing knowledge flow.

2.5.1. Interactions between Relational and Cognitive Social Capital

Norms of professionalism led to lack of shared language and understanding among people working in different professions. Because working in different domains, some engineers had difficulty understanding others’ perspective and valuing others’ knowledge. For example, an engineer in R&D used to work on mechanical design. When he
participated in designing electro circuit, there was disagreement between him and a senior engineer.

"Electronics and mechanics are two different things. (People) who work on electronics won’t take a mechanical centre. …you were not clear about this and designed (this). So, the thing you designed definitely had poor parameters with high price and improper structure. When you told him (this), he couldn’t understand it. He insisted. Ignorance made (him) give up cooperation.” (Senior hardware engineer and adviser, engineering department, CTI-Shenzhen)

Because of norms of professionalism, lack of shared language and understanding made it difficult for people to accept others’ ideas, and then further affected cooperation and knowledge exchange.

2.5.2. Interactions between Relational and Structural Social Capital

Lack of companion trust weakened the strength of social network ties. Take as an example an interviewee who was previously an employee in R&D in CTI-Shenzhen. After resigning, this engineer moved to work in another high-tech company in Shenzhen. When he just left CTI-Shenzhen, he had contact with many engineers in CTI-Shenzhen, and discussed with them the problems encountered in their work. However, with the time passed (six months later), their contact became less frequent. Lack of interaction weakened ‘companion trust’ (Newell et al., 2002) among them; as a result, the connection between his previous co-workers and him became weak; and the weakened connection further reduced companion trust which was the key to maintaining friendship ties between them. One year after he left CTI-Shenzhen, he had contact with only one engineer.

“I guess they will forget me. That is because I made more phone calls to them. They seldom called me. (They) only called me when they had something to deal with. … Anyway, I felt that if you were my friends, you should not only go to me when there were things needed to deal with; you could come to me when there was nothing to deal with, even if you made a phone call just to greet me, right?” (Radio frequency engineer, R&D, Woo Communications)
In addition, as mentioned before (Section 7-2.2.1), the strong and multiple ties between engineers in R&D helped group cohesion. Engineers were willing to cooperate with each other and to help each other to solve problems that they encountered in work. Therefore, the strong and multiple ties helped to develop norms of cooperation, and, in turn, facilitated the internal knowledge flow.

2.5.3. Interactions between Cognitive and Structural Social Capital

As mentioned in Section 7-2.2.1, the R&D members were connected by strong and multiple ties. This helped to develop shared understanding among those engineers, thereby making it easy for engineers to communicate and to exchange knowledge with each other. On the other hand, without shared history of cooperation and shared experience built up by frequent and close interactions, it was relatively easy to cause some misunderstanding among some engineers (see Section 7-2.3.3). Therefore, interaction between the structural social capital (the strong internal ties and multiplexity) and the cognitive social capital (shared understanding) facilitated internal knowledge flow.

Weak ties in friendship networks led to lack of shared language, and then affected knowledge sharing between friends.

“There was little contact (between us); sometimes you wanted to chat something with him/her, but because contact was very rare, of course, you don’t know what kinds of knowledge he/she would offer you.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

On the other hand, lack of shared language along with norms of professionalism made interaction less frequent between people who worked in different professions.

“Because I don’t do the power amplifier...I have relatively few (communication with engineers in CTI-USA). ... (If) there are some things about the power amplifier part which I don’t know, then I will ask. If I know, I don’t ask.” (R&D leader and radio frequency expert, CTI-Shenzhen)
Therefore, the weak connection indicated a cognitive distance (lack of shared language), and lack of shared language further weakened the strength of network ties. The interaction between weak ties and lack of shared language became an obstacle to sharing knowledge through friendship and workflow network ties.

3. The Direct and Indirect Influence of Power Relations

Knowledge flow was not only connected to different effects of social capital, but also closely related to the power relations. This section explains how the different dimensions of power influenced the knowledge flow. The discussion is split into four subsections in accordance with four dimensions of power (Hardy, 1994; 1996).

3.1. The Influence of the Power of Resources

The power of resources highlighted the power relations in which two actors manage dependency by controlling resources on which the other depends (Hardy, 1994). In the 3G case, the resource dependency relations between CTI and its client – TUS-China, and between CTI-Shenzhen and CTI-USA indirectly influenced knowledge flow by affecting norms of cooperation, norms of control knowledge, and norms of professionalism. Details are as follows.

On the one hand, CTI and TUS-China depended on each other’s power resources: CTI wanted to increase its sales volume by dint of TUS-China’s large market share in the telecommunication equipment market of China and other places in the world. TUS-China wanted to reduce the cost and improve the quality of its telecommunication equipment products by using CTI’s power amplifier products, as CTI had its advanced technology in making power amplifier products, and power amplifiers were the essential parts of telecommunication equipments. Engineers in these two organisations needed to be cooperative with each other to ensure that their products can work well together. They were willing to provide the necessary technology support in the interface. Therefore, the resources and expertise dependency relations between these two firms indirectly
facilitated knowledge flow (knowledge related to integration) by developing norms of cooperation.

“(If) they wanted to sell the products, (they) would give you the technology support in order to let you work on your products.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

One the other hand, the power of resources also developed norms of control knowledge. Because possessing highly specialised knowledge was important for maintaining the competitive advantages of any organisations, organisations tended to control and monopolise the specialised knowledge to increase others’ dependence on the knowledge they possess. For instance,

“Many (people), our clients - our R&D clients, some of them, relatively, do a better job on the aspect of structure design... and have (better) ideas and whatever. But if you dared to know something from him/her, basically it was very difficult. He/she wanted to protect the benefits gained from his/her knowledge. ... he/she is not willing to let many people (or) his/her rivals or whatever make progress. It was particularly controlled in this aspect.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

Therefore, the power of resources negatively influenced inter-organisational knowledge flow by developing norms of control knowledge.

There were also resource interdependency relations between CTI-Shenzhen and CTI-USA. R&D in CTI-Shenzhen and the designing team in CTI-USA specialised in different technology aspects of the power amplifier products. Especially, CTI-USA had advanced technology in the making of power amplifiers on which CTI-Shenzhen depended. In addition, CTI-USA also depended on CTI-Shenzhen’s social capital, because Tsai and marketing people in CTI-Shenzhen had good relations with its clients who were important for CTI to sell their products (see Section 6-4). These kind of resource interdependency relationships between these two units produced norms of cooperation which facilitated inter-departmental knowledge flow (sharing knowledge related to integration) (see Section 7-2.4.4).
On the other hand, CTI-USA controlled the flow of the specialised knowledge to increase CTI-Shenzhen’s dependence. This led to norms of control knowledge which became the impediment to sharing specialised professional knowledge (also see Section 7-2.4.2)

“That’s confidential technology. They [engineers in CTI-USA] didn’t give the blueprints (to us). … Otherwise, (the technology) might be diffused outside.”
(Senior hardware engineer, R&D, CTI-Shenzhen)

The power of resources also developed norms of professionalism, because controlling the specialised knowledge could increase the resources power of individuals, and sharing the knowledge reduced the resources power of individuals. Therefore, people would like to hoard their specialised knowledge, rather than share it with their ‘potential competitors’. For instance,

“In many overseas companies…because of the pressure of work, people might not always tell you everything. This is my speciality, I don’t always tell you about it.”
(Senior software engineer, CTI-USA)

Therefore, the control of power resources (specialised knowledge) led to norms of professionalism; and norms of professionalism harmed the willingness to share the specialised professional knowledge.

To sum up, the power of resources indirectly influenced inter-departmental and inter-organisational knowledge flow by affecting norms of cooperation, norms of control knowledge, and norms of professionalism. As a result, in the 3G case, engineers were willing to share the knowledge related to integration; but hoarded certain specialised professional knowledge.

3.2. The Influence of the Power of Processes

According to Hardy (1994; 1996), the power of processes illustrates the power relations that people use power to control the decision-making process to achieve preferred outcomes, such as preventing the opposite groups/individuals from getting involved in
the decision-making arena by setting up certain rules and procedures. In the 3G case, the power of processes directly and indirectly influenced knowledge flow. The influence of the power of processes can also be observed in selecting people, rewarding people, organising knowledge sharing activities, and controlling work procedures. Details are as follows.

### 3.2.1. Selecting people

Chief engineer and General Managers had the power of processes to select people. For instance, based on ‘competence trust’ (Newell et al., 2002), Chief engineer brought many of his previous co-workers to join CTI-Shenzhen.

> “At the time, they [Chief engineer and an adviser] felt that we were able to make contributions to the company [CTI]... so (they) asked us to join here.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

As mentioned in Sections 7-2.2.1, and 7-2.4.4, the strong and multiple ties helped group cohesion, and developed ‘companion trust’ among engineers in R&D. And, strong ties interacted with norms of cooperation (see Section 7-2.5.2) to facilitate internal knowledge flow. Therefore, the power of processes indirectly influenced knowledge flow by affecting structural (strong internal ties) and relational social capital (companion trust and norms of cooperation).

However, there were also unexpected effects of the selection. Several leaders had the power of processes to get involved in the decision-making arena for the recruitment of employees. Being connected with those powerful individuals increased some employees’ hold of their jobs.

> “This definitely caused the (situation) that ‘I didn’t listen to you; and you didn’t listen to me’, right? If my brother was a leader in (the company), (I) didn’t care about you at all.” (Radio frequency engineer, R&D, Woo Communications)
Some engineers connected with different powerful individuals did not have shared experience and shared history of cooperation. They had different understanding about work, but tended to stick to their own ideas. Sometimes, it was not easy for those engineers to accept others’ opinion. For instance,

“He knows the Doctor of ours; (John) favours him; … Why must I spend energy (persuading him to accept my advice)? I could find a person who knows more about (the work); and there are lots of people who are experts. But He has this kind of relations.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

3.2.2. Non-Decision-making Power on Pay Issues

In CTI-Shenzhen, the power of making decision on pay-related issues was in the hand of Personnel department. Department managers had very limited influence on the decision of how to reward employees, because they were excluded from the final decision-making process related to pay issues. For instance, R&D leader did not have the reward power,

“I feel that there are not many people (in R&D department). (The management) still needed to rely on the emotional communication. … (That is because) I don’t have the power to give you a cash award if you did this thing well, right? And then, I don’t have the power to fire you if you didn’t do it well.” (R&D leader and radio frequency expert, CTI-Shenzhen)

He used ‘emotional control’, rather than a tight control, to manage the department to foster a cooperative atmosphere in R&D. This helped to develop ‘companion trust’ (Newell et al., 2002) among engineers, and norms of cooperation (see Section 7- 2.4.5). As a result, engineers were willing to help each other, and to exchange ideas to solve problems. Therefore, R&D leader’s response to non-decision-making power on pay issues indirectly facilitated intra-departmental knowledge sharing by developing companion trust and norms of cooperation.
3.2.3. Controlling work procedures

The process interdependency relations were also embodied in controlling work procedures. It indirectly influenced knowledge flow. Firstly, engineers’ work procedures followed the fixed procedures (also see Section 6-5.2). The work procedures were established by the management and became conventional, since they were deemed the effective way of developing new products in CTI. The work procedures determined the formal workflow ties between engineers in R&D, and at the interface in work. Because engineers frequently interacted with each other in the interface in work, the ties between those engineers were strong, and the strong ties facilitated internal knowledge flow (see Section 7-2.2.1). Therefore, the power of processes on controlling work procedures affected knowledge flow by developing formal ties, and by influencing the strength of formal ties.

Second, to serve the management’s interest in maximising profits, the employees were expected and assigned to do lots of work. The engineers’ workload was heavy. They were asked to work overtime at nights and weekends. The engineers were left with little time and energy to have social life. The imbalanced work/life resulted in few opportunities for engineers to interact with their friends.

“(I had,) relatively, lots of friends. … But (I) didn’t have time (to contact them)… because (I) had to work overtime all the day. …(I am) too tired, really wanted to stay at home, watching TV for a while, having a sleep. …recent years I seldom communicated with many of my close friends, and gradually there was a distance between us.” (R&D leader and radio frequency expert, CTI-Shenzhen)

Because informal contact could play a complementary role in accessing new knowledge, knowledge flow might be restricted because of limited opportunities for engineers to explore the resources resided in their social networks. Therefore, the power relations embodied in controlling work procedures indirectly influenced knowledge flow by restricting the opportunities of developing informal ties.
3.2.4. Organising knowledge sharing activities

The process interdependency relations also can be seen from organising knowledge sharing activities. There were few knowledge sharing activities organised by the company. The management’s attention was paid to making profits, not to organising activities to encourage knowledge sharing. Thus, this decreased the opportunities for people to share their knowledge.

“(The company) hasn’t organised (such activities) – to organise (activities) and ensure (knowledge sharing), such as arranging meetings to exchange knowledge inter-personally.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

Although employees were aware that there was a need for such knowledge sharing activities, and acknowledged the importance of knowledge sharing, they did not have the power of processes to raise the issues in the decision-making process. This was because they were not involved in the decision-making process.

3.3. The Influence of the Power of Meaning

Organisational culture and structure could be the mechanisms of exercising the power of meaning, because they can be used intentionally to influence people’s behaviour by influencing their perception about what is regarded as legitimate (Hardy, 1994). In the 3G case, the power of meaning embodied in the organisational structure, culture, and sub-cultures directly and indirectly influenced knowledge flow.

3.3.1. Organisational Culture and Subcultures

First, in CTI, the management deliberately fashioned a culture which promoted cooperative behaviour between departments, especially between technology departments. They encouraged engineers to participate in formal and informal discussions to help others to solve problems. This culture produced a sense of being cooperative among engineers. It fostered norms of cooperation. Based on norms of cooperation, engineers
were willing to help each other, and to exchange ideas to solve technology problems (see Section 7-2.2.1 and 7-2.4.4). Therefore, this kind of culture indirectly facilitated knowledge sharing within R&D by influencing norms of cooperation.

Second, as for learning, there were different sub-cultures between R&D and CTI-USA. The different sub-cultures had negative effects on inter-departmental knowledge sharing. As mentioned in Section 7-2.2.1, the senior software engineer in CTI-USA said that they constantly learned new things even when they were very busy. Although learning was thought of as important, by comparison, the sub-culture of R&D tended to emphasise cooperation and task accomplishment. Such a difference between these two departments/units was reflected in, and influenced, the ways people did things. For instance, engineers in CTI-USA had a different view about learning from people in R&D in CTI-Shenzhen.

“When (some people in R&D in Shenzhen) were busy with work... they didn’t have time to learn. I think this was not a problem of yours... in the USA... like us, we constantly learn new things. We never stopped, but constantly learned new things within these three years, whether using our own time or sometimes the (work hours in) the company.” (Senior software engineer, CTI-USA)

Different subcultures led to separate identities. As mentioned before (Section 7-2.2.1), engineers in R&D, and engineers in CTI-USA had strong and distinct identities. Engineers in CTI-USA thought that some engineers in CTI-Shenzhen did not have enough professional dedication, the desire of self-learning, and the capacity to design good products. They were willing to share the knowledge related to work integration with engineers in R&D, but not their specialised knowledge. Therefore, to some degree, the different sub-cultures indirectly impeded inter-departmental knowledge sharing by influencing identities and competence trust.
3.3.2. Flattened structure

As mentioned in Section 7-2.2.2, the leaders (Chief engineer, Ben, John, and R&D leader) often discussed with engineers to solve problems that occurred in work. Unlike managers in the functional departments, they did not emphasise that communication must follow formal channels and hierarchy layers. Both formal and informal contact was encouraged, and considered legitimate in technology departments, so engineers were able to contact the leaders and technology experts directly and freely. Thus, in the 3G case, the hierarchy of communication networks was flattened.

“I felt that the leaders and employees communicated with each other very easily, and with very nice attitude.” (Senior machine structure engineer, R&D, CTI-Shenzhen)

The flattened structure influenced knowledge flow by increasing the density of communication networks, because it increased the opportunities for engineers to learn from experts through interactions.

“(We) learned from the experts, such as John in the USA. When they saw the figure (of components) or something, they knew immediately what caused the problems. You did not even need to explain to them, and solved the problems by following their suggestions.” (Senior hardware engineer, R&D, CTI-Shenzhen)

The flattened structure also helped to develop ‘companion trust’ (Newell et al., 2002), and norms of cooperation. Companion trust and norms of cooperation further facilitated internal knowledge flow (See Section 7-2.4.4).

In a word, the power of meaning embedded in the structure indirectly facilitated knowledge flow by increasing the density of communication networks, and by fostering companion trust and norms of cooperation.
3.4. The Influence of the Power of the System

The power of the system lies “in the unconscious acceptance of the values, traditions, cultures and structures of a given institution or society” (Hardy, 1994). The power of the system is embedded in the social and institutional context.

3.4.1. The Competition in Telecommunication Industry and Labour Market

First, because of the rapid development of telecommunication technology and the increased competition in labour market, engineers doing technology-related work in the industry needed to constantly renew specialised professionals knowledge and develop new knowledge. The development of technology and the competitive labour market became the forces which stimulated engineers’ learning.

“To know new knowledge is the key, because doing (work about) technology, (knowledge) always updates very fast, consistently renewing. Like this, what I did before couldn’t be used at present at all, and (it) is even washed out.” (R&D leader and radio frequency expert, CTI-Shenzhen)

On the other hand, the competition in labour market led to norms of professionalism. People tended to hoard their specialised professional knowledge so as to secure their jobs.

“If you don’t know, (people) won’t tell you how to do this thing, (because) I am the only one person who can do this (job) in this company. If you were able to do it, then I will lose my job.” (Senior software engineer, CTI-USA)

Second, in the competition environment in Shenzhen, it was difficult for people to develop ‘companion trust’ (Newell et al., 2002). For instance,

“People who are in Shenzhen have few friends, because the work environment is very tense in here. … Shenzhen is always like a city of stranger, no matter how long you have been working in here, because its (life) rhythm is relatively fast, unlike the inland (of China). … (in the inland) the environment - the competition is not as radical as it is in here; (because of) people’s mindset, (in the inland), genuine human warmth is relatively stronger than in here.” (Senior machine structure engineer, R&D, CTI-Shenzhen)
As companion trust was the foundation of friendship ties, lack of companion trust negatively influenced the development of social network. As a result, some engineers had a relatively small-sized friendship networks.

3.4.2. The Changing Social Context

Along with the economy development, there was a massive social change in Shenzhen, China. First, because of the ‘reform and opening-up’, employees were no longer tied to one company for the rest of their life – the ‘iron rice bowl’, but free to change to different companies to pursue economic benefits.

“(Moving to different companies) was looking for a job with better welfare and salary. (My) goal is always looking for the maximisation of economic benefits.”
(Senior hardware engineer, R&D, CTI-Shenzhen)

Especially, in Shenzhen, the first city in China with the special economic policies applied, people were able to and had opportunities to choose their occupations.

“In Shenzhen, if I am not comfortable with staying in this (company), I would leave – change to another environment, (I) might find a right place for me again.”
(R&D leader and radio frequency expert, CTI-Shenzhen)

Second, with the social change, the collective value held by people in the period of pre-‘reform and opening-up’ shifted to instrumental value. People’s self-awareness was evoked. They were encouraged to ‘get rich’, and to pursue their personal development whereas during the Maoist period, employees were taught to bestow a great, familial affection on the enterprises they worked for. Such a shift of value revolutionised people’s view about the employment relationship.

“The company’s business is not my business, right? You assigned tasks to me and pay me monthly; I helped you to accomplish (them). That is all. It is not necessary for me to consider something for you.”
(Radio frequency engineer, R&D, Woo Communications)
"It is the relation of business between the boss and employees. ... I helped to finish this thing, you pay me money." (Senior software engineer, CTI-USA)

No longer loyal to the company they worked for, employees regarded “running one’s own business” as a yardstick to measure a person’s success. It was also a faster way to get rich. Many people in Shenzhen wanted to run their own business. In fact, some people in CTI had the experience of running their own business, such as the R&D leader, and some engineers in Engineering department.

“Always doing work for others is a failure. No matter how great you do the work, doing work for others is a failure.” (Senior hardware engineer, R&D, CTI-Shenzhen)

Employees’ commitment toward the company they worked for became weak. As a result, people would like to gain knowledge and information which were useful for their personal development, not for the organisational development. Sometimes, this knowledge and information might help their personal development, but was least contributory to the product innovations.

“I intended to keep in touch with people, such as the software supplier, people working in Purchasing and Marketing. (I) definitely contacted them frequently, because I can get the information about the market and the import channels for (getting) materials and components. The information would be very useful in case (I) want to do (my own) business in the future. These are intangible resources.” (Senior hardware engineer, R&D, CTI-Shenzhen)

3.5. Summary
Specialised knowledge, market share, and social capital became important power resources which the firms and departments used to manage dependency. The resource interdependency relations influenced knowledge flow by affecting the norms of cooperation, norms of control knowledge, and norms of professionalism. By selecting people and by controlling work procedures, the power of processes developed formal ties, but also resulted in employees’ imbalanced work/life. The non-decision-making power embodied in pay system indirectly facilitated knowledge flow by influencing norms of
cooperation and companion trust within R&D. Because of non-decision-making power, knowledge sharing activities were seldom organised. On that score, engineers had few opportunities to share knowledge by participating in such activities. As the mechanism of the power of meaning, cooperative culture facilitated internal knowledge flow by developing norms of cooperation. Different sub-cultures impeded inter-departmental knowledge flow by affecting competence trust, and by developing exclusive identities; flattened structure increased the density of communication networks and provided engineers with more leaning opportunities; it also facilitated internal knowledge flow by developing companion trust and norms of cooperation. Competition in telecommunication industry and labour market motivated learning. It also led to norms of professionalism and lack of companion trust. As a consequence, people had small-sized social networks and tended to hoard their specialised knowledge to secure their jobs. The change of people's value reflected the social change in Shenzhen. As one of the response to the social change, organisational commitment became weak. Table 7-1 summarises the effects of the four dimensions of power on knowledge flow and utilisation of social capital.

4. Chapter Summary

In the 3G case, knowledge related to integration was shared across the departmental and organisational boundaries, but sharing certain specialised professional knowledge was often difficult. The results of the 3G case showed that the ‘conditional’ knowledge flow was related to the positive and negative effects of the three dimensions of social capital and power influence.

First, strong internal ties facilitated internal knowledge flow within COPs, but led to redundant knowledge. Strong internal ties also fostered separate identities which negatively influenced knowledge flow between COPs. The external ties helped engineers to access non-redundant knowledge from outside of the organisation. Several key individuals played important roles for the boundary-spanning knowledge flow. The high.
Table 7-1: The Power Influence in the 3G case

<table>
<thead>
<tr>
<th>Dimensions of power</th>
<th>Representation</th>
<th>Influence on social networks and structural social capital</th>
<th>Influence on cognitive social capital</th>
<th>Influence on relational social capital</th>
<th>Influence on other aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st dimension of power</td>
<td>Control of knowledge between departments/organisations</td>
<td>Norms of cooperation Norms of control knowledge Norms of professionalism</td>
<td>Unwillingness to share highly specialised knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd dimension of power</td>
<td>Selecting people</td>
<td>Developing strong internal ties within departments</td>
<td>Companion trust Norms of cooperation within departments</td>
<td>Unwillingness to accept others’ opinion because of ‘guanxi’</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-decision-making power in pay issues</td>
<td>Companion trust Norms of cooperation</td>
<td>Imbalanced work/life</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controlling work procedures and routines</td>
<td>Developing strong formal ties Weakening friendship ties</td>
<td></td>
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<tr>
<td></td>
<td>Few knowledge sharing activities organised</td>
<td></td>
<td>Few opportunities to share knowledge</td>
<td></td>
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<tr>
<td>3rd dimension of power</td>
<td>Culture and subcultures</td>
<td>Norms of cooperation Lack of competence trust Distinct Identities</td>
<td></td>
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<tr>
<td></td>
<td>Flattened structure</td>
<td>Increasing density of communication networks</td>
<td>Norms of control and compliance Companion trust Increasing opportunities of learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th dimension of power</td>
<td>Competition in Telecommunication industry and labour market</td>
<td>Small-sized friendship networks Lack of companion trust Norms of professionalism Stimulating learning,</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>The Changing social context</td>
<td></td>
<td>Weak commitment,</td>
<td></td>
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</tbody>
</table>
level of diversity of the communication networks indicated that people were able to access resources resided in the social networks.

Second, shared language and shared cause/effect beliefs (Thompson, 1967) facilitated knowledge flow, while lack of shared language, and different interests impeded knowledge flow. However, effective boundary objects, and shared narratives helped people to overcome the 'semantic boundaries' (Carlile, 2002; 2004).

Third, hierarchical norms, and norms of specialisation helped knowledge flow between technology and other functional departments, but the shared knowledge was often basic. Norms of reciprocity was fundamental for knowledge sharing through different network ties. But norms of professionalism and norms of control knowledge became impediments to sharing highly specialised knowledge. Norms of cooperation facilitated knowledge flow within R&D. In addition, the three dimensions of social capital interacted with each other, and the interactions enlarged the negative and/or positive effects on knowledge flow.

Finally, by developing norms of cooperation, the resource interdependency relations indirectly supported the sharing of knowledge related to integration, but impeded the sharing of specialised knowledge by influencing norms of professionalism and norms of control knowledge. The process interdependency relations were embodied in selecting people, organising knowledge sharing activities, controlling work procedures, and non-decision-making on pay issues. They directly affected engineers’ learning and their willingness to accept different opinions, and also indirectly influenced knowledge flow by affecting social networks, trust, and norms. Organisational culture and structure were the mechanisms of the power of meaning. Both developed norms and trust to facilitate internal knowledge flow. But, different sub-cultures impeded knowledge flow by fostering distinct identities. The institutional and social context served as the backdrop of inter-organisational relationships, employment relationships, and value shift. The power of the systems embedded in the institutional and social context had contingent effects on knowledge flow and utilisation of social capital.
Chapter 8

Results of Data Analysis from the ERP Case

1. Introduction

This chapter presents the results of data analysis from the ERP project. This chapter is structured like Chapter 7: Section 2 of this chapter discusses the results of data analysis in terms of social networks and social capital; Section 3 discusses how different dimensions of power influenced knowledge flow and social capital; Section 4 is the summary of this chapter’s findings.

2. The Positive and Negative Influence of Social Networks and Social Capital on Knowledge Flow

2.1. Content of Knowledge Related to the Process Innovation

As introduced in Chapter 6, the aim of launching the ERP project was to use the ERP system to integrate and coordinate the work of different units and departments, and to improve the organisation’s performance. Since the work of different departments was connected via work flow, people needed to know both how to work effectively in their own department and how to cooperate with other departments. When people did not have enough knowledge about the sequence of their work, inter-departmental coordination was to be affected. For instance, the work of Production and Warehouse was affected, when a quality inspector did not know which kinds of materials were urgently required by the production line:

“I checked a batch of Terminals [electronic components] and put it at the corner. Who knew that Warehouse didn’t count it for a long time! Then, I always felt that they always pressed me for (checking) those things which I didn’t check.” (Quality inspector 1, Quality department, CTI-Shenzhen)

For ERP leader, knowing which work each department was responsible for was much more crucial, because he needed the information to set up the modules of the ERP system for each department.

“There were some settings about IQC [incoming material quality check] (in the ERP system). (Some settings of) IQC followed the standards of the international applications. … For example, you received a batch of goods, such as 1000 pieces of
them, right? How many (pieces) do you need to check? ... You need to make the judgment whether those things meet the quality criteria or not? How do you make judgements? Is it okay for (having) one piece failed or two (pieces) failed, or (having) one piece with significant faults or two pieces? ... I never knew these (before). Through setting up these things in the ERP (system), I knew these things.”

(ERP leader and PMC manager, CTI-Shenzhen)

Therefore, knowing what work people did in different departments was essential for innovation of the ERP project.

Meanwhile, it was important for ERP leader to understand the ERP system and how to integrate the ERP system into people’s daily work, because he needed to use this kind of knowledge to make the new system a practical tool with which to integrate the work of different departments. As he stated,

“Basically, when you were promoting a project, the most difficult thing was to handle the overall (situation), because you would encounter lots of resistance. ... There are at least thirteen, fourteen modules in (the ERP system)... every module was connected with one another. When you were promoting (the project), it was impossible for you to promote all those (modules) at once. If you did so, you would definitely be a dead man. I promoted one module well, and then connected it to another, and put them in a chain one by one. (You needed to know) which (module) you should promote first, and you needed to try to realise it gradually.”

(ERP leader and PMC manager, CTI-Shenzhen)

It was also important for employees who used the ERP system in their daily work to know about the ERP system and its functions. Understanding how the new system worked helped to reduce their resistance to the new system, and to decrease frictions between different departments.

“For employees, everyone, as long as you touched the ERP, ... firstly, you needed to know what the ERP is; and then, you needed to know what kind of convenience it can bring to you by using the thing, ... (and) how your workload could be reduced.”

(Senior official, Purchasing department, newly appointed as Director of PMC and Warehouse, CTI-Shenzhen)

However, for most employees, even those key users of the ERP system, they did not have enough knowledge about the system and the integration. ERP leader explained where the shoe pinched:

“What they [the key users] have learned might be very basic, and operational - clicking on this (key) and clicking on that one. ... Basically, they know ‘what’, but
don’t know ‘why’... There were some logic and settings. They did not know very clearly about that.” (ERP leader and PMC manager, CTI-Shenzhen)

It raised questions: what were the causes of their lacking knowledge? Was knowledge shared to facilitate the process innovation? If yes, how and why? In fact, there was knowledge flow which helped the process innovation. However, there were conditions of the knowledge flow. The following subsections discuss how knowledge flow was facilitated and/or impeded in ERP in terms of social networks and social capital.

2.2. Social networks and the Structural Social Capital
This subsection discusses how the social networks and structural social capital influenced knowledge flow on three different levels: ties level, individual level, and network level.

2.2.1. Different Network Ties

2.2.1.1. Internal Ties within COPs
According to the interview data and observation, most people in a functional department cooperated with each other in order to get things done. For instance,

“I think we cooperate well in our department, because they [warehousemen] are very responsible.” (Official, Warehouse, CTI-Shenzhen)

They were willing to help each other to solve problems that they encountered in their work.

“When (I) encountered some problems, I consulted my colleagues, Tom and Jenny [another two senior planners]. (If) we were able to sort them out, we would discuss together to sort them out.” (Senior planner 2, PMC, CTI-Shenzhen)

Through discussion, they shared and exchanged ideas about their work; thus, their knowledge about the work was improved.

People also accumulated knowledge about their work by learning from senior members, and by practicing – a process of ‘legitimate peripheral participation’ (Lave and Wenger, 1991).

“I went to James. His seat was just beside mine. James said that “To deal with this thing, you should go to whom.” Then, I remembered that and knew next time I should ask whom to deal with this kind of things. In the very beginning, I learned
from Don. He taught me how to do this and that.” (Junior clerk, Purchasing department, CTI-Shenzhen)

Therefore, in CTI-Shenzhen different functional departments were like different COPs.

The strength of internal ties within the COPs was strong, because people in the same department were connected by multiple relations - multiplexity (Barnes, 1979). For instances, some people in the same department previously worked together in another company, some of them were relatives, and so on.

“He/she was a manager; he/she introduced people here; lots of people were introduced by him/her to join (CTI). … So I think those people must be relatively close … having some connections. Louis, Jenny, Tom, and Walter, they were all in the same department. They were all brought here by Louis. Scott [Director of Production] and his sister-in-laws were in the same (department).” (Official, Warehouse, CTI-Shenzhen)

Moreover, people in the same department not only worked together, but also were willing to participate in some social activities. The shared social life further strengthened the internal ties.

“It [the mutual engagement in social activities] happened among these people who worked in the same department. After all, they were working together, so they spent their leisure time together as a group. Likewise, people in our department would like to go out and have dinner together.” (Senior planner 1, PMC, CTI-Shenzhen)

This kind of strong internal ties facilitated knowledge sharing within the COPs in the following ways. Firstly, when other colleagues in their department needed to use the ERP system, the key users taught them how to operate the new system.

“For some newcomers, I let them observe how I operate it [the ERP system] first. Then, after a period of time, when their eyes were very familiar with it, then I formally handed over the work to them, and then let Louis open an (ERP) account for them.” (Quality inspector 1, Quality department, CTI-Shenzhen)

Secondly, when there were two or more people operating the ERP system, they exchanged ideas about how to operate the new system.

“I always asked Lee. He was the person who frequently uses the ERP (in our department). I could solve problems by asking him.” (Assistant leader, testing group, CTI-Shenzhen)
In addition, the strong internal ties facilitated learning. Some newcomers were assigned as key users to operate the ERP system. For them, knowing the daily work was essential for promoting the innovation project. Being instructed, newcomers were able to pick up knowledge about the daily work from old-timers. However, the knowledge that these old timers taught newcomers was often basic.

"Because she just joined (CTI) at that time, I just taught her the work procedures we usually follow. That is, (I) taught her about the procedures of operating the ERP (system) and doing our daily work in our department." (Clerk, Purchasing department, CTI-Shenzhen)

More importantly, the strong internal ties fostered strong and exclusive identities. People called their own department manager "our boss", but referred to managers of other departments as "boss" beginning with "your" or "their". The exclusiveness of identities affected interpersonal relations among people from different departments. For instance, people from Production and engineers from Engineer department had separate identities.

"(Engineers) felt (they) were on a relatively higher level (than others). ...when you asked them (questions), they seemed impatient with me. Many of them were like that." (Quality inspector 2, Quality department, CTI-Shenzhen)

The distinctiveness and exclusiveness of identities reflected the difference of those groups of people in their knowledge background and way of doing things. The exclusiveness of strong identities not only affected interpersonal relations, but also affected the way of communication between people from different departments.

"Normally we don’t go to engineers directly. (We) communicated with Engineering department through Scott [Director of Production] or Reg [PER leader], and they ‘lent’ their engineers to our side. We won’t go there by ourselves. ... This may be because of the frictions between departments." (Assistant leader, testing group, CTI-Shenzhen)

As a result, the inter-departmental knowledge flow was impeded, since the communication channels of inter-department communication were restricted. The formal ties between managers or leaders of different departments/groups turned out to be the main communication channels.

The strong and exclusive identities also restricted the development of informal ties between people from different departments.
"Normally, the close friends (we have) are within our own (testing) group. It is just like different small cliques, that is to say, this group won't have a very close relationship with (people in) another group." (Assistant leader, testing group, CTI-Shenzhen)

Knowledge flow between different departments was impeded, since the development of friendship networks between people from different department was constrained to some degree, especially between Engineering department and Production.

Nonetheless, it did not mean there were no informal ties connecting people in different COPs. In fact, there were both formal and informal network ties connecting people in different functional departments. Knowledge was shared through those ties, but the content of such knowledge flow was limited. The details were as follows:

2.2.1.2. Formal Ties between Departments

There were two kinds of formal ties between different departments. First, formal ties between people in different departments were established by management so as to promote the ERP system. For instance, there were formal ties between ERP leader and key users in different departments.

"For the concrete operation of the ERP (system), every department assigned a key user. They were the key users. ...I taught him/her, and then he/she was responsible for spreading (the knowledge). ... If there was any problem in your department, came to him/her first. If he/she couldn't solve it, then came to me." (ERP leader and PMC manager, CTI-Shenzhen)

Knowledge related to the ERP system was shared through the formal ties. ERP leader gave key users training lectures about how to use the ERP system. He also advised key users and helped them solve problems about operating the new system. (The network role of ERP leader will be discussed later).

"I went to ERP leader, when I had problems about the ERP. ERP leader is Louis. I think lots of people in our company would go to him, because he is good at that." (Official, Marketing department, CTI-Shenzhen)

It was a two-way communication. Based on their knowledge and understanding about their own work, these key users gave ERP leader suggestions to help to deal with some concrete and detailed problems in integrating the new system to their work. For instance,
"I found that nobody knew whether those items were returned to (the suppliers) or not, but we still paid the money to the suppliers. Then, I went to Louis. … (We) let Louis know those problems were found in our work, and then everyone made adjustments to perfect the work gradually." (Official, Warehouse, CTI-Shenzhen)

Those suggestions helped ERP leader to understand the actual needs from people’s daily work, and improve the functions of the system to make it more practical.

"In fact, it was always the operators whom you received advice from (and) you really (needed to) contact with, because they understand more (about their work). Because the managers or whoever … they won’t deal with those concrete things about the operation, right? Only those people below you are clear about what’s wrong with the software, (and) how it could be more convenient for them." (ERP leader and PMC manager, CTI-Shenzhen)

Meanwhile, the ERP system increased the work interdependence of different departments. The work of key users in different departments was connected by the ERP system.

"If you were not doing well this step, it would affect the next step. And, the next step would affect the next of the next step.” (Junior clerk, Purchasing department, CTI-Shenzhen)

The formal ties between key users, established by the ERP system, facilitated knowledge sharing between those key users. For instance, the ERP system adopted a new serial of material codes which were coded by PMC. Since most key users in other departments were unfamiliar with the codes, they needed to contact the key users in PMC to get the information.

"People who were responsible for materials in different departments, and some engineers who know functions of the materials but don’t know the standard material serial codes that I definitely know…. (They) needed to know the codes, because they needed to use the codes to collect materials.” (Senior planner 1, PMC, CTI-Shenzhen)

Second, people in different departments also had interface in their daily work. Through this kind of formal ties, people shared knowledge about their actual work. For instance,

"People in other departments asked me (for help), when they were not clear about something and wanted to check the information related to my work, such as the types of contracts and clients. (Those questions) were asked by Engineering department, R&D, and PMC.” (Official, Marketing department, CTI-Shenzhen)

However, knowledge shared through those formal ties was very basic and superficial. The reasons for the limited knowledge flow were related to the effects of cognitive and
relational social capital, and power relations. These issues will be addressed later in this chapter.

2.2.1.3. Formal Ties between Organisations

The formal ties connecting ERP leader and engineers from Win@ware, the software supplier of the ERP system, were established for the purpose of launching the new system. However, through the formal ties, ERP leader obtained the knowledge about the ERP system from engineers in Win@ware, but not the knowledge about how to integrate the new system, because those engineers were not fully involved in the project.

“They came here once or twice a week. They were not very clear about the actual circumstances of every department. It was hard for the boss to empower them.”

(ERP leader and PMC manager, CTI-Shenzhen)

The nature of formal ties affected the effectiveness of knowledge flow through the formal ties between ERP leader and engineers in Win@ware. This was because the formal tie between them was based on “cost and promised functionality” (Swan and Scarbrough, 2005), rather than on a “truly collaborative partnership” which is more effective in facilitating knowledge integration (ibid). According to the company’s documents (i.e. the contract of buying software and related services, and the work records of Win@ware’s installing and testing the ERP system), CTI-Shenzhen paid Win@ware by instalments in keeping with the process of the installing and testing of the ERP system. Win@ware’s engineers visited CTI-Shenzhen about once a week (sometimes in two weeks’ time) to carry on the work of software instalment, system running test, and training of ERP leader about how to use the software. Modifying the software, such as solving the errors of codes display or adding a new function for quality check, was the work done by the software engineers from Win@ware, rather than through a cooperative work of people in CTI-Shenzhen and from Win@ware. Win@ware’s engineers were not involved in the promoting of the new system in CTI-Shenzhen; therefore, they hardly provided the useful knowledge/information about how to integrate the new system into the daily work.

2.2.1.4. Friendship Ties

Firstly, informal network ties facilitated knowledge sharing across the organisational boundaries. For ERP leader, the most important knowledge was about how to integrate the new system to the daily work. He obtained this kind of knowledge through his personal contacts.
“Edwards was my university classmate. He was a specialised ERP salesman, an ERP sales manager. The questions I asked (him) were about the price of (ERP systems) at that time. ... They were clear which software was okay or whatever. Because the ERP I used before was (brought) from overseas, I didn’t use a domestic (designed system). This man [William], he was ... an ERP supporter.... We were in the same company [JED]. ... We (discussed) some detailed things about the methods (of promoting the system). Robert, he was a PMC manager, also (worked) in JED before. ...I talked with him about the directions...when we had dinner together.” (ERP leader and PMC manager, CTI-Shenzhen)

Second, the informal ties between some of the key users and people from other functional departments facilitated inter-departmental knowledge sharing. For instance,

“I really relied on having (good) relationship with those employees (on production line). ... They were old timers. I ... asked (them) what problems were easier to occur and what should be kept in mind. They knew all of those. They were more experienced than I in checking those things.” (Quality inspector 1, Quality department, CTI-Shenzhen)

The friendship network ties between key users and people in other functional departments helped them to exchange knowledge about their actual work. And this kind of knowledge exchange improved the knowledge integration between departments. For instance,

“Through private communication, she [a friend, Manager of Purchasing department] knew something about the current situation of our Marketing department; and I knew something from her, such as what kind of raw materials of some types of amplifiers was hardly bought. I knew these things, and then I was able to (answer) customers when they inquired about those. I could get the information in this way. I felt it was very helpful for me; it was helpful for the work as well.” (Official, Marketing department, CTI-Shenzhen)

However, this kind of informal network ties between people in different functional departments was few in CTI-Shenzhen; therefore, knowledge sharing through these informal ties was limited. Except for the effects of exclusiveness of identities mentioned before, the conflicts between different functional departments also resulted in the limited friendship ties.

“(Friends) should belong to different departments which were not connected in the work. If there was contact between the two departments we two belong to, normally our relationship were affected. That was not because of the problems of our subordinates; actually, there were many conflicts between departments. From the standpoint of one department, you saw the problems of another department.” (Assistant leader, testing group, CTI-Shenzhen)
The causes and effects of the inter-departmental conflicts are discussed in next subsections, because they were related to other dimensions of social capital.

2.2.2. The Role of Key Individuals

ERP leader and key users of the ERP system in different departments played important roles in the process innovation. Firstly, the key users were the gatekeepers who obtained knowledge about the ERP system directly from ERP leader and then shared the knowledge with the rest of people in their department. Meanwhile, they also shared their knowledge about their work with ERP leader to help him to integrate the new system with the work. (See Section 8-2.2.1) Therefore, knowledge flow through the gatekeepers (key users) supported the implementation of the ERP project.

Nonetheless, since the key users had limited knowledge about the ERP system, the knowledge they shared with other people in their department was basic and superficial. For instance,

"Many colleagues have not used ERP before, so they asked what ERP is, and I explained to them. (They also asked) how to operate the ERP. I knew more about the ERP operation, so mainly I told them about that. After all, I haven’t figured out the theory behind it.” (Senior planner 1, PMC, CTI-Shenzhen)

Second, ERP leader was in the position of ‘liaison’ (Conway, 1997), because he provided indirect connections between functional departments by connecting the gatekeepers of each department (the key users). For instance, as long as key users in one department found problems in their work which were related to other departments, they reported the problems to ERP leader. After which, ERP leader contacted the other people in related departments to solve the problems. Therefore, he acted as an intermediary between the people in different functional departments.

Furthermore, ERP leader was also a gatekeeper who searched for knowledge from outside of the organisation, and who distributed and applied the knowledge internally. As mentioned before, through the formal ties between ERP leader and people in Win@ware, and also through the informal ties between ERP leader and his friends outside the organisation, ERP leader was able to bring non-redundant knowledge and information.
from those external groups into CTI-Shenzhen. The knowledge and information helped the process innovation.

2.2.3. The Size and Diversity of the Networks

Many people in CTI-Shenzhen had small-sized social networks. Many interviewees mentioned their small-sized social circles; for instance,

“(My) social circle is relatively small. (I) know relatively very few people.... because I don’t often communicate with others initiatives.” (Clerk, Purchasing department, CTI-Shenzhen)

“My social circle is relatively small.” (IT support engineer, CTI-Shenzhen)

Small-sized social networks indicated limited knowledge and resources resided in the social networks. For instance,

“(For) people, like us, our social circle is not big. I also want to know more friends, and learn more things. But this kind of opportunity is relatively few for us.”(Senior planner 2, PMC, CTI-Shenzhen)

Therefore, there were fewer opportunities for people to obtain knowledge through the social network ties.

The degree of diversity of the social networks was low in the ERP project. The communication networks of most people involved in the ERP project were limited within CTI-Shenzhen. As noted before, amongst all interviewees, ERP leader was the only person who utilised the external ties to obtain knowledge/information contributing to the process innovation. For most of the key users, their network ties were the formal networks within the company, and mostly within their department.

“The (communication) is only within their own departments. ... they solve problems (with) those people who are related to the problems.” (Quality inspector 2, Quality department, CTI-Shenzhen)

In other words, most key users’ social network ties were embedded in the formal workflow network ties.

“(My work) has very little contact with other departments. I mainly contact PMC.” (Clerk, Purchasing department, CTI-Shenzhen)
This led to a low level of diversity of the social networks. And, knowledge flow was restricted when people had little connection in work. Hence, the low diversity of social networks referred to limited knowledge flow through those networks.

Therefore, because of the small size and low diversity of social networks, the formal internal ties became the main channels of knowledge sharing. Since the informal external ties were important for getting innovation source (Conway, 1997), the innovation of the ERP project relied on one person – ERP leader. As Conway (1997) puts it, there is a potential danger for innovation relying on the informal and personal connections of strategic key roles. In fact, CTI-Shenzhen faced problems when ERP leader left CTI-Shenzhen one year after the ERP project was launched.

"Last time, I couldn’t count (the amount of materials). The number had to be adjusted in ‘the chartered provider’ part, and then I couldn’t count. I asked him [Senior IT support engineer, who took over from Louis as the temporary ERP manager] to solve this problem, but he couldn’t.” (Official, Warehouse, CTI-Shenzhen)

2.2.4. Summary

The internal and formal network ties established by the ERP project helped knowledge flow within and across the departmental boundaries. The content of knowledge flow based on this kind of internal ties was about how to understand and operate the new system. The formal workflow networks helped people within a department to share the knowledge about the daily work. However, the strong and exclusive identities developed by the strong and multiple internal ties among people in different departments (‘communities of practice’) impeded inter-departmental knowledge flow. As a result, sharing knowledge about the actual work was easier within each department than across departmental boundaries. In addition, because of the small size and low diversity of social networks, the internal ties and formal ties became the main channel of internal knowledge flow. The innovation source derived from the external ties relied heavily on the personal contacts of one individual, ERP leader.

2.3. The Cognitive Social Capital

As mentioned before, the aim of launching the ERP project was to improve inter-departmental coordination and integration.
“(The Management) hoped to integrate these several strengths (of different departments). It was not efficient if let them work alone. Everyone just did their own work well as long as they weren’t blamed by (people) above them.” (Director of Production, CTI-Shenzhen)

However, integration was not achieved easily. There was lack of necessary knowledge flow for integrating the work of different departments. Different work content added to the difficulty of knowledge flow.

“I knew the part (of work) which was done by us. But, (I) knew little and less comprehensively about others’ parts, because you didn’t get involved. If we asked others, (they) were not clear (about these), because they have not touched this part of the work.” (Senior planner 2, PMC, CTI-Shenzhen)

In comparison, it tended to be easier to share knowledge within each department than between departments. In terms of the cognitive dimension of social capital, there were several main factors facilitating and/or impeding knowledge flow. Details are as follows.

2.3.1. Different interests and preferred outcome

Sharing knowledge within each department seemed easier than between different departments. One of the reasons was that people in the same department had shared interests in getting things done. The pragmatic boundaries (Carlile, 2002; 2004) were lowered.

“When two persons work in the same department, and see things from the same viewpoint, then it is very easy for these two to communicate with each other.” (Senior planner 1, PMC, CTI-Shenzhen)

However, people from different departments had different interests and preferred outcomes. The different interests and preferred outcomes caused the conflicts among many departments in CTI.

“It is unavoidable that there are (conflicts) between departments, (because) if you didn’t do (the work), then I had to do it. This might be in favour of my department, but with regard to the whole company, the benefit is problematic, (because the strength of) one plus one is not two, but less than two.” (Director of Production, CTI-Shenzhen)
For instance, workers on assembly line wanted the people in Quality department to lower the standards of quality check. Because their opinions sharply divided, conflicts occurred between Quality department and the assembly group.

"He/she just argued for getting the (better) figure about products which passed the quality check. For example, I needed you to achieve (the goal) that 90% products are (pass); finally it was 60%. Then, he/she though out all the ways to (argue with you)." (Quality inspector 2, Quality department, CTI-Shenzhen)

There were also conflicts between Engineering department and Production department. Engineering department was responsible for after-sale services. The goal of Engineering department was to satisfy customers. People on production line cared about how to complete the assembling tasks, rather than the quality of the products. Therefore, problems appeared when the workers rushed to meet the delivery date of products.

"When Production (department) made the things, they made (mistakes) at the first time, and second time, (even) the fifth time – (They) were like this. … (We) were blamed (by the customers). … (We spoke to people in Production) “You must pay attention to this problem” and whatever. Afterwards, (they) still made this kind of mistakes. (We were) really bothered. … At present, when I saw the mistakes (they made), I corrected them. I won’t tell you there were mistakes.” (Official, Engineering department, CTI-Shenzhen)

This kind of conflicts negatively influenced the willingness to exchange knowledge and information, thereby affecting the knowledge sharing between these two departments.

As Carlile (2002, 2004) points out, the difficulty of sharing knowledge across pragmatic/political boundaries lies in the fact that people need to invest time and resources to acquire knowledge in practice. In CTI-Shenzhen, sharing knowledge with or receiving knowledge from people outside the ‘community of practice’ meant that people had to give up the old way of doing things and combine others’ knowledge to find out a new way to solve problems. Therefore, people needed to spend extra time and resources combining their own knowledge with others’ to develop new knowledge. However, people were not willing to make the effort.

“If I communicated with those (people) at the middle layer (of management), they either don’t oppose you, or say they agree with you, because the things you give to them would give them huge pressure.” (Senior official, Purchasing department, CTI-Shenzhen, newly appointed director of PMC and Warehouse)

As a result, people in different departments refused to accept others’ opinions and ideas.
"(The disagreements between colleagues in different departments) are definitely because of different standpoints. If he/she accepted (my opinion), his/her work would be doubled." (Senior planner 1, PMC, CTI-Shenzhen)

Therefore, the pragmatic boundaries (Carlile, 2002, 2004) caused by different interests among departments restricted knowledge flow across departmental boundaries.

"Harry is in charge of testing in Production; when I told him (something)...he said I was picky in finding out others' mistakes (and) said we were too strict to them... (They) did not accept and sign (the documents I gave them)." (Official, Engineering department, CTI-Shenzhen)

2.3.2. Shared Cause/Effect Beliefs

It was relatively easy to share knowledge within a department, because people within the same department had shared cause/effect beliefs (Thompson, 1967). They understood the causes and consequences of their action. Therefore, they were willing to exchange ideas to deal with the new situation.

"(As colleagues in the same department), maybe she knew more and was clearer than I about the component's delivery date. ... We two sat down, put our information together, and then analysed them, because we might have different ideas. ... The first concern was the production, (as) you must deliver products to your customers on time. With this concern ... (materials must) arrive before the time assembling started." (Senior planner 1, PMC, CTI-Shenzhen)

However, lack of shared cause/effect beliefs impeded inter-departmental knowledge flow across the departmental boundaries. Since the process innovation required inter-departmental coordination and integration, problems emerged when people did not have shared cause/effect beliefs about the coordination and integration: people only paid attention to accomplishing the work of their own department, rather than cooperating with other departments (see Section 8-2.3.1, the quote of Director of Production).

Lack of shared cause/effect beliefs had much to do with lack of shared interests between people in different departments, and between the management and shareholders. For instance, management had different opinions about what the new system should be and how it should be promoted and implemented.

"There were also disagreements among shareholders. ... He/she didn't care about other things but only that: for example, I invested two hundred million Yuan; I
cared about nothing but how much I can get from the profits.” (Senior official, Purchasing department, CTI-Shenzhen, newly appointed Director of PMC and Warehouse)

“Bob, of course, wanted me to use the set of (procedures) he built up in the US (side). But, if I did that, he would lead my nose and pull me to go with him, right? (I) would do whatever he asked. There would be no place for me to develop and expand my own ideas and talent freely.” (ERP leader and PMC manager, CTI-Shenzhen)

Lack of shared cause/effect beliefs together with lack of shared interests not only affected the implementation of the ERP system, but also caused the difficulty in combining others’ knowledge and developing the new method of doing things. For instance, management and employees had different interests (such as making profits or getting job done), so they did not have shared understanding about the use of the ERP system,

“When the system was used in the actual work, there were many methods of doing things which they did not want to change. Then, it became that, while the boss was willing to use this system, the employees were not.” (Supply chain manager, Qunni Electronic)

On the other hand, conflicts did not exist between every two departments. Knowledge was shared across the departmental boundaries, when people had shared understanding about the causes and effects of their actions. For instance, a marketing official mentioned that it was not difficult for her to communicate with R&D people when she needed information from them.

“Some people might have different viewpoints, so they had disagreement about the work. … But, if some colleagues had the similar way of thinking (about the work), then you would feel it is easy to communicate with them.” (Official, Marketing department, CTI-Shenzhen)

2.3.3. Shared Language and Common Knowledge

Firstly, due to their mutual engagement in practice, people in the same department had shared language and work experience. This helped them to exchange ideas.

“Working in the same work environment… will make it easy to communicate or get along with each other, and whatever.” (Assistant leader, testing group, CTI-Shenzhen)
However, it was not saying that knowledge sharing within a department was not a problem at all. As mentioned before, knowledge shared within a department was often basic and limited. One reason was that some people lacked knowledge and the capacity to combine knowledge. People in the same department might have different work experiences; thereby, to some degree, they had different ways of doing things. For instance, a senior official suggested communicating with people in other departments by using the electronic files, instead of using telephone or contacting them in person (see Section 8-2.3.4). But other members in the department did not accept his idea.

“My current leader - Julie, she did not have such a concept. So ... when I shared (the concept) with them...this was also a problem about knowledge structure. ...when I communicated with Don [a clerk, Purchasing department], he didn’t know (what I meant) very clearly.” (Senior official, Purchasing department, CTI-Shenzhen)

Therefore, because of lack of shared language and experience, sharing certain kind of knowledge became difficult even within the same department; consequently, the knowledge shared by people was often basic.

Secondly, shared language was important for inter-departmental knowledge flow. Having common language and basic knowledge became important in exchanging ideas with people with different perspectives. For instance,

“Julie [Manager, Purchasing department] communicated with Finance (department), the finance (people) said, “That doesn’t work.”; but, when I went there, the finance (people) said, “That works.”; because I have (knowledge) about finance. .... I knew how to communicate (with them). I knew the related domestic law, like tax law. ... She would accept (my suggestions) as long as they were reasonable.” (Senior official, Purchasing department, CTI-Shenzhen)

However, lack of shared language and common knowledge was a main impediment to inter-departmental knowledge flow, especially between people in technology departments (i.e. R&D and Engineering department) and those in other departments. Many people in production-related departments (such as assembly line, PMC, Warehouse, and Quality department) had little education; some of them only had a high school education. Lack of related knowledge was a barrier for them to communicate with engineers.

“(Working in) our company always needed to use English, such as sending an E-mail to a colleague in the US. .... He/she sent you (E-mails) in Chinese, also (sometimes) in English. ... My English...is relatively poor. (I) needed to check
dictionary word by word. (It was) very hard.” (Senior planner 1, PMC, CTI-Shenzhen)

People in Warehouse were not familiar with some special materials. Lack of knowledge platform became the impediment of communication between engineers and people in Warehouse at the syntactic boundaries (Carlile, 2002, 2004).

“If I said a telephone, white-coloured, then he might know immediately. But if I said what kind of SM head, what mixed functions, then he did not know what kind of thing it was. Such a person managing Warehouse, I think, at least you are not qualified. … In the whole warehouse, (people) did not have the professional knowledge. … That was mainly because they were not familiar with products.” (Senior software engineer, CTI-USA)

As a result, people could not have any good communication, not to mention share knowledge with each other. For instance, between engineers (in R&D and Engineering) and people in Warehouse,

“The jargon was relatively difficult to understand. …He/she might go to Warehouse, and say, “Please give me this and that material.” But the Warehouse man didn’t know what material he/she wanted.” (IT support engineer, CTI-Shenzhen)

Finally, shared language was also essential for people to share knowledge through friendship network ties. In the ERP case, shared narratives between friends helped people to understand the information and knowledge developed in a different context:

“Julie and I, every day when we had lunch together, I would talk what happened today in the part of my (work)… she would talk about her worries, too. … So, I can know something which she was responsible for, some things related to (my work), such as the workload, and some particular things (that happened) in her department. For me, it was very useful sometimes.” (Official, Marketing department, CTI-Shenzhen)

Shared language also helped knowledge sharing across the organisational boundaries through friendship ties. For instance,

“(My) friends outside (CTI) normally work in the same profession, or have a similar status. (We) … talked about work, (and) had dinner together. …Everyone in different companies might encounter some difficulties. We gathered together to know (their situation) and to find out whether we were able to help to solve the problems.” (ERP leader and PMC manager, CTI-Shenzhen)
On the other hand, lack of shared language impeded knowledge flow through friendship network ties. Since some friends of the employees worked in different organisations, the context-related knowledge that they gained in various practices was different. This led to lack of shared language and knowledge between them.

“It was not a very big help offered (by my friends), because our jobs were different. (We) would talk about some unimportant things, because he/she didn’t understand your work, and could not talk much about it.” (Quality inspector 2, Quality department, CTI-Shenzhen)

In fact, except for ERP leader, no interviewed key users obtained useful knowledge from outside of the organisation through their friendship ties. This was because those key users and their friends did not have similar work experience, thereby failing to have shared language which was essential for sharing knowledge.

“No one can help me (with my problems in work) in my social circle.” (Official, Engineering department, CTI-Shenzhen)

2.3.4. Boundary Objects

The purpose of launching the ERP project was to integrate different departments and units in CTI. However, the ERP project failed to provide an effective boundary object (Carlile, 2002) to help people to integrate their work and share their knowledge. Especially in the very beginning, there was resistance to the new system.

“The big problem was that many people felt that it was troublesome, and didn’t want to use the ERP (system).” (Assistant leader, testing group, CTI-Shenzhen)

To facilitate knowledge sharing at syntactic boundaries, effective boundary objects should establish “a shared syntax or language for individuals to represent their knowledge” (Carlile, 2002:451). For instance, in the ERP system, using standard material codes to refer to materials standardised and formalised the information related to materials, such as the paperwork related to storing and sending materials. However, the standard material codes failed to be an effective boundary object, since the codes did not provide a common ground for people to exchange information about materials.

“Some incoming materials from American side, and something suppliers gave to them [engineers], because those were special materials, sometimes we have never seen them before. Sometimes, there was not a match of the codes between what the
suppliers provided and ours. We didn’t even know what those things referred to, when we saw the codes.” (Official, Warehouse, CTI-Shenzhen)

In the ERP system, materials were coded by people in PMC. The principles of coding were not explained to others. One the one hand, the material code system increased the information dependency between PMC and other departments.

“Every department often went to our department and asked the types and codes (of materials)...because at present he/she can not collect materials without (knowing) the standard codes.” (Senior planner 3, PMC, CTI-Shenzhen)

On the other hand, the incomprehensible material coding system failed to provide a common ground facilitating information exchange; as a result, it caused resistance to using the ERP system.

“I needed to check the standard codes of materials in the ERP (system). It was very troublesome to check the codes, because you don’t know the rules of coding.” (Assistant leader, testing group, CTI-Shenzhen)

In CTI-Shenzhen, the ERP system focused on the material control. It used a series of standardised work record sheets to deliver information from one department to another, such as BOM (bills of materials), and PO (product order) sheets. Those standardised sheets recorded and connected the work processes of different departments. Figure 8-1 gives an example of how the work of different departments was connected by working on those sheets in the ERP system.

“The most important contribution of the ERP was in the aspects of the material and capital flows. It is difficult to say that it helped R&D department greatly. At least, it helped (to use) the BOM sheets, and standard sheets, making these (work) processes more clear.” (ERP leader and PMC manager, CTI-Shenzhen)

However, in the ERP system, some standardised forms designed by the formalised software were less effective in sharing information between different functional departments. For instance,

“(Drawings) were always revised by the engineers; and then, I put those revised (information into a report) in the ERP system. And then, I sent notice about (the revision) to (other departments). Sometimes, the content of (information) about the revision was relatively loaded with trivial details. ... The report form was...not clear enough. ... When you sent a notice to him/her, (he/she) definitely knew there were some revisions. But (the revisions) could not be seen (clearly) from the (text) on the paper. I wish (the revisions) could be put into a table (form). That is to say, showing what I have revised by using a (table) form of report, it would be clear at a
glance. But, it was not like this at present.” (Official, Engineering department, CTI-Shenzhen)

Figure 8-1: The module of sales-production procedures in the ERP system

- Input and output of standardised work records

Source: The ERP training course, (Date: 28th June 2004), lectured by EPR leader; reorganised and drawn by the author.

At a semantic boundary, as Carlile (2002) suggests, an effective boundary object should "provide a concrete means for individuals to specify and learn about their difference and dependencies across a given boundary" (p. 452); while at a pragmatic boundary, a useful boundary object should "facilitate a process where individuals can jointly transform their knowledge" (ibid). For instance, a senior official used the electronic files which detailed information including price, available date, brand, and standards and capabilities of components. Those kinds of information helped him to communicate with engineers in R&D and Engineering departments, and to make the sensible decision of purchasing what met the requirement of design, and to decide on the production delivery date at a reasonable price.
“(If) the things [information] you gave him were ambiguous and unclear, he would definitely ask the same and very simple questions repetitively for many times. You must give clear (information). Firstly, which band do you want to buy? Which standard of this brand? Which important parameters have you decided to achieve with this standard? …because I considered (everything) very comprehensively for you, they [engineers] won’t (refuse) me.” (Senior official, Purchasing department, CTI-Shenzhen)

2.3.5. Summary

Lack of shared language and interests, and incomplete understanding of cause/effect relationship were the main impediments to knowledge sharing between different departments in CTI-Shenzhen. Effective boundary objects could help the knowledge flow across departments. However, the ERP system failed to provide effective boundary objects to overcome the barriers of knowledge sharing. In contrast, sharing knowledge within a department was easier, since people in the same department had shared interests and cause/effect beliefs. However, since the knowledge and work experience of people in the same department were different, knowledge shared within a department was often basic and superficial. Shared language and experience was essential for sharing knowledge through friendship ties. The next subsection will discuss the effects of the relational social capital on knowledge flow.

2.4. The Relational Social Capital

2.4.1. Hierarchical Norms

Hierarchical norms influenced intra- and inter-departmental knowledge sharing through the formal ties. Based on hierarchical norms, the formal communication channels were defined by the hierarchical structure of the organisation. Firstly, the department manager and group leader were the representatives of a particular department or group. Based on the hierarchical norms, members of the department took the managers’ advice to deal with problems they encountered in their work. For instance,

“It seemed a rule; that is to say, for doing everything which was related to technology, we must get Long Lee’s approval [group leader, assembly line].” (Assistant leader, testing group, CTI-Shenzhen)

Secondly, the formal ties between department managers were the legitimate communication channels between departments.
“In principle, I always went to department managers. It was not fixated, but a principle of management. We call it ‘reporting without skipping (management) layers, commanding without skipping (management) layers’. Normally, I won’t go to the members of his/her department. That equals to skipping a (management) layer to command (people).” (Director of Production, CTI-Shenzhen)

“If it was impossible (for me to solve the problem of adjusting departments’ actions), I just told the superintendents...to let the superintendents communicate with each other (to solve them).” (Warehouse man, CTI-Shenzhen)

Through those managers’ interactions, information/knowledge was shared across the departmental boundaries. The content of knowledge shared through discussions was about how to achieve coordination and how to deal with conflicts between departments. For instance,

“(I) always talked with (other) managers about the work flows. That is, talking with them about the big flows.” (ERP leader and PMC manager, CTI-Shenzhen)

“(I) communicated with (R&D department) nothing but something about management or work flows, (such as) that BOM sheets were not standardised, what kind of procedures you would use to transfer production (technique).” (Director of Production, CTI-Shenzhen)

However, there were also downsides of hierarchical norms. Firstly, because of hierarchical norms, the formal ties between department managers were the main channels of inter-departmental communication, and informal communications were often disapproved.

“(I) did not have many opportunities to communicate with them [managers of other departments]. Normally, we would go to...our leader - Reg. If there were some problems related to inter-departmental communication, we would directly inform Reg, and then, let Reg appear publicly in communications. Normally, we won’t go to the place out of the production line to communicate with other managers.” (Assistant leader, testing group, CTI-Shenzhen)

Secondly, hierarchical norms limited the content of knowledge shared between the formal ties, because in CTI-Shenzhen, hierarchical norms indicated ‘not interfering in others’ business’. For instance, Director of Production did not know very much about the ERP system, because he did not participate in promoting the project: “it was not I who worked on it”, he said. Similarly, because of hierarchical norms, the IT support engineer did not engage in adjusting material flow in ERP; so, he did not know how the ERP system controlled material flow. It caused difficulties for him to take over the job of managing the ERP system, when Louis left CTI-Shenzhen.
“For the part of material flow (related to the ERP), actually I started to become involved in the core (of the ERP project) for two weeks, half a month ago. I didn’t meddle with that before, because Louis was fully responsible for that.” (IT support engineer, CTI-Shenzhen)

2.4.2. Norms of Professionalism

Because of norms of professionalism, people who had specialised knowledge did not have a desire to take part in some activities, because they thought that those activities were not related to their professional work; as a result, they lost opportunities to learn knowledge by participating in the activities. For instance, because of norms of professionalism, the IT support engineer emphasised his role as an IT specialist rather than a key member of ERP project, so that he did not try to understand the logistics of supplying material to production – material flow.

“I am specialised in IT. … I did not care about how the actual material flow goes…I only participated in when there were some problems related to the Net, computer and some things about the configuration. Usually, I didn’t participate in adjusting the material flow. ” (IT support engineer, CTI-Shenzhen)

Norm of professionalism affected learning because people did not have any intention of learning knowledge which was ‘irrelevant’ to their professional knowledge.

“He [senior software engineer, CTI-USA] installed the instrument on a kymograph. What kind of graph it makes? I won’t try to understand it. I won’t try to know (if) the value is correct or wrong. … I provided them with an interface, and let them work on it. That’s all.” (IT support engineer, CTI-Shenzhen)

2.4.3. Norms of Reciprocity

Norms of reciprocity facilitated knowledge sharing through formal and informal network ties. Firstly, norm of reciprocity helped knowledge sharing within departments.

“As a colleague, it was inevitable to help others. Sometimes I also asked for his/her help. So did him/her. It’s unavoidable.” (Senior planner 1, PMC, CTI-Shenzhen)

Secondly, based on norms of reciprocity, the key users of the ERP system exchanged their ideas about how to operate the new system. Therefore, knowledge was shared across departmental boundaries through the interaction of the key users.
"We always learned from each other. ... In the very beginning, it was impossible for everyone to know everything (about the ERP system)." (Junior clerk, Purchasing department, CTI-Shenzhen)

Thirdly, norms of reciprocity together with competence trust (Newell et al., 2002) facilitated knowledge sharing between friends. Norms of reciprocity referred to the fact that people were able to give each other similar kinds of help to deal with problems that they encountered in their work; therefore, people needed to trust each other to have the ability to handle those problems. Along with competence trust, norms of reciprocity facilitated knowledge flow through friendship networks ties. For example,

"I would still help you as long as you are my friend. Honestly, you must admit that my competence was as good as yours. So, you must at least pay for it reciprocally if I help you. Otherwise, it was impossible for me to help you to do your work." (Senior planner 1, PMC, CTI-Shenzhen)

On the other hand, norms of reciprocity indicated that once people felt they could not receive any similar help from others, they were hesitant to offer their help. For example, an official talked about her response when the newcomers asked her for help:

"When you asked me to do something – actually I was not busy, (but) I had a kind of very uncomfortable feeling which was hard to tell – I wanted to help you, but I felt there were no advantages in helping you." (Official, Engineering department, CTI-Shenzhen)

Therefore, lack of reciprocity impeded knowledge sharing.

2.4.4. Norms of Cooperation

First, norms of cooperation facilitated intra-departmental knowledge flow. Based on norms of cooperation, people in the same department were willing to help each other. For instance,

"I think we cooperated with each other very well in out department. ... He/she did everything assigned to him/her well and quickly. ... If they found any problem, they came here and asked me to check it out" (Official, Warehouse, CTI-Shenzhen)

Norms of cooperation were also related to companion trust (Newell et al., 2002). Companion trust is based on ‘judgements of goodwill or personal friendships’ (Newell et al., 2002:58). As mentioned before, in CTI-Shenzhen, people in the same department were
like a ‘community of practice’: they developed goodwill to help each other in the mutually engaged work. Therefore, norms of cooperation together with companion trust facilitated intra-departmental knowledge sharing.

“(In our department) we communicated with and helped each other, when we encountered some problems. That’s not a problem. Since we have been working together for a long time, it was impossible to say “I don’t know”, when the colleagues asked you (for help).” (Official, Marketing department, CTI-Shenzhen)

Second, norms of cooperation together with hierarchical norms positively influenced the inter-departmental communication to some degree. For instance,

“For the work, I would do my best to have the best communication with others. Anyway, there is only one goal - to get the work well done.” (Quality inspector 2, Quality department, CTI-Shenzhen)

However, generally speaking, cooperation between some departments did not go well. The work of some departments was not coordinated. Those departments only considered how to do their own work. Since the work of different departments was connected, it was unavoidable that there were conflicts between those departments, such as between Quality and Production departments, and between Purchasing, PMC and Warehouse. For instance,

“The system showed that Purchasing didn’t deal with (the sheets), and actually didn’t change the PO, then we went to Purchasing…(we) needed to know the delivery date. But, he/she did not enter it; therefore, it appeared that the departments found fault with each other. …if we made mistakes when we sent the sheets, Purchasing (department) would find fault with us.” (Senior planner 3, PMC, CTI-Shenzhen)

As a result, people in those departments did not cooperate with others in sharing information. Therefore, lack of cooperation impeded inter-departmental knowledge flow. For example,

“If there were some problems, (I) needed to collect related information from Warehouse and Production; (and) I asked them to help me to check those things. But, he/she always could not give you some of the things. … (They) didn’t want to communicate with you. (They) had the considerations, some things related to personal benefits.” (Quality inspector 2, Quality department, CTI-Shenzhen)

Similarly, an official in Warehouse told a story about how a planner in PMC was not willing to help her to solve problems.
“I told her [senior planner, PMC] there were more things than should be; she wouldn’t check that for me. Because…checking that was very complicated. She needed to ask people whether they delivered or received goods one by one; she needed to go to Financial department and checked out all related sheets; she also needed to check out her own (work) to see whether she made mistakes or did not place the order. … Now, she just said: “I don’t know.” … Then she left it. But we needed to do the rest work. … No one was bothered about it. Have nothing to do is better than having troubles. Everyone had this kind of thinking.” (Official, Warehouse, CTI-Shenzhen)

Lack of cooperation between different departments was also caused by exclusiveness of identity, especially between technology departments and other functional departments.

“For them [engineers] it seems that (their status) is higher than ours. If we went to them directly, they had a kind of attitude of unwillingness toward cooperating with (us). Therefore, normally we did not go to them by ourselves.” (Assistant leader, testing group, CTI-Shenzhen)

Because of exclusiveness of identity, lack of cooperation affected interpersonal relations as well as inter-departmental knowledge sharing.

2.4.5. Summary

Different norms and trust had both negative and positive influences on knowledge flow. Based on hierarchical norms, internal communication was defined by the hierarchy, and formal network ties became the main channels of inter-departmental knowledge flow. On the other hand, informal communication between departments was not approved. Norms of professionalism restricted learning, because people did not intend to learn knowledge about other professions even when there were such opportunities available. Norms of reciprocity together with competence trust facilitated knowledge flow through different network ties. Lack of reciprocity impeded knowledge sharing. Norms of cooperation along with companion trust facilitated knowledge flow within a department. However, because of the conflicts between departments, and exclusiveness of identities, lack of cooperation became the main impediment to sharing knowledge between different departments.
2.5. Interactions among the Three Dimensions of Social Capital

2.5.1. Interactions between Relational and Cognitive Social Capital

Lack of shared cause/effect beliefs and lack of shared interests led to lack of cooperation between different departments. People in different departments had different understanding about the causes and effects of their actions. They tended to focus only on their own work. For instance, when people in Warehouse found that the actual amount of material was not the same as recorded in account books, they wanted to let PMC people check it. But planers in PMC were not willing to do so. That was because checking material meant extra work for the planers, and they also did not want to know that they made mistakes.

“When you went to the person, the person would think about this and think about that. The person would do this thing for you only when he/she found that he/she won’t lose anything.” (Official, Warehouse, CTI-Shenzhen)

Therefore, lack of shared cause/effect beliefs and lack of shared interests between different departments led to lack of cooperation between them.

2.5.2. Interactions between Relational and Structural Social Capital

Companion trust (Newell et al., 2002) was fundamental to friendship networks ties. When companion trust was undermined, friendship network tie between two actors was broken. Lack of companion trust also affected the development of friendship network ties. For instance,

“I am a little bit unwilling to trust others; (I am afraid that) maybe I she/he would betray me. … I have been there before. Thus, I was scared. … I seldom make friends in the company at present. (My friends) were very few.” (Official, Engineering department, CTI-Shenzhen)

Therefore, as a result of the interaction between companion trust and the development of social network ties, people had small-sized social networks.

Competence trust (Newell et al., 2002) helped to develop formal workflow network ties. For instance, based on competence trust, department managers brought their own people to CTI, because they believed that those people were able to do a good job.
“He/she dared to bring his people to join here; it demonstrated that he/she trusted the capacity of those people.” (Senior planner 3, PMC, CTI-Shenzhen)

Strong internal ties developed companion trust (Newell et al., 2002) among people within a department. And the companion trust further improved interpersonal relationships, and fostered norms of cooperation amongst people in the same department.

“For the colleagues who frequently cooperate with each other in work, their relationships are better than others’. They spent more time together after work. That’s for sure. … Definitely, that helped cooperation.” (Senior planner 1, PMC, CTI-Shenzhen)

2.5.3. Summary

The three dimensions of social capital were interrelated, and interacted with one another to influence knowledge flow. Competence trust helped the development of formal internal ties. Strong internal ties fostered companion trust, and improved cooperation within the same department. However, lack of companion trust impeded the development of friendship ties, and even led to the breakdown of network ties. Furthermore, lack of shared cause/effect beliefs and lack of shared interest harmed inter-departmental coordination and cooperation. Lack of companion and competence trust also aggravated the disconnection and lack of cooperation between departments. In fact, different dimensions of social capital also interacted with different dimensions of power. The next section will discuss the power issues.

3. The Direct and Indirect Influence of Power Relations

3.1. The Influence of the Power of Resources

The power of resources is “exercised by actors to influence decision outcomes and bring about the desired behaviour through the deployment of key resources on which others depend” (Hardy, 1996:S7). The management team of CTI was composed of several General/Vice-General Managers - the top layer, and department managers. As those General/Vice-General Managers were responsible for different affairs in CTI, they controlled different resources, such as money, technology, customer relations, and so on.

“There is a big boss in the company. That is the person who is behind. They are General Managers - Dr. He, Tsai, and Ben. The big boss is the person who invests money. Bob...he is the boss’s relative and right-hand man. …several (General) Managers always needed to have one part of affairs in hand. John was in charge of
technology; Ted was responsible for running the CTI-Shenzhen; Ben was in the US. So, Bob, of course, took the part of the (work) flows in hand, and then he was very aware of how you run (the business).” (ERP leader and PMC manager, CTI-Shenzhen)

Those General/Vice-General Managers were powerful persons. They directly and indirectly influenced the decision-making related to the ERP project, such as the programming of software which fitted in with the particular situation of CTI, the purchasing of formalised ERP software from a specialised software company, and so on. The divergence between them was rooted in the fact that those people had different interests, and competed for power of controlling resources. For Bob, adopting the CTI-USA’s work procedures could increase his power, since it increased CTI-Shenzhen’s dependence on his party. On the other hand, Ted wanted to reduce CTI-Shenzhen’s dependence on CTI-USA.

“You could never imagine the resistance and trouble I encountered when I worked on the ERP. ... Of course, that was related to the relationships and conflicts at the top-layer. ... Bob, of course, wanted me to use the set of (procedures) he built up in the USA (side). ... Even you did what he wanted, it might not be good for here [CTI-Shenzhen]. The boss in here [Tsai] suggested doing our own (procedures). If you did what he (Bob) wanted, when there were problems, you had to take the whole responsibilities. ... At that time, Bob was strongly against buying software. If you did not use his (software), the situation would be that I was very clear about (the procedures), and much more clear than he.” (ERP leader and PMC manager, CTI-Shenzhen)

In competing for resources, the power of controlling resources together with hierarchical norms negatively influenced norms of cooperation. For instance, hierarchical position offered Bob the power of controlling human resources and information flow. He used the power of resource to resist the new system.

“Signing contract and whatever was done without notifying (Bob). When he knew that, he stamped with fury. When I had some problems which I needed to communicate with the engineers on the US side, I also did that without notifying him. Of course, he was the boss; sometimes they reported the situations or whatever to him. So, he knew that, he raged, and was against (me). That made the situation deadlocked.” (ERP leader and PMC manager, CTI-Shenzhen)

As a result, the process of installing and running the new system was delayed because of lack of cooperation from the CTI-USA. According to the work records of installing and testing the ERP system, from February 2004 to March 2004, the plan of software
instalment was kept on being deferred, because engineers in CTI-USA did not approve the BOM.

The conflicts of controlling power resources among the General Managers affected inter-departmental communication. It further harmed coordination and integration between the ERP system and the work of technology departments. Because of lack of communication between ERP leader and engineers in CTI-Shenzhen, exchanging ideas on how to integrate the work failed.

“There are different work procedures of R&D. If you didn’t strongly indoctrinate them into (the ERP system), following (procedures) would be very unclear.”
(Senior official, Purchasing department, CTI-Shenzhen, newly appointed director of PMC and Warehouse)

In addition, the wrestle for the power of resources undermined the companion trust between ERP leader and Bob. As ERP leader explained, the poor relationship between him and Bob was one reason why he decided to leave CTI.

“He [Bob] treated me very nice. …now it was very awkward when we saw each other. … The trust built up in years was broken; it was hard to repair for ever.”
(ERP leader and PMC manager, CTI-Shenzhen)

As mentioned before, since the innovation of the project relied heavily on ERP leader, his leave bogged down the improvement of the new system.

3.2. The Influence of the Power of Processes

The power of processes is the power of using “a variety of procedures and political routines” in decision-making process to achieve desired outcomes by preventing others’ participation (Hardy, 1996: S7). The power of processes affected knowledge flow through selection, training, pay system, and work procedures.

3.2.1. Selecting People

Department managers were able to select members of their departments. Other employees and department managers were excluded from the decision-making related to the selection. For instance, ERP leader recruited several people who previously worked in his team. When he left CTI to work in another company, those people also left to follow him.
"Every manager joined here, bringing a batch of his/her own right-hand men. If the members in your department were not your own people, (they) would not be cooperative when you let him/her do things. You would be quite bothered if it was always the case." (ERP leader and PMC manager, CTI-Shenzhen)

This kind of selection developed strong internal ties, because people had multiple connections.

The power of processes embodied in selection generated both positive and negative effects on knowledge flow. On the one hand, the selecting process helped strong internal ties and strong identities of being the members of the department. People were willing to exchange knowledge, and to help other members in their department. Therefore, the power relations embedded in the selecting process indirectly facilitated internal knowledge sharing within a department by developing multiple and strong internal ties, and by building up norms of cooperation, and strong identity.

On the other hand, because of selecting one's own people, employees in different departments had separate identities. It led to lack of cooperation and communication between departments, when there were inter-departmental conflicts. For instance,

"Lots of people were introduced (by someone) to join here. … They were related to each other if they were introduced to join here. …you offend one, and then, more come afterwards." (Official, Warehouse, CTI-Shenzhen)

"There are many cliques. … People in different cliques were not willing to cooperate with others in work. … It was not that he/she was not able to provide (information) to you; sometimes (he/she) was just unwilling to do so." (Quality inspector 2, Quality department, CTI-Shenzhen)

Thereby, the power relations embedded in the selecting process indirectly impeded inter-departmental knowledge sharing by negatively influencing cooperation and identities.

3.2.2. Non-Decision-making Power on Pay Issues

The control of the rewarding processes also affected knowledge flow. In CTI-Shenzhen, department managers were able to give suggestions about wage of the members of their departments.

"We [department managers] have the right to give suggestions about the wage (of subordinates), and (personnel department) decides what the wage of a particular
position is, in accordance with the company’s regulations.” (Director of Production, CTI-Shenzhen)

However, the final decision on employees’ wage, bonus, and overtime fee was made by Personnel department. The influence of department managers was limited, and employees were completely excluded from the decision-making process in relation to pay issues.

The process interdependency relations embodied in pay issues had negative effects. Firstly, it led to reluctant knowledge sharing, when employees felt the pay system was not fair. For example, an official complained that:

“My salary might be the lowest in our department. I have asked our department leader twice to give me a raise. Our department leader also mentioned that to Personnel department. But it was not alright. ... (People in Production got) money paid for every hour they worked overtime...But we didn’t. ... Emotionally, it was very difficult for me to accept this point.” (Official, Engineering department, CTI-Shenzhen)

The dissatisfaction with wage changed her attitude toward the work:

“I had this kind of mentality: I only do my own work well; I won’t help any others to do anything because I felt that I lost the passion for work. ...before I was like a workaholic.” (Official, Engineering department, CTI-Shenzhen)

And it also changed her attitude toward knowledge sharing. She became unwilling to share knowledge with others.

“If you were a newcomer and you didn’t know something and asked me, I would definitely (say I was) very busy and told you this and that perfunctorily. I won’t tell you about your problems.” (Official, Engineering department, CTI-Shenzhen)

Second, the non-decision-making power on pay issues had negative influence on norms of cooperation. For instance, owing to his dissatisfaction with wage, a senior planner was unwilling to help other people to solve problems, knowing they were paid differently.

“If I knew a BA holder who did the same job as I got four times more wage than I. ... Don’t think I would help him if he encountered some problems in the work. ... My wage motivates my work (enthusiasm). The efficiency of my work was low, because my wage was low.” (Senior planner 1, PMC, CTI-Shenzhen)
3.2.3. Controlling Work Procedures

Firstly, employees were excluded from controlling work procedures. The tight work procedures of functional departments were established to serve management’s interest in increasing productivity. The employees had heavy workload. The tight work procedures and heavy workload deprived them of time and opportunities to learn knowledge about the ERP system.

“The big problem was I didn’t have time to get familiar with material codes, and to identify what things they referred to. Every day I am busy. My workload is already very heavy. I don’t have extra time to know those things.” (Official, Warehouse, CTI-Shenzhen)

Moreover, heavy workload led to employees’ unbalanced work-life, then affecting the structural social capital. Since people did not have free time to contact their friends, their friendship ties with other people outside the organisation became weak.

“Most of my friends do IT. …after I joined this company, we seldom met together. ... I was very busy.” (IT support engineer, CTI-Shenzhen)

Second, the process interdependency relations also influenced communication patterns. As mentioned in Section 8-2.4.1, the formal ties set up by following the hierarchical structure were approved as main communication channels. This restricted the development of informal network ties.

Finally, because ERP leader was powerless in controlling work procedures, the work procedures of every department and the ERP system did not achieve coordination. Based on the priority rule of delivering goods to customer, sometimes people did not follow the ERP system. This resulted in lack of shared understanding of the causes and consequences of following the ERP system – the integration purpose and the principle of using the ERP system were ignored.

“You had to skip the ERP to meet the requirement of delivering goods. This was (because) you could earn money. (But) you were in trouble at this moment. This was not (a problem) about one or two departments, but the whole company – the management patterns, even the boss’s view of value. Saying this might not be very specific, but actually it was true.” (ERP leader and PMC manager, CTI-Shenzhen)

“Because (the materials) were urgently needed, engineers used it immediately in that project without (following the procedures of) storing (materials) and (quality)
checking when they were purchased from or supplied by the suppliers.” (IT support
engineer, CTI-Shenzhen)

Therefore, the process interdependency relations embodied in controlling work procedures
affected the understanding of causes and effects of operating the ERP system. As a result,
the inter-departmental cooperation was harmed.

3.2.4. Providing Training

Since the management’s attention was paid to the short-term goal of making profits by
producing products and delivering them to clients on time, rather than a long-term goal of
improving its quality of operation and output by training employees, little training was
provided to employees in CTI:

“When employees were recruited, there was not a systematic training provided to
them. … (I) relied completely on myself to work hard to try to find out the rules.”
(Official, Engineering department, CTI-Shenzhen)

“The (ERP) training course focused primarily on the things which we would use in
work. …the things which other departments would use were skipped, and not
emphasised and explained.” (Quality inspector 2, Quality department,
CTI-Shenzhen)

In fact, many people (department managers and employees) felt that employees needed
more formal and systematical training to help them work efficiently. For instance,

“In the first week (the new employees) working for you, (indoctrinating) ideas
(about work procedures and requirements) is very important.” (Senior official,
Purchasing department, CTI-Shenzhen)

People were aware of the training issue, but they were not able to bring issues to
management, and made any change. That was because the existing decision-making
processes did not allow them to access the decision-making arena. And, because there were
many works for them to do, they were not able to give priority to the need of training.

“If you analyse it carefully later on, (you will know that) I did not lose money in
providing training. …but it is one thing that the boss won’t (let you decide).”
(Senior official, Purchasing department, CTI-Shenzhen)

“For (the knowledge) related to technology, definitely, technology-related people in
R&D should train us about this part, right? But now, everyone really doesn’t have
time, because time is too short to meet the required delivery date.” (Official, Marketing department, CTI-Shenzhen)

Lack of training directly affected learning and knowledge flow, because opportunities to obtain knowledge from training were restricted.

3.3. The Influence of the Power of Meaning

The third dimension of power (Lukes, 1974) is the power of managing meaning (Pettirew, 1979), controlling people’s behaviour by influencing their value, perceptions, cognitions and references (Hardy, 1994; 1996). Organisational culture “embodies potential unobtrusive control mechanism” (Hardy, 1994).

In CTI-Shenzhen, the quick growth of the company relied on its specialised technology in making power amplifiers, and on its ability to sell products to the main communication equipment suppliers. To meet the delivery date was important, since it was the key to earning money.

“(The strategy) is one thing that the boss won’t (let you decide). …He/she [the shareholders] doesn’t care about the concrete things behind the results. That is, I invested two hundred million Yuan; I care nothing but how much profit I can get from my share.” (Senior official, Purchasing department, CTI-Shenzhen, newly appointed director of PMC and Warehouse)

The organisational culture implied the management’s strategies and concepts about how to run business, which inconspicuously influenced people’s behaviour; sometimes it had unexpected results. To borrow Bate’s (1994) idea of describing organisational cultures with ‘isms’, the organisational culture in CTI-Shenzhen (especially among the function departments) was identified as having three features which might be described as three ‘-isms’: segmentalism, hierarchicalism, and elitism.

3.3.1. Segmentalism

The process innovation in CTI-Shenzhen required coordination and integration between different departments and units. However, CTI-Shenzhen had the segmentalist culture which gave rise to the difficulty of integration. With its quick growth, CTI-Shenzhen acquired more and more orders, but became comparatively short-staffed. Employees were busy with work. And, new orders often made it difficult for people to follow the original
production plans, and to keep up with other related work schedules. In order not to be blamed by the bosses, each department only emphasised and focused on one’s own work. As Director of Production described the situation of CTI-Shenzhen,

“Definitely, the department’s conservatism is the effective way to achieve the best performance of their own department. … It is unavoidable that some work hasn’t been done for the reason of (pursuing) their own department’s convenience and benefits. Every company might have this (kind of problem), anyway. Our company also has some.” (Director of Production, CTI-Shenzhen)

The “department’s conservatism” that Director of Production talked about actually embodied segmentalism of CTI-Shenzhen – every department only paid attention to accomplishing its own tasks, rather than cooperating with other related departments. This kind of culture led to lack of cooperation between departments. For instance,

“I gave the feedback to PMC, when I found any problems. But now, I felt that there were some problems in PMC, … Anyway, (if) they didn’t deal with the problems, I went to them promptly; and then (they) always gave you very perfunctory answers which cannot be put into practice.” (Official, Warehouse, CTI-Shenzhen)

Segmentalism also led to lack of shared interests between departments. Except for ERP leader, no other department managers were actually involved in the ERP project, all focusing on the tasks in hand. They knew fairly little about the new system, not to mention their supporting the project by sharing knowledge. Accordingly, segmentalism affected the participation in promoting the ERP project.

“I haven’t had time to get familiar with (the ERP), because the goods haven’t been delivered by Production yet.” (Director of Production, CTI-Shenzhen)

Under the sway of the segmentalist culture, different functional departments failed to achieve coordination; and this further affected the process innovation:

“As a manager, that is, a (manager) at the middle-layer (of management), you didn’t have the idea to consider (to support the ERP); you didn’t even have the kind of concept, how could you make it? It is impossible.” (Senior official, Purchasing department, newly appointed director of PMC and Warehouse, CTI-Shenzhen)

3.3.2. Hierarchicalism

As noted before, in functional departments, people followed hierarchical norms, and formal communication was considered legitimate to follow the hierarchical ranks in the
organisation. The cultural hierarchicalism influenced norms of control and compliance. The cultural hierarchicalism fashioned department managers’ perceptions and values. For them, the top-layer’s decisions were important, and had to be obeyed. They were not willing to utter a different voice.

“A (new) thing came (and) threw every plan into confusion…. managers and employees didn’t give the opposite voice… because from the very beginning everyone only had one concept – ‘I don’t have the power to command him/her to do (something) – he/she is the boss’.” (Senior official, Purchasing department, newly appointed Director of PMC and Warehouse, CTI-Shenzhen)

The words of Director of Production showed the influence of the cultural hierarchicalism on people’s perceptions:

“I think the leader’s [the top-layer of management] view is further and broader than mine, a department manager. When he/she made the strategies, I think, the leaders they have definitely considered the current situation of the company, and correspondingly which stage each department should go to.” (Director of Production, CTI-Shenzhen)

Hierarchicalism not only influenced the department managers’ perceptions, but also other employees’ conceptions and ideas. The subordinates simply followed department managers’ commands. When department managers did not have the will to participate in the process innovation, it was hard for the officials and workers in their department to have the idea of developing new knowledge by getting involved in the innovation project.

“This kind of skeleton (persons), they didn’t have this kind of idea (of participation). …the employees should be (told that) ‘You need to use the thing – the ERP’… and this thing can bring benefits to your enterprise, and bring efficiency to your work. … If you didn’t instil this idea (into employees), he/she won’t get used to using the thing. He/she … would still use the conventional methods or habit to do their work.” (Senior official, Purchasing department, newly appointed Director of PMC and Warehouse, CTI-Shenzhen)

3.3.3. Elitism

As a high-tech company, the advanced technology of making power amplifiers was something that CTI cannot do without. On that account, engineers (especially those engineers working in R&D) were privileged for their specialised knowledge.

“Definitely, R&D is particularly emphasised, because our products are relatively high-tech and the company pays relatively much attention to the products. Certainly,
these two departments were given priority.” (Director of Production, CTI-Shenzhen)

“Our company relatively emphasises technique. People who work on technique are relatively popular.” (Quality inspector 2, Quality department, CTI-Shenzhen)

The elitist culture developed the strong and separate identity of the engineers. In comparison, other employees (including workers in Production and officials and clerks in functional departments) had little specialised knowledge. Most of them did not have good education; some of them were merely graduated from high school. Based on the cultural elitism, the distinctiveness and exclusiveness of the identity affected interpersonal relationship, and impeded knowledge sharing between people of different status, such as between engineers and workers.

“(Engineers) felt (they) were at a relatively higher level (than others). …when you asked them (questions), they seemed impatient with me. Many of them were like that. … I remembered the first time I asked a person - he left CTI already. …”Have you seen this? This is a lead” (he said). I felt his expression made me discomposed. He gave me a no good impression. …if the person didn’t give me a good impression, next time, I would avoid appearing as long as I could.” (Quality inspector 2, Quality department, CTI-Shenzhen)

3.4. The Influence of the Power of the System

3.4.1. The Competitive Labour Market

As noted before, the economy reform brought competition into the labour market in Shenzhen. People had more chances to earn more money by working in Shenzhen, but also faced huger work pressure because people no longer held a permanent job with stable income as then in a state-owned enterprise.

“She work pressure is bigger here, and competition is more intense here.” (Official, Warehouse, CTI-Shenzhen)

The competition in the labour market stimulated learning. Because people needed to learn new things in order to be competent to do their job, and to remain competitive. For instance,

“In Shenzhen, this kind of place, …if you couldn’t follow the new things, (you are) really in danger.” (ERP leader and PMC manager, CTI-Shenzhen)

“I think (people in) every field need to update oneself (knowledge) constantly’. In Shenzhen people call it ‘charging’. …there are many things changing too fast
indeed...like the market, the pressure from the market is quite enormous.” (Supply chain manager, Qunni Electronic Ltd.)

Secondly, the competitive environment caused the lack of companion trust between people. As mentioned before, because of the competition in Shenzhen, people were busy with their own work, and they also had to compete with each other for a job or for a better position. This led to lack of companion trust among people. It was difficult to develop ‘companion trust’ (Newell et al., 2002) among people.

“It was about the change of cultural atmosphere, the development of economy, or the change of the concept of time, etc. Everybody changed a lot. ... It is impossible for you to have time and energy to care about many things.” (Supply chain manager, Qunni Electronic Ltd.)

Lack of companion trust made it difficult to develop friendship networks, therefore causing the small-sized friendship networks.

“People in Shenzhen, maybe, they have a very strong sense of self-defence. ... They are not as close as friends. Sometimes most people get along with each other superficially.” (Official, Warehouse, CTI-Shenzhen)

3.4.2. The Changing Social Context

People being members of the society, people’s value reflected the changing social context of Shenzhen. As described in Chapter 5 and Chapter 7, people left their hometown, and came to Shenzhen in hope of getting better income and personal development.

“The aim of leaving home to work for others is to earn money.” (Senior planner 3, PMC, CTI-Shenzhen)

‘Getting rich’ was promoted by the government; earning more money became a personal goal as well as the indication of being successful in one’s personal development.

“There were more than 30 students in our (MBA) course; more than 20 persons drove their own car to attend the lectures, whereas several persons who work in manufacturing enterprises, we took the bus. This was not saying that we pursue those things; but those things represented their successes.” (Director of Production, CTI-Shenzhen)

However, the social system was to the advantage of some professions. For example, working in marketing-related work, people can earn more money, because, except for the salary, they can earn extra commissions for each closed contract. In addition,
marketing-related work offered more opportunities to develop good relationships with clients, which helped people to run their own business:

“(I) still want to do marketing. … (I) don’t want to stay in manufacturing. I had a colleague in JED. Before, he was a planner in my department. Afterwards, he was transferred to work on marketing. Two years past, he left (the company) and opened his own company. He (bought) a Bentley car, and became a boss. The development is distinctive.” (ERP leader and PMC manager, CTI-Shenzhen)

The power relations embedded in the social system produced advantages for those people who worked in marketing-related professions. And other people tended to make some change in their career, because their current situation was not in line with their preference and value. Consequently, their commitment to the organisation became weak.

“There is another reason why I am leaving (CTI). There is a limitation (to work in here). … (I) have worked in manufacturing industry for six years. The work is very trivial and very concrete. …you stay here, and are imprisoned by these trivial things; and your thought is limited. …(you) don’t have any energy to do other things.” (ERP leader and PMC manager, CTI-Shenzhen)

The weak commitment and the leave of key individuals gave rise to the difficulty of project innovation, especially when the innovation relied heavily on key individuals’ informal social networks and personal contacts.

3.5. Summary

Different dimensions of power affected knowledge sharing in both direct and indirect ways. There were conflicts within the top-layer of management in competing for power resources. This kind of power relations affected knowledge flow by impeding inter-departmental communication, and by affecting norms of cooperation between departments. Furthermore, it also undermined companion trust and led to the breakdown of network ties. Non-decision-making power was exercised in selecting people, rewarding people, providing training, and controlling work procedures and routines. The power relations related to non-decision-making directly affected learning, and willingness to share knowledge. They also indirectly affected knowledge flow by influencing norms of cooperation, the understanding of causes and effects relations, and social networks. Influenced by the organisational culture, different departments had different interests and identities, and did not participate in the project. So, the inter-departmental cooperation was also affected. The power relations were embedded in the competitive labour market and changing social environment in Shenzhen. It stimulated learning, but also led to lack of
companion trust, and weak commitment. Table 8-1 summarises the influence of power relations on knowledge flow and social capital.

4. Chapter Summary

In the ERP case, knowledge was shared conditionally and superficially. The results of the ERP case showed that structural, cognitive, and relational social capital had both positive and negative effects on knowledge flow. On the one hand, formal network ties were the main channels of communication, and the formal ties developed by the ERP system facilitated knowledge sharing between ERP leader and key users, and among key users themselves. The strong internal ties helped knowledge sharing within a department. On the other hand, strong identities developed by internal ties impeded inter-departmental knowledge flow. Through friendship ties, ERP leader’s personal contacts connected him with external cliques, and helped him to access non-redundant knowledge about the process innovation. Nevertheless, most people had small-sized social networks; therefore, the innovation networks had a low degree of diversity. Having shared interests, cause/effect beliefs, and shared language facilitated intra-departmental knowledge sharing. Lack of shared interests, cause/effect beliefs, and language impeded knowledge flow. Hierarchical norms, norms of professionalism, and norms of reciprocity were associated with trust to influence knowledge flow through different network ties. Four dimensions of power influenced knowledge flow and utilisation of social capital. Competing for power resources caused the lack of cooperation and companion trust. Non-decision-making power had double-edged effects on different dimensions of social capital, thereby affecting knowledge flow. Featuring segmentalism, hierarchicalism, and elitism, the power of meaning resided in the organisation’s culture influenced the structural, cognitive, and relational social capital to affect intra- and inter-departmental knowledge flow indirectly. The power relations embedded in the social system stimulated learning on the one hand, but restricted the development of social network ties, companion trust, and organisation commitment, on the other.
Table 8- 1: The Power influence in the ERP

<table>
<thead>
<tr>
<th>Dimensions of power</th>
<th>Representation</th>
<th>Influence on social networks and structural social capital</th>
<th>Influence on cognitive social capital</th>
<th>Influence on relational social capital</th>
<th>Influence on other aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st dimension of power</td>
<td>Conflicts among the top-layer of management</td>
<td></td>
<td></td>
<td>Lack of cooperation between departments, undermining companion trust</td>
<td>Impeding inter-departmental communication</td>
</tr>
<tr>
<td>2nd dimension of power</td>
<td>Selecting people</td>
<td>strong internal ties within a department</td>
<td></td>
<td>Norms of cooperation within a department</td>
<td>Strong and separate identities</td>
</tr>
<tr>
<td></td>
<td>Lack of reward power</td>
<td></td>
<td></td>
<td>Lack of cooperation</td>
<td>Lack of willingness to share knowledge</td>
</tr>
<tr>
<td></td>
<td>Controlling work procedures and routines</td>
<td>Developing formal ties; Restricting the development of informal ties; Weakened friendship ties</td>
<td>Lack of cause/effect beliefs</td>
<td>Lack of cooperation between department</td>
<td>Unbalanced work/life restricting learning</td>
</tr>
<tr>
<td></td>
<td>Little training provided</td>
<td></td>
<td></td>
<td></td>
<td>Limited learning</td>
</tr>
<tr>
<td>3rd dimension of power</td>
<td>Segmentalism</td>
<td></td>
<td>Lack of shared interests among departments</td>
<td>Lack of cooperation</td>
<td>Lack of participation in the ERP project</td>
</tr>
<tr>
<td></td>
<td>Hierarchicalism</td>
<td>Formal workflow tie as main communication channels</td>
<td></td>
<td>Norms of control and compliance</td>
<td>Lack of participation in the ERP project</td>
</tr>
<tr>
<td></td>
<td>Elitism</td>
<td></td>
<td></td>
<td></td>
<td>Separate identities</td>
</tr>
<tr>
<td>4th dimension of power</td>
<td>Competitive labour market</td>
<td>Small-sized friendship networks</td>
<td></td>
<td>Lack of companion trust</td>
<td>Stimulating learning</td>
</tr>
<tr>
<td></td>
<td>The change of social context</td>
<td></td>
<td></td>
<td></td>
<td>Weak organisational commitment</td>
</tr>
</tbody>
</table>
Chapter 9

Discussing the Effects of Social Networks & Social Capital

1. Introduction

This chapter and the next chapter (Chapter 10) draw together the two results chapters, and discuss the similarity and disparity between the results of the 3G and the ERP project in terms of social networks, social capital and power relations. The aim of this chapter is to draw out the main findings of this research from cross-case comparison, and then to find out how the results support or contradict existing literature, and how the findings contribute to the understanding of knowledge flow and innovation.

This chapter focuses on the effects of social network and of different dimensions of social capital on knowledge flow, whereas Chapter 10 discusses the effects of power relations. This chapter has seven sections. Section 2 summarises the different features of these two projects, because those features helped to highlight the context of each project which might be related to the effects of social capital and power relations which will be discussed later. Sections 3, 4, and 5 focus on social networks and structural social capital, cognitive and relational social capital respectively. Section 6 investigates the interactions between the three dimensions of social capital. Concerning the easiness to follow the arguments, Section 3 to 6 follows the same structure as the previous two chapters in discussing the elements of social networks and social capital. Section 7 is the chapter summary.

2. The Features of the Cases

The 3G and the ERP case had some distinct features. For instances, the types of knowledge used and shared for innovation were different; these two projects also involved different parties, and received different levels of support from employees and management, and so on. These features reflected the special contexts of these two
projects, and helped to explain the different effects of social capital and of power relations on knowledge flow in the two cases. The details are as follows.

2.1. People

There were different types of workforce in these two cases. In the 3G case, engineers had specialised knowledge and considerable work experience in telecommunication technology. They were “knowledge workers”, because the knowledge they possessed had the feature of “scarcity” (Hislop, 2005:95), and was important for achieving the organisation’s goals. In contrast to the engineers, most people involved in the ERP project were low-skilled routine workers. For instance, the key users of the ERP system were the officials and workers. Many of them only had a technical secondary school or high school education. Knowledge they possessed did not have the feature of ‘scarcity’.

“Like us, the staff turnover is high. Merely taking two months’ training, it is very easy to get a handful of people to do our job.” (Junior clerk, Purchasing department, CTI-Shenzhen)

This indicated, first, that different types of knowledge were employed and shared in the innovation process in the two cases. In the 3G case, in order to develop new products, the knowledge related to work integration needed to be shared among engineers in different units, organisations, and professions. Highly specialised professional knowledge was also very important for the innovations (see Section 7-2.1); in the ERP case, coordination and integration between departments were crucial for the process innovation; people needed to know knowledge related to the ERP system and about other people’s work.

Second, because people involved in these two projects had different knowledge backgrounds, their ability to combine knowledge and create new knowledge was different. For instance, in the ERP case, lack of basic knowledge made it difficult for some key users to absorb and share knowledge through both internal and external ties (see Section 8-2.1).
Last but not least, the different workforce in the two cases indicated that people had unequal power resources (expertise). Specialised knowledge was important power resources of people in these two cases. The engineers possessed the specialised knowledge which was important for the organisation to retain its competitive advantages. They were thus regarded as having higher status and being more powerful in securing their job than the routine workers who did not have such kind of knowledge.

2.2. Employee Turnover

The employee turnover in these two cases was different. During the fieldwork of the research, not a single engineer in the 3G case left the company; but, in the ERP case, the personnel constantly changed. For instance, ERP leader left the company. And two senior planners (the key users of the ERP system) in his department also left CTI to follow him, which showed that the strong ties between individuals were stronger than the employees’ attachment to the organisation. Because people brought away with them not only their knowledge but also their social capital when they left the company, the high turnover rate indicated the higher risks of losing important knowledge and social capital in the ERP case.

2.3. Extent of Innovation Networks

These two innovation projects also involved different numbers of the groups and organisations. The innovation networks in the 3G case tended to be more external than those in ERP. The 3G project involved the R&D department, designing team in CTI-USA, its suppliers, and the client – TUS-China. In comparison, the ERP project focused more on inter-departmental coordination. That is, it covered almost every department in CTI-Shenzhen. Inter-departmental knowledge flow tended to be more crucial for the success of the process innovation.

2.4. Innovation Processes

The processes of innovations were different in these two cases. The 3G project followed the existing innovation process and procedure (see Chapter 6). On the contrary, there was not any existing process and procedure for the ERP project to follow. Promoting the ERP
system was a completely new experience for people in CTI-Shenzhen. This indicated that lots of resistance the ERP project had to face in the process of promoting the new system, because the process innovation meant for many people changing or even giving up existing work procedures that they were used to.

2.5. Received Support

The support received by the 3G and the ERP project was different. First, the investment in the 3G case was relatively low, because there were some software and components available at hand. The ERP project needed to buy new ERP software and related service from the software company, but the budget was limited. As the IT support engineer said,

"Very good ERP (software) costs much. The company didn’t plan to pay that much. … The distribution of money was divided into different parts. Only this amount of money was distributed to this part, so (we) were only able to buy this (ERP software).” (IT support engineer, CTI-Shenzhen)

Second, since the product innovation was crucial for the company’s profits, the 3G project was highly supported by the management and the engineers as well. On the contrary, the ERP project was treated as the supporting role for R&D and production. Meanwhile, the conflicts among people in the management and between departments led to the situation of lack of support in the ERP project.

Tidd et al. (2001: 264) point out that process innovation needs continuity more than product innovation to carry on a continuing pattern of change of the organisation’s process. This was the case in this study. Like other product innovation projects in CTI, the 3G project took a relatively short time to complete the new product development. However, the ERP project took much longer to continue the integration and improvement of the new system.

2.6. Summary

The 3G and the ERP case had different features in term of the content of knowledge flow, involved parties, innovation processes, and received support (see Table 9-1 for the
summary). Those differences were interrelated with and also reflected the different effects of social capital and power relations in these two cases which will be discussed later.

Table 9-1: Cross-case comparison (the general features of the cases)

<table>
<thead>
<tr>
<th></th>
<th>3G</th>
<th>ERP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcomes</td>
<td>Successfully developed the 3G power amplifier platform</td>
<td>Integrating work process with the ERP system faced lots of challenges</td>
</tr>
<tr>
<td>People</td>
<td>Knowledge/ Skills</td>
<td>People Knowledge/ Skills</td>
</tr>
<tr>
<td></td>
<td>Highly skilled with specialised knowledge</td>
<td>Low-skilled routine workers</td>
</tr>
<tr>
<td>Turnover</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Involved parties</td>
<td>Client company, R&amp;D, CTI-USA, suppliers</td>
<td>Software company, 7 functional departments of CTI-Shenzhen</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Content of knowledge requirement</td>
<td>Knowledge related to the ERP system</td>
</tr>
<tr>
<td></td>
<td>Knowledge about integrating different professional works</td>
<td>Need to be highly integrated with other departments and the software supplier</td>
</tr>
<tr>
<td></td>
<td>Need to be highly integrated with other professions and departments</td>
<td>Need to be highly integrated with other departments</td>
</tr>
<tr>
<td>Investment</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Innovation process</td>
<td>Fixed and has been practiced</td>
<td>New and uncertain</td>
</tr>
<tr>
<td>Support from management</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Support from employees</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Good</td>
<td>Poor</td>
</tr>
</tbody>
</table>

3. Social Networks and the Structural Social Capital

3.1. Different Network Ties

3.1.1. Internal Ties within COPs

In both cases, the communication network ties overlapped with workflow network ties. Within departments – COPs, the strength of the internal ties was strong, because of the frequent interactions at work and multiplexity of the network ties. The positive and negative effects of the strong internal ties on knowledge flow were the same in both cases (see Section 7-2.2 and 8-2.2). The strong internal ties facilitated knowledge flow within COPs. On the other hand, they led to knowledge redundancy, and also fostered strong and separate identities which impeded inter-departmental knowledge flow. In the ERP case, people had a strong sense of protecting their own party’s benefits - when there were problems, some people in different departments tended to pass the buck in order to avoid
undertaking the responsibility or doing extra work; they were not willing to share information with and accept information from people in other departments. In the 3G case, because of different identities, engineers in CTI-USA were not willing to share certain kinds of ‘confidential’ knowledge with R&D people in CTI-Shenzhen.

In the social network literature, research suggests that ‘multiplexity’ (Barnes, 1979) increases the strength of ties between people (Tichy et al., 1979; Kilduff and Tsai, 2003). Strong ties have positive effects on knowledge sharing, especially tacit knowledge (Hansen et al., 1999). However, some researchers also argue that strong internal ties have negative effects on knowledge flow and innovation. For instance, too much dependence on internal ties makes it difficult to obtain new ideas and non-redundant knowledge from external sources (Adler and Kwon, 2002; Edelman et al., 2004; 2006; Uzzi, 1996, 1997, 1999; Uzzi and Gillespie, 2002).

The results of this research came to the same conclusion reached by previous studies, showing that, first, multiple relations between actors increased the strength of internal ties; second, strong internal ties had both positive and negative effects on knowledge flow. Internal ties facilitated internal knowledge flow by developing common ground for sharing knowledge through frequent interaction and shared experience; they also led to knowledge redundancy. By combining the approach of social networks, social capital and COP, the research further found that strong internal ties affected knowledge flow by developing strong and separate identities which had a positive effect on internal knowledge flow within COPs, and also a negative effect on sharing knowledge between COPs. (See table 9-2).

Table 9- 2: Cross-case comparison (the effects of internal ties)

<table>
<thead>
<tr>
<th>Projects</th>
<th>Characteristics</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Embeddedness, multiplexity, strong</td>
<td>Facilitating internal knowledge flow, but leading to redundant knowledge; fostering separate identities which became an impediment of sharing specialised knowledge between R&amp;D and CTI-USA</td>
</tr>
<tr>
<td>ERP</td>
<td>Embeddedness, multiplexity, strong</td>
<td>Facilitating internal knowledge flow, but leading to redundant knowledge; fostering strong and separate identities which impeded knowledge flow between COPs</td>
</tr>
</tbody>
</table>
3.1.2. Formal Ties between Departments

The formal communication network ties were embedded in the relationship that people had interfaces at work. In the 3G case, formal ties facilitated knowledge sharing between engineers in CTI-Shenzhen and CTI-USA. Likewise, in the ERP case, the formal ties facilitated knowledge sharing between ERP leader and the key users as well as between department managers. However, there was also a downside of the formal ties. Compared with the 3G case, the knowledge shared between departments through the formal ties tended to be basic and superficial (see Section 7-2.2 and 8-2.2). This might be because, firstly, people in the ERP project, especially the key users, only had very basic knowledge in relation to ERP system and others’ work; second, unlike engineers in the 3G project who had joint responsibility for the development of 3G products, in the ERP project people in different departments did not have joint responsibility regarding the promoting of ERP; thirdly, because of lack of support from employees as well as managers, key users did not have initiative to promote ERP, and other department managers were not involved in promoting ERP. All these factors had a negative effect on knowledge sharing through the formal ties. Thereby, the effectiveness of the formal ties in facilitating inter-departmental knowledge flow was closely related to the nature of the formal ties and also the actors connected by the ties.

Several scholars (Hansen, 1999; Tsai, 2001, 2002; Tsai and Ghoshal, 1998) have discussed the effects of internal ties between units/departments on knowledge flow and innovation. They found that inter-unit knowledge exchange contributes to innovation (Tsai and Ghoshal, 1998) and that frequent interaction between actors facilitates knowledge sharing between units/departments knowledge (Hansen, 1999). On the other hand, there are also negative effects of formal ties between units/departments. Because formal ties are often defined by formal hierarchy, it may have a negative effect on the initiative to share knowledge, thereby impeding inter-unit knowledge sharing (Tsai, 2002). However, too much emphasis on hierarchical feature of formal ties might limit the understanding of the dynamics of ties (Delbridge and Mariotti, 2007).
The results of this research showed that formal ties had both positive and negative effects on inter-departmental knowledge flow which are also suggested by existing literature of social networks and innovation. The results further suggested that the effectiveness of the formal ties in facilitating inter-departmental knowledge flow was closely related to the context in which the formal ties were developed, such as the base of the formal ties, people's knowledge background, received support, and so on. (See Table 9-3).

Table 9-3: Cross-case comparison (the effects of formal ties between departments/units)

<table>
<thead>
<tr>
<th>Cases</th>
<th>Characteristics</th>
<th>Effects on knowledge flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Embeddedness</td>
<td>Facilitating knowledge flow between units (sharing knowledge related to integration)</td>
</tr>
<tr>
<td>ERP</td>
<td>Embeddedness</td>
<td>Facilitating knowledge sharing between ERP leader and key users, as well between department, but the shared knowledge often basic because of lack of knowledge and participation</td>
</tr>
</tbody>
</table>

3.1.3. Formal Ties between Organisations

In the 3G case, there were different formal ties between CTI and its clients and suppliers. The formal ties helped people in different organisations to share knowledge related to integration, but not certain specialised knowledge. In the ERP case, only ERP leader had formal ties connecting engineers in Win@ware – the software supplier. Through the formal ties, ERP leader learned knowledge about ERP system, but nothing about how to integrate the new system into daily work, because the software engineers did not get involved in the promoting of the project. Although with limits, in comparison, formal ties which connected CTI and other organisations in the 3G case tended to be more effective in facilitating knowledge and innovation than those in the ERP case. That was because, in the 3G case, the formal ties between CTI and TUS-China were based on organisation cooperation, but, in the ERP case, CTI and Win@ware did not have joint responsibility for developing the innovation project.

In the social network literature, many studies (e.g., Conway, 1995; Harris et al., 2000; Kaufmann and Tödtling, 2001; Perez and Sanchez, 2002; Ragatz et al., 1997; Romijn and Albu, 2002; von Hippel, 1988) have shown that networking suppliers and clients...
facilitate innovation, because the organisational boundary spanning networks help firms to obtain new ideas and information. Nonetheless, there are also limits of the networking. For instances, conflicts between firms might impede inter-organisational knowledge flow (Coles et al., 2003); and certain types of formal network formation tend to be less effective in facilitating inter-organisational knowledge flow (Hardy et al., 2003; Swan and Scarbrough, 2005).

The results of this research supported the findings of existing studies showing that formal ties between organisations facilitated knowledge flow and innovation, and the nature of ties affected the effectiveness of those formal ties in facilitating knowledge flow across organisational boundaries (see Table 9-4). In addition, there were also other factors influencing the effectiveness of the formal ties, such as organisation relations and power. Those issues will be discussed in Section 9-5 and Chapter 10.

Table 9- 4: Cross-case comparison (the effects of formal ties between organisations)

<table>
<thead>
<tr>
<th>Cases</th>
<th>Types of formal ties</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Between CTI and its clients and supplier; based on organisation cooperation</td>
<td>helping to share the knowledge related to integration, but not specialised professional knowledge</td>
</tr>
<tr>
<td>ERP</td>
<td>Between ERP and the software supplier; based on sale-and-buy relation</td>
<td>helping ERP leader to learn knowledge related to ERP system, but not how to integrate the system into daily work</td>
</tr>
</tbody>
</table>

3.1.4. Friendship Network Ties

First, in both cases, informal ties facilitated knowledge flow across organisational boundaries through providing channels for people to access non-redundant knowledge which was important for innovation. In the 3G case, many engineers used their personal contact to gain non-redundant knowledge from outside of the organisation. However, in the ERP case only ERP leader obtained knowledge from external groups via his friendship ties. This became the risk of the process innovation, because the important linkage which connected the internal and external contacts no longer existed with ERP leader leaving the company.
Second, informal ties also facilitated inter-departmental knowledge flow (see Section 7-2.2 and 8-2.2). But, in the ERP case, this kind of positive effect of informal ties was restricted, because formal ties were thought of as more legitimate than informal ties in relation to the inter-departmental communication. In contrast, in the 3G case, friendship ties were substituted for formal ties when there were no interface at work; both formal and informal ties were important for inter-departmental communication, and informal ties were seen as legitimate for communication. This indicated that the effectiveness of utilising informal ties was influenced by the formal organisation.

In the literature of social networks and innovation, informal networks are identified as the important channels of obtaining useful information from external sources by many studies (e.g., Conway, 1995, 2000, 2001; Freeman, 1991; Kreiner and Schultz, 1993). Informal networks also facilitate knowledge flow between units and departments in organisations (Krackhardt and Hanson, 1993; Tsai, 2000). While the positive effects of informal ties on innovation are recognised, Conway (2000) further suggests that informal networks might also have complex and dysfunctional nature, and that formal organisations have power to influence the development of the informal network ties.

The results of this research echoed those studies, stressing the important role of informal networks identified in the literature. The results also lent support to Conway’s idea (2000), showing that utilising and developing informal ties was influenced by the formal organisation. (See Table 9-5 for the summary).

Table 9-5: Cross-case comparison (the effects of friendship network ties)

<table>
<thead>
<tr>
<th>Projects</th>
<th>Characteristics</th>
<th>Effects on knowledge flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Many informal ties connecting internal and external actors, and between departments</td>
<td>Supporting knowledge flow across departmental and organisational boundaries</td>
</tr>
<tr>
<td>ERP</td>
<td>Few informal ties connecting internal and external actors, and between department</td>
<td>Facilitating inter-organisational and inter-departmental knowledge flow</td>
</tr>
</tbody>
</table>
3.2. The Role of Key Individuals

In both the 3G and the ERP case, some key individuals played an important role in innovation in terms of accessing external sources and facilitating inter-organisational and inter-departmental knowledge flow (see Section 7-2.2.2 and 8-2.2.2). In the 3G case, key individuals played multiple roles to facilitate knowledge flow, and made significant contribution to the product innovation. Chief engineer, Ben, and David played the role of gatekeepers - they accessed non-redundant knowledge from various external groups through formal tie and their personal contacts, and then, transferred the knowledge to related engineers. Meanwhile, Chief engineer and Ben were also in the network position of liaisons, as they had multiple memberships in CTI-USA and CTI-Shenzhen by which sharing related knowledge between these two units was facilitated. And David also played the role of boundary-spanner to search for new ideas from external source.

In the ERP case, ERP leader played the role of gatekeeper and also liaison. As gatekeeper, he was the only person who accessed information from outside of the organisation through the formal external ties and also his personal contacts; being in the position of liaison, his direct connection with the key users and managers in other departments facilitated inter-departmental knowledge flow. However, because he did not have multiple memberships in different departments, it was difficult for him to mitigate the conflicts among departments and make people accept opinions from other departments. The key users also played the role as gatekeeper to transfer ERP related knowledge to other members in their department. However, because of their having limited knowledge, the knowledge shared by the key users was basic and less significant for the process innovation.

Comparatively, some key individuals who played multiple key roles (i.e. Chief engineer, Ben, David, and ERP leader) tended to make more contribution to innovation than those who played solely the role as gatekeeper (i.e. the key users), because firstly, the former connected more numbers of external groups than the latter so that they were able to access non-redundant knowledge more effectively; second, the former was in more senior positions than the latter, which enabled them to share and apply knowledge internally;
third, the former had better knowledge background than the latter, which allowed them to have the capacity to obtain and share knowledge. In addition, link-pins were more effective in facilitating inter-departmental knowledge sharing than gatekeepers, due to their having multiple memberships in different departments/groups (see Table 9-6 for the summary).

The importance of key roles in facilitating knowledge flow and benefiting innovation are well recognised by research (Allen, 1977; Conway, 1997; Lincoln, 1982; Macdonald and Williams, 1993a, 1993b; Tushman, 1977; Tushman and Katz, 1980). For instance,

Table 9-6: Cross-case comparison (the role of key individuals)

<table>
<thead>
<tr>
<th>Projects</th>
<th>Key roles</th>
<th>Effects on knowledge flow</th>
<th>Significance in innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Gatekeepers and Link-pins (Chief engineer and Ben)</td>
<td>Transferring non-redundant knowledge from the external source; facilitating knowledge integration between units/departments</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>Gatekeeper and Liaison (senior software engineer in CTI-USA)</td>
<td>Searching and obtaining new ideas from outside the organisation; facilitating knowledge integration between units/departments</td>
<td>Significant</td>
</tr>
<tr>
<td>ERP</td>
<td>Liaison and Gatekeeper (ERP leader)</td>
<td>Searching and obtaining new ideas from outside the organisation; facilitating inter-departmental knowledge flow</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>Gatekeepers (key users)</td>
<td>Facilitating inter-departmental knowledge flow and internal knowledge diffusion</td>
<td>Less significant</td>
</tr>
</tbody>
</table>

research suggests that people in network positions of link-pins are important for successful innovation, because they provide direct link between groups by virtue of their membership of each (Conway, 1997; Lincoln, 1982). Macdonald and Williams (1993a) point out that those gatekeepers who are senior members tend to be more effective in ‘brokering’ knowledge, because they are more powerful in handling the reluctance to accept ideas from external groups than less senior members.

The results of this research supported the finding of Conway (1997) and Macdonald and Williams (1993a) that multiple memberships of link-pins and senior positions of
gatekeepers facilitated knowledge sharing between COPs. Furthermore, the results suggested that effectiveness of key roles in facilitating knowledge flow was closely related to the multiple roles that those individual played as well as their capacity to combine and apply knowledge. In a word, individuals who played more than one key role and who had stronger knowledge background tended to be more effective in facilitating knowledge flow.

3.3. The Size and Diversity of Networks

In the 3G case, the small-sized internal communication networks promoted group cohesion, but led to knowledge redundancy. However, since many engineers were able to access new knowledge/information through their personal contacts, the communication networks were extended, and the new knowledge/information significantly benefited the product innovation. Similar to the 3G case, the size of internal communication networks in ERP was small. However, since most people in ERP had small-sized social networks, the overall size of communication networks was small, which limited the possibility to access new knowledge from external groups.

The level of the diversity of networks was high in the 3G case, because there were various formal external ties connecting CTI and its suppliers and the clients, and there were many key individuals whose informal ties spanning various ‘structural holes’ (Burt, 1992). The highly diversified networks allowed engineers to access non-redundant knowledge. On the contrary, in the ERP case the level of the diversity of networks was low, because the innovation networks tended to be internal rather than external (see Section 9-2.3). The networks contained fewer non-redundant contacts which spanned structural holes, thereby providing limited opportunities to obtain new knowledge/information.

The overall configuration of network is an important element of the concept of social capital because it is associated with flexibility and ease of information exchange (Nahapiet and Ghoshal, 1998; Portes, 1998). Dense social networks benefit internal knowledge exchange and knowledge creation (Coleman, 1988; Powell, 1990). On the
other hand, research argues that dense social networks lead to knowledge redundancy, but diversified networks reduced levels of redundancy by providing more opportunities to access non-redundant knowledge (Burt, 1992; Edelman et al., 2005; Uzzi, 1996, 1997, 1999; Uzzi and Gillespie, 2002); therefore, diversity of networks is of importance for innovation (Kaufmann and Tödtling, 2001; Perez and Sanchez, 2002; Romijn and Albu, 2002). The results of this research supported the view that high level of diversity of networks is important for innovation by reducing levels of redundancy (see Table 9-7).

Table 9-7: Cross-case Comparison (the size and diversity of networks)

<table>
<thead>
<tr>
<th>Projects</th>
<th>Configuration</th>
<th>Effects on knowledge flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Small-sized internal communication network, extended social networks; high level of diversity</td>
<td>Increasing group cohesion; accessing non-redundant knowledge</td>
</tr>
<tr>
<td>ERP</td>
<td>Small-sized internal communication networks and social networks; low level of diversity</td>
<td>Increasing group cohesion; restricting access to non-redundant knowledge flow from external sources</td>
</tr>
</tbody>
</table>

3.4. Focal Innovation Action-Sets

Borrowing Conway and Steward’s idea (1998), two simplified “Focal Innovation Action-Set” were drawn, showing the structural feature of the 3G project and the ERP project (See Figure 9-2 and Figure 9-3, Figure 9-1 is the illustration of conventions used in the “Action-sets”).

Figure 9-1: Conventions Adopted to depict variations in actors, linkages, and flow

Key individuals, department manager, or representative body for department manager
Departments/Units
Representative body for key users in ERP
Representative body for other members in a department
<table>
<thead>
<tr>
<th>Direction of flow:</th>
<th>Strength of tie:</th>
<th>Type of tie:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-way flow</td>
<td>Strong</td>
<td>Formal</td>
</tr>
<tr>
<td></td>
<td>Not strong</td>
<td>Informal</td>
</tr>
</tbody>
</table>
Figure 9-2: Focal Innovation Action-Set of 3G Project
Figure 9-3: Focal Innovation Action-Set of ERP Project
The figures illustrated how various actors (individuals, groups, and organisations) were connected by different links (formal/informal or weak/strong connections), and knowledge flow through those connections. The differences were highlighted by comparing Figure 9-2 and 9-3. First, the 3G project had more external connections (including both informal and formal connections) than the ERP project. The ERP project had very few external connections through ERP leader’s formal and personal contact, so that it had very limited innovation resources obtained through those external connects. Comparatively, in the 3G project there were more formal and informal ties connecting many individuals (Chief engineer and many engineers and managers) with their suppliers, clients, friends, and even competitors. Through these external ties the 3G project obtained non-redundant knowledge from external sources which contributed to the product innovation.

Second, there was difference in the role key individuals played in facilitating knowledge flow. There were more key individuals in the 3G project who not only had multiple external contacts but also had strong formal links with different departments/units. Those individuals had multiple memberships overlapping different ‘communities of practice’. These key individuals’ multiple memberships facilitated knowledge flow between those departments/units. Because of these key individuals, the inter-departmental knowledge sharing in the 3G project was more effective than that in the ERP project.

In a word, adequate external connections and multiple memberships were the factors facilitating internal and external knowledge flow, and led to the success of the product innovation in the 3G case. Although the process innovation emphasised internal cooperation, lack of external innovation resources and multiple memberships of key individuals caused the difficulty of internal and external knowledge flow in ERP case. The differences revealed by the Action-sets also suggested the different effects of power relations - there were different power relations which underpinned those social network ties, and the key individuals had different power sources. The details will be discussed in Chapter 10.
3.5. Summary

At tie level, the results of this research confirmed the findings of current studies: (1) multiple relations increased the strength of network ties, and the strong internal ties had both positive and negative effects on knowledge flow; (2) formal ties between departments facilitated inter-departmental knowledge flow, under the condition that innovation projects received enough support from formal organisations; (3) formal ties between organisations facilitated knowledge flow, and the positive effects of the formal ties were associated with the nature of the ties; (4) informal ties was of importance for knowledge sharing and innovation, but the formal organisations affected the development and utilisation of informal ties. Moreover, the results further suggested that the role that internal ties played in developing strong and separate identities was of direct relevance to the understanding of the ‘double-edged’ effects of strong internal ties.

At individual level, the results substantiated the ideas that multiple memberships of link-pins and senior positions of gatekeepers facilitated inter-departmental knowledge flow. Furthermore, this research found that the multiple roles that key individual played, and the gatekeepers’ capacity to combine and apply knowledge were also important for understanding the effectiveness of key roles in facilitating knowledge flow and innovation.

At network level, the results of this research agreed with existing research that dense and small-sized network helped internal knowledge exchange, but led to knowledge redundancy, while high diversity of networks reduced levels of knowledge redundancy. The levels of diversity were related to non-redundant contacts as well as the nature of the innovation projects.

4. The Cognitive Social Capital

4.1. Different Interests and Preferred Outcomes

The negative effects of different interests and preferred outcomes on knowledge flow were found in these two cases. In the 3G case, different interests and preferred outcomes between organisations became impediments of sharing specialised knowledge between
CTI, and its clients and suppliers (see section 7-2.3.1). In the ERP case, unlike R&D and CTI-USA which had joint responsibility for the developing of the 3G products, different functional departments did not have shared interests in promoting the ERP project; different interests and preferred outcomes hampered inter-departmental knowledge flow (see Section 8-2.3.1). The negative effects of different interests on inter-organisational knowledge flow were not evident, because the extent of innovation networks in the ERP case tended to be internal rather than external. Thus, the problems caused by different interests between the departments became significant.

In the knowledge management literature, the negative effects of different interests and preferred outcomes on information/knowledge flow have been discussed by numerous studies (Carlile, 2002, 2004; Henderson, 1995; Star and Griesemer, 1989; Leonard-Barton, 1988). Of which, Carlile (2002, 2004) points out that lack of shared interests leads to pragmatic/political boundaries which cause problems to knowledge flow. The results of case comparison in this subsection dovetailed with Carlile’s findings.

4.2. Shared Cause/Effect Beliefs

In both cases, shared understanding about the causes and effects of cooperation facilitated knowledge sharing within a COP. In 3G, shared cause/effects beliefs (Thompson, 1967) also facilitated knowledge flow between departments/units. On the contrary, in ERP, lack of shared understanding about the cause/effect relations in the using of the ERP system impeded knowledge flow between the functional departments. Such a difference as found between the 3G and ERP cases suggested three possibilities: first, the management and shareholders had different opinions about the developing of the ERP system, but not about the developing of the 3G products; second, different from the ERP project, the 3G project followed the existing innovation process and procedure in which the engineers have already developed shared cause/effect beliefs; third, the ERP projects received little support from management and employees, so that no particular attention was paid to developing a shared understanding about the cause/effect relations of using the ERP system (see Section 9-2.3 and 9-2.4).
Thompson’s work (1967) suggests that shared cause/effect beliefs are closely associated with information exchange. Because of interdependency between departments, exchanging information to understand the cause/effect relations is needed for collaboration between departments (Thompson, 1967). In the literature of knowledge management and innovation, how shared cause/effect beliefs influences knowledge flow was not fully discussed. The results of this research demonstrated that shared cause/effect beliefs influenced acceptance of others’ knowledge/information, and showed that shared cause/effect beliefs facilitated knowledge exchange, and that lack of shared cause/effect beliefs impeded knowledge flow.

4.3. Shared Language and Common Knowledge

Shared language and common knowledge had the same effects on knowledge flow in the 3G and ERP cases: shared language and common knowledge facilitated knowledge flow through internal ties, formal ties between departments, and informal ties; one the other hand, lack of shared language and common knowledge impeded knowledge flow through those various ties.

It should be reminded that there were some small differences between the two cases. First, the positive effects of shared language in the 3G case tended to be more effective in contributing to innovation than those in the ERP case. This was because people in the 3G case were all professionals, but in the ERP case most people were routine workers without enough knowledge to communicate with some senior members (see Section 9-2.1); therefore, lack of shared language impeded internal knowledge sharing, or only basic knowledge was shared. Second, the main impediments to inter-departmental knowledge flow in the 3G case were ‘semantic boundaries’ (Carlile, 2002; 2004), but in the ERP case were ‘syntactic boundaries’ (ibid). In the 3G case, engineers worked in different professions, so the knowledge they developed in practice were different. Given that difficulty of digesting knowledge from different domains, they had problems sharing knowledge at semantic boundaries. In the ERP case, knowing very little about telecommunication technology, routine workers did not have common knowledge to communicate with engineers, thereby failing to share knowledge at syntactic boundaries.
In the literature of knowledge management and innovation, it is found that shared language and understanding are critical for sharing knowledge between different functional departments, and between different professional groups (Dougherty, 1992; Boland and Tenkasi, 1995; Brown and Duguid, 1991; Edelman et al., 2004; Fiol, 1994; Jelinek and Schoonhoven, 1990; Nahapiet and Ghoshal, 1998). While the importance of shared language in facilitating knowledge flow is well recognised, realising that lack of shared language impedes knowledge sharing is also important for understanding knowledge flow and innovation. Carlile (2002; 2004) categorises three different types of boundaries (syntactic, semantic, and pragmatic) which impede knowledge flow, and suggests that lack of shared language and common knowledge could cause problems to knowledge sharing at syntactic and semantic boundaries.

The results of this research lent support to Carlile’s concepts, and further showed that in a particular context, one type of boundaries might be more significant in impeding knowledge flow than others in relation to lack of shared language. Semantic boundaries were the main obstacles to knowledge sharing across different domains. When there existed a wide knowledge gap between engineers and low-skilled routine workers, syntactic boundaries came to the front. Therefore, the context can help to explain the difficulty of sharing knowledge across different boundaries.

4.4. Boundary Objects

The advantages of boundary objects in facilitating knowledge flow were found in both cases. But it seemed that boundary objects in the 3G case tended to more effective in facilitating knowledge flow than those in the ERP case. In the former case, boundary objects (i.e., sample machines and documents) allowed engineers in R&D to learn from those in CTI-USA at semantic boundaries, thereby effectively facilitating knowledge flow between departments (see Section 7-2.3.4). In the latter case, although detailed electronic forms were effective boundary objects used by one senior official to communicate with engineers, most boundary objects (i.e., material code system, some report forms) were ineffective in facilitating inter-departmental knowledge flow, because no common ground was provided for people in different departments to understand the new system and others’
work (see Section 8-2.3.4). In addition, people in these two cases showed different ability to utilise boundary objects. Engineers had professional knowledge which enabled them to gain knowledge by looking at sample machines. But in the ERP case, people in functional departments did not have sufficient knowledge to communicate with engineers, thus having difficulty making use of boundary objects. Ineffectiveness of boundary objects partly explained why the 3G project went smoothly but the ERP project did not.

The advantages of boundary objects in facilitating knowledge flow are well recognised by research (e.g., Ancona et al., 2001; Bechky, 2003; Carlile, 2002; 2004; Star, 1989). Carlile (2004) further suggested that a match between the capacities of boundary objects to provide common knowledge and the capability of the actors to use the boundary objects, and the types of boundaries is important for sharing knowledge at boundaries. The results of this research supported Carlile’s proposition.

4.5. Summary
The results of this research supported the view that different interests led to pragmatic boundaries (Calile, 2002; 2004), and then impeded knowledge flow. Understanding cause/effect relations was identified by this research as an important element of cognitive social capital which influenced knowledge flow. Shared cause/effect beliefs facilitated knowledge flow, while lack of shared cause/effect beliefs impeded knowledge flow. Shared language facilitated knowledge sharing through different ties. Lack of shared language and common knowledge led to syntactic and semantic boundaries (ibid). Effective boundary objects facilitated knowledge flow, but ineffective boundary objects failed to support knowledge flow. Furthermore, the results suggested that the features of the cases helped to understand the difference of the effects of cognitive social capital. (See the summary Table 9-8).
Table 9-8: Cross-case Comparison (the effects of cognitive social capital)

<table>
<thead>
<tr>
<th>Elements</th>
<th>Cases</th>
<th>Effects on knowledge flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different interests and preferred</td>
<td>3G</td>
<td>Impeding sharing specialised knowledge between organisations</td>
</tr>
<tr>
<td>preferred outcomes</td>
<td>ERP</td>
<td>Impeding inter-departmental knowledge flow</td>
</tr>
<tr>
<td>Shared cause/effect beliefs</td>
<td>3G</td>
<td>Facilitating intra- and inter-departmental knowledge flow and cooperation</td>
</tr>
<tr>
<td></td>
<td>ERP</td>
<td>Facilitating knowledge sharing in COPs; lack of shared cause/effect beliefs impeding</td>
</tr>
<tr>
<td>Shared language and common knowledge</td>
<td>3G</td>
<td>Facilitating knowledge flow through various ties; lack of shared language impeding</td>
</tr>
<tr>
<td></td>
<td>ERP</td>
<td>Facilitating knowledge flow through various ties; lack of shared language impeding</td>
</tr>
<tr>
<td>Boundary objects</td>
<td>3G</td>
<td>Effectively facilitating knowledge flow (sample machines and documents)</td>
</tr>
<tr>
<td></td>
<td>ERP</td>
<td>Ineffectively helping knowledge flow (material codes, reports)</td>
</tr>
</tbody>
</table>

5. The Relational Social Capital

5.1. Hierarchical Norms

In the ERP case, hierarchical norms had both positive and negative effects on knowledge flow. Based on hierarchical norms, department managers communicated with each other through formal network ties. On the other hand, hierarchical norms restricted informal communication between departments, and also limited the participation in the process innovation (see Section 8-2.4.1). Lack of informal communication and participation had negative effects on the process innovation, because they affected inter-departmental coordination and integration. This kind of negative effect of hierarchical norms was not found in the 3G case, because both formal and informal communication was seen as legitimate in the technology departments. However, this did not mean that hierarchical norms did not exist in the 3G case. In fact, based on hierarchical norms and norms of specialisation, engineers helped people in other functional departments to solve technology problems (see Section 7-2.4.1). But because people in other functional departments did not have specialised knowledge, the knowledge shared through this kind of interaction
between engineers and them was often basic, thus making nearly no contribution to the process innovation as well as the product innovation.

Hierarchical norms indicate the legitimate norms accepted by the formal organisations, such as divisions of labour, formal work procedures, and formal communication channels. In the innovation literature, the drawbacks of hierarchical norms are often discussed. For instance, studies (e.g., Crane, 1969; Krackhardt and Hanson’s, 1993; Conway, 2001) of informal organisations show the negative effects of hierarchical norms – because of hierarchical norms, formal communication is encouraged, and informal communication which is of importance for innovations might be regarded as illegitimate. This kind of negative effect of hierarchical norms was found in this research. Moreover, the results showed that there were also positive effects of the hierarchical norms.

Therefore, the results suggested that, first, facilitating innovations or causing problems to innovations was determined by what kind of behaviour was accepted by the hierarchical norms. Since informal ties were important for accessing non-redundant knowledge, when informal communication was of importance for innovation, and promoted by the formal organisation, the hierarchical norms facilitated knowledge flow, and thus generated positive effects on innovation. On the other hand, when information communication and participation was not approved by the formal organisation, the hierarchical norms impeded knowledge flow, thereby generating negative effects on innovation. Second, how significant the effects of the hierarchical norms on knowledge flow and innovation were was related to the general features of the projects. For instance, because most people in functional department did not have professional knowledge, the knowledge flow between engineers and other workers did not help innovation significantly. Therefore, it was suggested that taking a holistic view to evaluate hierarchical norms helped to understand the effects of the hierarchical norms.

5.2. Norms of Professionalism

In the 3G case, norms of professionalism impeded inter-departmental knowledge flow, because based on norms of professionalism and norms of control knowledge, engineers in
CTI-USA were unwilling to share the specialised knowledge of making power amplifiers with engineers in CTI-Shenzhen (see Section 7-2.4.2). However, this kind of negative effects was not found in the ERP case. The reason was because people in the functional departments were low-skilled routine works. They did not have any specialised knowledge which can bring them competitive advantages.

“Generally, those (people) who are professionals specialising in technology did not want to tell others what he/she knows. However, we only know some ABCs. Nothing can be a secret.” (Warehouse man, Warehouse, CTI-Shenzhen)

In the ERP case, norms of professionalism impeded individuals’ learning because certain professional knowledge was seen as irrelevant to people working in different professions (see Section 8-2.4.2). But evidence of this kind of negative effects was not very strong in the 3G case. A possibility was that engineers worked in the related fields and needed to integrate their work with others’, so they did not think others’ professional knowledge was irrelevant. In addition, the IT support engineer’s lack of intention of learning did not have major negative effects on innovation, because knowing kymograph was not that important for the ERP project. And, if the IT support engineer did not succeed Louis as ERP manager by chance, knowing material flow was not necessary for him to work on the project. However, this did not mean to say that this would be the case elsewhere. It was possible that norms of professionalism caused problems to innovation, because of the ‘not invented here’ syndrome (Katz and Allen, 1982). Therefore, norms of professionalism were potential risks to innovation by impeding learning.

Norms of professionalism are often identified as risks for organisational change, as norms of professionalism might clash with other organisational norms (Raelin, 1991). In the knowledge management literature, the negative effects of norms of professionalism on knowledge flow were identified, as norms of professionalism could cause problems to acceptance of different ideas from external groups (e.g., Katz and Allen, 1982; Edelman et al., 2005; Newell et al., 2003; Raelin, 1991). This concept was supported by the results of this research: norms of professionalism negatively affected innovation by restricting knowledge flow and learning.
5.3. Norms of Reciprocity

In both the 3G and the ERP cases, norms of reciprocity facilitated knowledge exchange through different network ties (i.e., formal/informal ties, intra- and inter-departmental network ties). However, lack of reciprocity and ‘competence trust’ (Newell et al., 2002) hampered knowledge flow. The interaction between norms of reciprocity and competence trust was found in this research. The results showed that norms of reciprocity were also associated with trust in supporting knowledge flow: competence trust helped people to anticipate the advantages of knowledge exchange, thereby reinforcing norms of reciprocity to support knowledge sharing. In addition, in the 3G case, reciprocally helping each other and exchanging ideas increased companion trust between friends, and then further confirmed their friendship. Although this kind of interaction between norms of reciprocity, companion trust, and friendship ties was not specifically mentioned by the interviewees in the ERP case, it is reasonable to assume that this was the case in the ERP case because companion trust is based on judgement of goodwill (ibid), and reciprocal behaviour of exchanging information is the goodwill between individuals.

In the social capital literature, research (e.g., Edelman et al., 2004; Portes, 1998; Putnam, 1993; Uizzi, 1997) suggests that norms of reciprocity are the fundamental elements of relational social capital, as “resources obtained through social capital have the character of a gift. As such, they are subject to norms of reciprocity” (Edelman et al., 2005). The results of this research supported the above view that norms of reciprocity were of importance to knowledge flow. Innovations benefited from the knowledge flow. The results furthermore demonstrated that the interactions between norms of reciprocity, competence trust, and companion trust assisted the knowledge flow.

5.4. Norms of Cooperation

Norms of cooperation had positive effects on intra- and inter-departmental knowledge flow in both the 3G and ERP cases. However, norms of cooperation in the 3G case seemed to be more effective in facilitating inter-departmental knowledge flow than those in the ERP case. In the ERP case, inter-departmental knowledge/information flow was impeded by
lack of cooperation resulting from inter-departmental conflicts and separate identities (see Section 8-2.4.4). One of the possible reasons for such a distinction was that people in the functional departments did not share joint responsibility for the promoting of the ERP system which mitigated the inter-departmental conflicts, as engineers in R&D and CTI-USA did for the developing of the new products in the 3G case. Another reason might be that the 3G project followed the existing innovation process, while the ERP project was faced with a great deal of resistance because of taking a new innovation process (see Section 9-2.4). An engineer explained the situation,

“It may be worse in other departments. …they didn’t care about the needs of other (departments) – no matter whom you wanted to go to, that was your business. They, relatively, worked on their own. But we were relatively cooperative.” (Senior hardware engineer, R&D, CTI-Shenzhen)

Moreover, norms of cooperation defined what action should be done. In the 3G case, sharing knowledge related to the work integration, rather than certain specialised knowledge, was considered as necessary for inter-departmental cooperation, because the project could still proceed without the latter knowledge. In the ERP project, cooperative behaviours were even defined as within limits. Therefore, norms of cooperation also produced negative effects in defining limited cooperative actions.

In the social capital literature, it is acknowledged that lack of cooperation caused problems to knowledge sharing (Tsai, 2002; Tsai and Ghoshal, 1998), and norms of cooperation are often regarded as producing positive effects by research (Gabbay and Zuckerman, 1998; Kramer and Goldman, 1995; Nahapiet and Ghoshal, 1998; Starbuck, 1992). For instance, Starbuck’s study (1992) shows that norms of cooperation helped the openness of information-sharing in a knowledge-intensive firm in the USA. However, the negative effects of the norms of cooperation are not explored by the research. The results of this research demonstrated that norms of cooperation produced positive effects as well as negative effects. The double-edged effects of norms of cooperation can help to understand the advantages as well as the potential risks of the relational social capital in facilitating knowledge flow and innovation.
5.5. Summary

The results of case-comparison showed that hierarchical norms had not only negative effects to deter informal communication, but also positive effects to facilitate formal communication. The effectiveness of the hierarchical norms in facilitating knowledge flow was related to people’s capacities of combining and exchanging knowledge. Similar to what suggested by other research, norms of professionalism negatively affected innovation by restricting knowledge flow and learning, and norms of reciprocity facilitated knowledge exchange. Meanwhile, the results showed that norms of reciprocity were reinforced by companion and competence trust. To some degree, norms of cooperation facilitated intra- and inter-departmental knowledge flow, which confirmed existing studies. However, the negative effects of norms of cooperation were also found, because cooperative actions were defined and limited by the norms. Those findings helped to better understand the advantages and also the drawbacks of relational social capital in relation to knowledge flow and innovation. Table 9-9 summarise the key points.

Table 9-9: Cross-case Comparison (the effects of relational social capital)

<table>
<thead>
<tr>
<th>Norms</th>
<th>Cases</th>
<th>Effects on knowledge flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchical norms</td>
<td>3G</td>
<td>Facilitating the sharing of basic knowledge between technology and other functional departments</td>
</tr>
<tr>
<td></td>
<td>ERP</td>
<td>Supporting communication through formal ties, but restricting informal communication and participation</td>
</tr>
<tr>
<td>Norms of professionalism</td>
<td>3G</td>
<td>Impeding inter-departmental knowledge flow</td>
</tr>
<tr>
<td></td>
<td>ERP</td>
<td>Leading to lack of intention of learning</td>
</tr>
<tr>
<td>Norms of reciprocity</td>
<td>3G</td>
<td>Along with competence trust and companion trust, facilitating knowledge flow through various ties</td>
</tr>
<tr>
<td></td>
<td>ERP</td>
<td>Along with competence trust, facilitating knowledge flow through various ties</td>
</tr>
<tr>
<td>Norms of cooperation</td>
<td>3G</td>
<td>Facilitating the sharing of knowledge related to cooperation, but not specialised knowledge</td>
</tr>
<tr>
<td></td>
<td>ERP</td>
<td>Facilitating knowledge sharing in COPs, but less effective in helping inter-departmental knowledge flow</td>
</tr>
</tbody>
</table>

6. The Interactions of Three Dimensions of Social Capital

6.1. The Interactions between Relational and Cognitive Social Capital

In the 3G case, lack of shared language interacted with norms of professionalism, producing negative effects on knowledge flow. Because of norms of professionalism, two engineers working in different professional domains did not accept opinions from other
professions. This kind of negative effects was not perceptible in the ERP case. The possible reasons were: first, unlike engineers in the 3G case, most people in the ERP case were routine workers who did not have professional knowledge; second, there were few interactions between technology people and routine workers.

In addition, the interaction between shared cause/effect beliefs (Thompson, 1967) and norms of cooperation also had negative effects on knowledge flow. In the ERP case, lack of shared cause/effect beliefs and different preferred outcomes negatively influenced norms of cooperation; as a result, cooperative behaviours between departments as defined by norms of cooperation were restricted, and inter-departmental information flow was impeded. This kind of negative effects of the interaction between cognitive and relational social capital was not found in the 3G. In the first place, joint responsibility and shared practice between R&D and CTI-USA promoted the development of shared understanding about cause/effect relations among them (see Section 7-2.3.1 and 7-2.3.2). Second, in contrast to the ERP project encountering lots of resistance with lots of changes brought into work process, the 3G project followed the existing product innovation processes (See Section 9-2.4) in which shared understanding about the cause/effect relations was promoted.

The positive and negative effects of the interaction between cognitive and relational social capital are gradually acknowledged by research. For instance, shared value helps the development of trusting relationship (Sitkin and Roth, 1993; Tsai and Ghoshal, 1998); on the other hand, Katz and Allen (1982) found that shared experiences enhanced strong norms; accordingly, people tended to rely on internal information, and resisted accepting others' ideas. In their recent research, Edelman et al. (2005) noticed that lack of trust in other professionals with different perspectives formed barriers for people to adopt the new cataract procedure of health-care; however, once the norms of professionalism were broken, people could accept the new procedure.

In addition to lending support to existing research, the results of this research further suggested that norms of professionalism affected acceptance of different opinions.
Moreover, the results also showed that the interaction between shared cause/effect beliefs and norms had negative effects on inter-departmental knowledge flow. Since these two different effects of the interaction tended to be more significant in one case than in the other because of the different features of the cases, this indicated that awareness of the particular context of a case can produce a better understanding about the effects of the interaction of different dimensions of social capital.

6.2. The Interactions between Relational and Structural Social Capital

In both the 3G and the ERP cases, it was found that norms, trust, and strength of internal ties reinforced each other, and then produced positive effects on knowledge flow. The strong internal ties helped to develop norms of cooperation and 'companion trust' (Newell et al., 2002), facilitating knowledge flow within departments (see Section 7-2.5.2 and 8-2.5.2). On the other hand, the interactions between companion trust and strength of network ties also had negative effects: the undermined companion trust broke the network ties between ERP leader and the Vice-General Manager (Bob), and made it difficult to promote the ERP system; as for the 3G case, lack of interaction weakened friendship ties, and then further undermined companion trust. In addition, in both cases, the interaction between lack of companion trust and weakened friendship ties led to small-sized social networks. Because small-sized networks might indicate limited knowledge resources, and weak ties are not effective in sharing tacit knowledge (Hansen, 1999), knowledge flow as a result of the interaction was restricted. Therefore, the interactions between the structural and relational social capital generated either the negative effects or the positive effects on knowledge flow.

In the social capital literature, the complexity of interaction between relational and structural social capital is recognised by research (e.g., Nanapiet and Ghoshal, 1998), but has not been fully explored. For instance, studies (Granovetter, 1985; Gulati, 1995; Krackhardt, 1992; Larson, 1992) show that strong ties are related to trust and reciprocity. Dyer and Nobeoka (2000) found that based on trust and norms of reciprocity, constant and frequent interactions developed strong ties between Toyota and its suppliers. The positive effects of the interactions are illustrated by those researches, but whether the interactions
might produce negative effects and how the interactions affected knowledge flow are
totally ignored. However, the results of this research suggested that the interactions
between the structural and relational social capital had contingent effects on knowledge
flow. While the strong internal ties, companion trust, and norms of cooperation reinforced
each other in facilitating internal knowledge flow, the interactions between lack of
companion trust and weak connections magnified their negative effects on knowledge
flow.

6.3. The Interactions between Cognitive and Structural Social Capital

Both positive and negative effects of the interactions between the structural and cognitive
social capital on knowledge flow were present in this research. On the one hand, in both
cases, the strong and multiple internal ties helped to develop shared cause/effect beliefs
within departments; as a result, people were willing to cooperate with each other and
exchange knowledge. On the other hand, in the ERP case, the strong internal ties led to
'social closure' (Edelman et al., 2005) and also fostered strong and separate identities. Due
to the exclusiveness of identities, people in different departments did not cooperate with
others as much; they refused to accept opinions from people in other departments when
there were conflicts between departments. In the 3G case, this negative effect of the above
interactions was not identified. The reasons were: the hierarchy of communication
networks in the 3G case was flatter than that in the ERP case; and, the multiple
memberships of key individuals in R&D and CTI-USA reduced the disconnection between
the two 'communities', and helped engineers to share the understanding of the cause/effect
relations of their cooperative actions (see Section 9-3.2). However, in the ERP case, the
project was faced with lack of such key individuals who had multiple memberships to
bridge the cognitive gap between different functional departments.

In addition, the results also showed that there were interactions between weak tie and
shared language. In the 3G case, the weak ties in friendship led to lack of shared language
between friends which further weakened the friendship ties. Similarly, in the ERP case,
lack of shared language became the impediment to developing informal ties between
engineers and routine workers.
Nahapiet and Ghoshal (1998) point out that the cognitive and structural social capital might not be mutually reinforcing. For instance, studies (e.g., Hayes and Clark, 1985; Katz and Allen, 1982; Szulanski, 1996) suggest that the potential drawbacks of the interactions between structural and cognitive social capital could be the lack of acknowledgement and acceptance of new ideas from external groups. A study by Edelman et al. (2005) reaches a similar conclusion that while facilitating internal knowledge flow, strong internal ties also created barriers which impeded knowledge flow from different professional groups because of the reluctance to accept ideas and disciplines from others. Because both structural and cognitive social capital had positive effects on knowledge flow, the question might be asked, whether the interactions between structural and cognitive social capital could influence knowledge flow in a positive way?

The results of this research demonstrated that the interactions between structural and cognitive social capital had contingent effects on knowledge flow: internal strong ties produced reluctance to accept different ideas by developing separate identities, but flattened hierarchy of communication networks and multiple memberships moderated this kind of negative effects; based on shared experience, strong internal ties developed shared language, but weak connections led to lack of shared language which further weakened the strength of social network ties. The contingent effects of the interaction reminded that there were advantages and also potential risks of social capital.

6.4. Summary

The results of this research contributed to the understanding of knowledge sharing by proving that (1) interactions between the three dimensions of social capital had contingent effects on knowledge flow; (2) the effects of the interaction were closely related to the different features of the cases. The effects of the interactions were, first, because of norms of professionalism and lack of shared language, people did not willing to accept ideas from different professions. Lack of shared cause/effect beliefs affected norms of cooperation, thereby negatively influenced inter-departmental knowledge flow. Second, strong internal ties helped to develop shared understanding in COPs, but also led to disagreement and lack
of cooperation between departments. Weak connection led to lack of shared language between friends, which further weakened the friendship ties. Third, strong internal tie, trust, and norms of cooperation reinforced each other to facilitate internal knowledge flow. However, lack of companion trust restricted the development of social capital. See Table 9-10 for the summary.

Table 9-10 : Cross-case comparison (the effects of the interactions of three dimensions of social capital)

<table>
<thead>
<tr>
<th>Interaction</th>
<th>3G</th>
<th>ERP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive effects</td>
<td>Negative effects</td>
</tr>
<tr>
<td>Relational &amp; cognitive social capital</td>
<td>Lack of shared language and norms of professionalism affected the acceptance of different ideas</td>
<td>Lack of shared cause/effect beliefs affected norms of cooperation restricting knowledge flow between departments</td>
</tr>
<tr>
<td>Structural &amp; cognitive social capital</td>
<td>Weak ties in friendship networks led to lack of shared language, and in turn, weakened the friendship network ties</td>
<td>Strong and multiple ties helped shared understanding within departments; ‘Bonding’ effects of internal ties led to disagreement and lack of cooperation between departments; lack of shared language restricted the development of social network ties</td>
</tr>
<tr>
<td>Relational &amp; structural social capital</td>
<td>Lack of companion trust weakened friendship ties impeding knowledge flow through the friendship ties</td>
<td>Strong internal ties developed companion trust and norms of cooperation facilitating knowledge flow within departments</td>
</tr>
</tbody>
</table>

7. Chapter Summary

The results of case-comparison of this research supported existing studies, showing that internal ties and formal ties had both positive and negative effects on knowledge flow, and informal ties and the diversity of networks were important for knowledge sharing and innovation. Furthermore, by combining the concepts of social networks, social capital, and COP, this research further suggested that strong internal ties had negative effects on knowledge flow, because they fostered strong and separate identities which negatively influenced knowledge sharing between COPs. The results also suggested that key
individuals who were in a senior position and who played multiple boundary-spanning roles contributed to knowledge flow and innovation much more than others. Moreover, the results of this research also suggested that the context in which different networks were developed and utilised help to better understand the effects of social networks and structural social capital.

Second, the results supported the findings of knowledge sharing literature, showing that different interests and preferred outcomes, shared cause/effect beliefs, and shared language affected knowledge flow in different ways. In addition, the effective boundary objects (e.g., sample machines) facilitated knowledge flow, but ineffective boundary objects did not.

Third, the results of this research confirm the existing literature showing that trust and norms of reciprocity were the fundamental rules of knowledge exchange, and norms of professionalism had negative effects on knowledge flow. Furthermore, the results suggested that norms of cooperation and hierarchical norms had both positive and negative effects on knowledge flow. This helped to better understand the benefits as well as risks of social capital.

Fourth, the results showed that three dimensions of social capital interacted with each other, and the interactions between them had contingent effects on knowledge flow.

Finally, the results suggested that the effects of social networks and social capital were closely related to the different features of the cases. In other words, the context contributed to a better understanding of the effects of social networks and social capital on knowledge. This also raised questions: whether or not the wide context – the cultural context of China – influenced knowledge flow and the utilisation of social capital, and whether the effects of social networks and social capital were related to power relations, as, for example, hierarchical norms and legitimate informal communication clearly indicated the exercise of power. These questions will be dealt with in Chapter 10.
Chapter 10

Discussing the Influence of Power Relations

1. Introduction

To continue the case comparison and discussion, this chapter examines the influence of power on knowledge flow and social capital. The discussion is split into four sections (Sections 2 to 5) in accordance with the four dimensions of power. Under each section there are three parts. The first part of each section compares and discusses the effects of power relations on knowledge flow and social capital as found in the 3G and the ERP case, and then, in the second part (under the heading of ‘Discussion’) which is followed by a section summary, the results of cross-case comparison are linked to the related literature to find out how the findings of this research could advance our understanding of knowledge flow. In addition, to avoid repetition, the influence of the cultural context of China will be fully discussed in the final section (Section 5.3), rather than in the ‘Discussion’ of each section. Finally, Section 6 gives the chapter summary.

2. The Influence of the Power of Resources

2.1. Cross-Case Comparison

As mentioned in Section 7-3.1, CTI and its client (TUS-China) depended on each other’s unique resources (i.e. market share and specialised knowledge). In order to increase market share and profits, TUS-China developed 3G products in cooperation with CTI. The knowledge interdependency relations developed norms of cooperation which helped engineers from these two firms to share knowledge to integrate their work. Meanwhile, in order to increase others’ dependence and avoid others’ power over them, the firm also put under control certain specialised knowledge on which the other depended. This led to norms of professionalism; and norms of professionalism impeded the sharing of specialised knowledge.
Likewise, the resource interdependency relations between the units (i.e. CTI-Shenzhen and CTI-USA) helped to develop norms of cooperation (see Section 7-3.1); as a result, the knowledge related to integration was shared between R&D and CTI-USA. On the other hand, monopolising the specialised professional knowledge could increase others' dependence; CTI-USA, based on norms of professionalism, controlled specialised knowledge of making power amplifiers to prevent the knowledge from leaking. Therefore, the resource (expertise and market share) interdependency relations indirectly influenced inter-departmental and inter-organisational knowledge flow by affecting norms of cooperation and norms of professionalism. On the other hand, the knowledge sharing/hoarding behaviour further reinforced the knowledge/financial resource dependency relations between the units, and organisations.

Unlike the 3G project which was under the control of the General Manager for technology, ERP involved many functional departments which were directed by Ted and several Vice-General Managers. Those people at the top-layer of management contended for different power resources (money, technology, customer relations, and knowledge about work process) (see Section 8-3.1). Because of legitimate power, the inter-personal conflicts at the top-layer of management were developed as the conflicts between functional departments. This affected inter-departmental communication, and led to lack of cooperation between those departments. Meanwhile, ERP leader had very limited power resources (money and hierarchical position) to mitigate the conflicts. The conflicts between him and Bob undermined 'companion trust' (Newell et al., 2002) between them, and ended up with his resignation, an incident which caused difficulty in the process innovation (see Section 8-3.1).

Because the ERP project tended to focus more on internal coordination than 3G, and had more powerful people involved in decision-making than 3G, the power relations based on knowledge/resource dependency had different effects on social capital and knowledge flow in these two projects. In a word, while the knowledge/resource dependency relations directly affected inter-departmental communication, they also had either positive and negative effects on knowledge flow by impacting the norms and trust (see Figure 10-1).
2.2. Discussion

By viewing power as resource dependency, knowledge is seen as an important power resource (e.g., French and Raven, 1959; Hales, 1993; Pettigrew, 1973); knowledge sharing/hoarding, the direct outcome of exchanging and/or controlling power resources (e.g., 1986; Hales, 1993; Newell et al., 2000; Swan and Scarbrough, 2005). For instance, the case study of Storey and Barnett (2000) shows that important knowledge was controlled by different groups which had different opinions about a knowledge management project in a Europe-headquarter company, in order to produce their preferred outcomes which will benefit them in the future. Swan and Scarbrough (2005) also find that because of lack of the resource power, project managers in a European company failed to control knowledge flows and networking. However, since they discuss power from the standpoint of management who had an interest in encouraging knowledge sharing and promoting innovations by exercising the power of resources, rather than from a holistic perspective. They failed to notice the indirect effects of the power of resources on knowledge flow which were identified by this research.

This research found that the power relations based on knowledge/resource interdependency not only had positive/negative effects on knowledge flow, but also influenced knowledge flow indirectly. The different effects of the power of resources on knowledge flow found in the 3G and ERP case were because in these two cases the power of resources was exercised in different ways, and because people had different responses to the exercise of the power of resources. This suggests that to better understand the contingent effects of the first dimension of power needs to consider the context in which the power was exercised,
and the responses to the exercise of the power. In addition, while taking in account the different context of particular projects can throw more light on the contingent effects of the power relations on knowledge flow, it follows that the institutional and national context was related to the effects of knowledge/resources interdependency relations. The influence of the institutional and national context will be fully discussed in Section 10-5.3.

2.3. Summary
The results of this research showed that the knowledge/resource interdependency relations not only directly affected knowledge flow, but also indirectly influenced knowledge flow through different norms and trust to generate contingent effects (See summary Table 10-1). And, knowledge sharing/hoarding behaviour further reinforced the power relations between different parties. The results also suggested that a holistic view bring forth a better understanding of the relations between power relations, knowledge flow, and utilisation of social capital.

Table 10-1: Cross-case comparison (the influence of the 1st dimension of power)

<table>
<thead>
<tr>
<th>Case</th>
<th>Representation</th>
<th>Influence on social networks &amp; structural social capital</th>
<th>Influence on cognitive social capital</th>
<th>Influence on relational social capital</th>
<th>Direct Influence on knowledge flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Knowledge/resource interdependency</td>
<td>Developing norms of cooperation, norms of control knowledge and norms of professionalism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERP</td>
<td>Knowledge/resource interdependency</td>
<td>Leading to lack of cooperation between departments; undermining companion trust</td>
<td></td>
<td>Impeding inter-departmental communication</td>
<td></td>
</tr>
</tbody>
</table>

3. The Influence of the Power of Processes

3.1. Selecting People
In this research, based on non-decision-making power in selection, the process interdependency relations had both positive and negative effects on knowledge flow and the utilisation of social capital. Those positive and negative effects found in 3G and ERP
were similar. That is, based on the process interdependency relations, the selection developed the strong internal ties, and the strong internal ties facilitated intra-departmental knowledge flow by developing companion trust and norms of cooperation. The strong internal ties also fostered strong and separate identities of people in different departments/units (see Section 7-3.2.1, and 8-3.2.1). One the other hand, while the strong and separate identities had positive effects on intra-departmental knowledge flow, they also had negative effects on inter-departmental knowledge flow. Meanwhile, because members tended to depend upon those powerful people who selected him/her, instead of others, it was not easy for them to accept different opinions from people from different ‘cliques’ (see Section 7-3.2.1, and 8-3.2.1). This was because, relying on the powerful individuals who selected them, they held a strong position in securing their jobs in the firm; thus, they were unwilling to compromise with others. On the other hand, this kind of cognitive barriers also confirmed the process interdependency relations between the powerful individuals and their members. So, the process interdependency relations in selection explained the origins of the cognitive barriers which impeded knowledge flow, as well as the contingent and indirect effects of strong internal ties on knowledge flow (see Figure 10-2).

3.2. Non-decision-making Power on Pay Issues

Department managers and employees were excluded from the decision-making processes with respect to pay. Although department managers were able to give suggestions about their department members’ wage, the final decision was still reached by Personnel department. Employees’ response to the non-decision-making power had contingent effects on knowledge flow. Firstly, in the ERP case, people (especially some key users of the ERP system) were not satisfied with their salary and bonus; therefore, to protest against the pay system (in a covert way), they were not willing to help others to solve problems, and to share knowledge with others (see Section 8-3.2). Therefore, the process interdependency relations directly affected people’s attitudes toward knowledge sharing, and also indirectly impeded knowledge flow by negatively influencing norms of cooperation.
The above-mentioned effects were not found in the 3G case, though. The reason was because in ERP most people were low-skilled routine workers, but in the 3G case nearly all staff were engineers who had specialised professional knowledge. There were different pay systems for engineers and low-skilled routine workers. As a key user described,

“Our (wage) is completely not at the same level as theirs in R&D, because they work on technology.” (Senior planner 1, PMC, CTI-Shenzhen)

In contrast to the low-skilled routine workers in the functional departments in ERP, engineers in R&D were relatively satisfied with their salary and bonus, as their wage and bonus increased in proportion to their “competence and achievement in work” (Chief Engineer, CTI). None of the interviewed engineers ever complained about their wage; and some interviewees’ responses even implied their satisfaction. Therefore, the different pay systems applied to technical personnel and non-technical personnel led to distinct attitudes of these two groups of people toward knowledge sharing.

On the other hand, the process interdependency relations had positive effects on relational social capital and knowledge flow. As mentioned in Section 7-3.2, in 3G, because of lack of rewarding power, the R&D leader used “emotional control” to manage R&D, which helped to develop norms of cooperation and ‘companion trust’ (Newell et al., 2002) among...
engineers: and norms of cooperation and companion trust facilitated knowledge sharing within R&D. Therefore, based on the process interdependency relations, internal knowledge sharing can be facilitated indirectly by developing norms of cooperation and companion trust. Nevertheless, this kind of positive effects was not found in ERP. The reason was because, first, the way functional department managers used to control their departments tended to be relatively formal, while the control of R&D tended to be informal and friendly; second, the hierarchy in the 3G case was different from that in the ERP case: the flattened structure in the 3G case made it easier to foster a cooperative atmosphere (see 7-3.3.2).

To sum up, the results of this research showed that the processes interdependency relations based on non-decision-making power on pay issues had direct effects on the attitude toward knowledge sharing, and also had indirect and contingent effects on knowledge flow by affecting norms of cooperation and companion trust. Moreover, employees’ response to the pay system further confirmed the power of processes (See Figure 10-3). The different effects found in the 3G and the ERP case suggested that the context of each case was necessary for a holistic understanding of the effects of the power relations on knowledge flow, and on the utilisation of social capital. For not only the employment relations, but also employees and department managers’ response to pay system were closely related to the effects. In addition, there was also a possibility that the Chinese cultural context influenced the effects of the power relations to some extent. This issue will be fully discussed in Section 10-5.3.

3.3. Controlling Work Procedures

In this research, the process interdependency relations based on non-decision-making power was also embodied in the controlling of work procedures. In both the 3G and ERP cases, because of ‘embeddedness’ of network ties, the process interdependency relations influenced the development of formal network ties within and between departments by setting down work procedures. And, those formal ties helped the intra- and inter-departmental knowledge flow. On the other hand, this kind of power relations also
had negative effects on knowledge flow. First, it indirectly impeded knowledge flow by affecting structural social capital. In the 3G case, when engineers had little interface in work, there was little communication among them, so the strength of formal ties became weak. Accordingly, there was little knowledge exchange among those engineers (see Section 7-3.2). As for the ERP case, the power of processes was used to lay down not only work procedure, but also communication procedure. The formal communication which followed the hierarchical rules was seen as legitimate, while informal communication was considered illegitimate (see Section 8-3.2). This led to lack of informal communication between people in different departments. And the effects of the structural social capital further reinforced the hierarchical power.

In both cases, the employees had excessive workload which left them with imbalanced work and life. As mentioned before, the employees often worked overtime. They had little time to spend with friends; as a result, the friendship network ties were weakened due to lack of socialisation. Particularly in the 3G case, lack of contact made some of their friends feel that they did not have shared language about their work, which further decreased the strength of friendship ties (see Section 7-3.2.3). In the ERP case, the heavy workload also affected learning and knowledge sharing, because people did not have any time to learn, and to share knowledge (see section 8-3.2.4). Furthermore, employees’ response to the
heavy workload (reduced socialisation and learning) reinforced the power relations based on non-decision-making power.

In addition, in the ERP case, because production was given privilege, sometimes people skipped the ERP procedures to meet the needs of production. This led to lack of shared cause/effect beliefs (Thompson, 1967) among people from different functional departments, and lack of shared cause/effect beliefs further led to lack of cooperation between those departments, which negatively influenced inter-departmental knowledge flow. Therefore, the power relations indirectly impeded knowledge flow by influencing cognitive social capital. This kind of negative effect was not found in 3G, because firstly 3G received much support from the management and also from employees, and second because 3G followed approved work process (see Section 9-2): all of those allowed engineers to develop shared understanding about the cause/effect relations of their actions.

To sum up, the results of this research suggested that the power relations based on non-decision-making power on the controlling of work procedures directly restricted learning; and also indirectly influenced knowledge flow (in both positive and negative ways) through different dimensions of social capital (see Figure 10-4). This indicated that management's attempt to control work procedures to improve its profitability from a managerial standpoint, to some degree, facilitated knowledge flow by establishing formal communication channels, but also incurred contradictory effects on knowledge flow (which negatively affected the development of social networks, shared language and understandings, norms of cooperation, and learning). Understanding the process interdependency relations, based upon which employees and management acted, was the key to understanding the contingent effects.

3.4. Organising Training and Knowledge Sharing Activities

Because the telecommunication technology developed rapidly, the competition in telecommunication industry in China was severe. CTI was a middle-sized semi-telecom-equipment supplier without considerable capital, human resources, and market share. The management's strategy emphasised short-term profits rather than
long-term growth. This emphasis was embodied in the decision-making related to investment and work procedures: many newly recruited workers started to work with or without a very brief induction period; that was because training was regarded as an investment; although training (as well as knowledge sharing activities) might yield long-term advantages, they were so time- and money-consuming that they were treated as inferior.

In the ERP case, the two training lectures given by ERP leader provided the opportunities for key users to discuss problems and solutions related to the operation of the system and coordination of work. However, there were very few such activities. Many workers in functional departments expressed that they needed more trainings, because they felt that lack of specialised knowledge caused difficulty in their work. In the 3G case, engineers did not mention that they needed training, but expressed their want of knowledge sharing activities. That was because engineers, even though with specialised professional knowledge, tended to be more interested in obtaining new knowledge and ideas from knowledge sharing activities rather than from basic training courses. However, employees
were not able to get involved in decision-making processes to raise such issues. Therefore, lack of training and knowledge sharing activities restricted the opportunities for employees to obtain and share knowledge.

Therefore, the results of this research suggested that the process interdependency relations embodied in non-decision-making related to training and knowledge sharing activities had contingent effects on knowledge flow (see Figure 10-5). By providing opportunities to obtain and sharing knowledge, the process interdependency relations could facilitate knowledge flow, and also restrict knowledge flow depending upon how the non-decision-making power served the interests of those in power, and upon the response of those who were less powerful. The facilitated/restricted knowledge flow further confirmed the non-decision-making power. In addition, as the management’s decision-making influenced the competition of telecommunication industry, this indicated that the effects of the power relations were related to a wide context. This issue will be discussed in Section 10-5.3.

Figure 10-5: The influence of the power of processes (organising training and knowledge sharing activities)

3.5. Discussion
First, in the literature of knowledge management and innovation, the positive effects of the power of processes (selection) are linked to Human Resource Management (HRM) practice. For instance, Swan and Scarbrough (2005) find that the power of processes used in selecting team members helped to develop social networks across the company. Newell et al. (2002) point out that a strong elite identity created through highly rigorous selection
can enhance employees’ willingness to share knowledge. However, this research suggested that selection produced both positive and negative effects on knowledge flow through structural, cognitive and relational social capital. Moreover, the strong identities developed via selection facilitated internal knowledge flow, but impeded knowledge sharing between departments.

Second, a lot of research which linked HRM practices with knowledge management show that appraisal scheme, reward and pay system, and training system are able to produce positive effects on learning, and knowledge sharing and exchange (e.g., Rajan et al., 1998; Hansen et al., 1999; Garvey and Williamson, 2002; Yahya and Goh, 2002). Swan and Scarbrough (2005:935) also suggest that training and regular meetings can help the development of informal networks across the local implementation teams of the project. Supporting existing literature, the results of this research also showed that training had positive effects on knowledge flow, because it offered opportunities for people to learn, and share knowledge. And, since little training was offered in spit of employees’ needs of training courses and knowledge sharing activities, lack of training and knowledge sharing activities restricted learning and knowledge flow. However, the results of this research showed that the non-decision-making power embodied in pay system directly affected people’s attitude towards knowledge sharing which had contingent effects, depending upon the pay system and also employees’ feeling about the fairness of the pay system, on knowledge flow; it also indirectly influenced knowledge flow through norms of cooperation and companion trust. The contradictory effects of the non-decision-making power on knowledge flow also indicated that the context of the projects can help to understand the relations between the power of the processes, and knowledge flow.

By studying the photo-copier repair technicians, Orr (1990), and Contu and Willmott (2003) give an example of the power of processes (control of work procedures and routines) influencing knowledge flow: the tight control of work procedures restricted learning opportunities of the technicians, but also helped to fashion the technicians’ identity as ‘heroic trouble shooters’, and stimulated their willingness to share their knowledge of fixing machines. However, this research suggested that the power of processes embodied
in control of work procedures influenced knowledge flow in a more complex way: it
directly influenced knowledge flow, but also indirectly influenced knowledge flow through
different dimensions of social capital. Those different dimensions of social capital
interacted with each other, and then had contingent effects on knowledge flow. In addition,
the difference effects of the power of the processes on knowledge flow as found in the 3G
and the ERP case cannot be understood without taking the context of the projects into
account.

In a word, the power relations based on process interdependency relations had contingent
effects on knowledge flow and utilisation of social capital. Since the results showed that
the context of the projects was related to the different effects of the power of processes on
knowledge flow, it was likely that knowledge flow was also influences by a wide context.
This issue will be addressed in Section 10-5.2.

3.6. Summary

This section discusses the similarity and discrepancy of the effects of the power of
processes in the 3G and the ERP case (See Table 10-2 for summary). The results suggested
that the power of processes had both positive and negative effects on knowledge flow. The
power of processes directly influenced knowledge flow. It also indirectly influenced
knowledge flow through social capital. On the other hand, the effects of social capital also
reinforced the power of processes. The results of this research also suggested that to
understand the relations between power and knowledge flow, it was necessary to
understand the context in which powerful and less powerful people acted.

4. The Influence of the Power of Meaning

4.1. Hierarchicalism Culture vs. Mitigated Hierarchicalism (Flattened Structure)
Hierarchicalism culture influenced the way people communicated with each other, thereby
defining their communication networks. In the ERP case, because of the hierarchicalism
culture, informal communication amongst functional departments were restricted, because
Table 10- 2: Cross-case comparison (the effects of the 2nd dimension of power)

<table>
<thead>
<tr>
<th>Cases</th>
<th>Representation</th>
<th>Influence on social networks &amp; structural social capital</th>
<th>Influence on cognitive social capital</th>
<th>Influence on relational social capital</th>
<th>Direct Influence on knowledge flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Selection</td>
<td>Developing strong internal ties within departments</td>
<td>Cognitive barriers to accept others’ opinion</td>
<td>Developing companion trust, norms of cooperation and identities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pay system</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controlling work procedures</td>
<td>Developing formal ties; weakening friendship ties</td>
<td></td>
<td></td>
<td>Work/life imbalance restricting communication</td>
</tr>
<tr>
<td></td>
<td>Organising knowledge sharing activities</td>
<td></td>
<td></td>
<td></td>
<td>Reducing the opportunities to share knowledge</td>
</tr>
<tr>
<td>ERP</td>
<td>Selection</td>
<td>Developing strong internal ties within a department</td>
<td></td>
<td>Fostering strong and separate identities, companion trust, and norms of cooperation within a department</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pay system</td>
<td></td>
<td></td>
<td>Leading to lack of cooperation</td>
<td>Willingness to share knowledge</td>
</tr>
<tr>
<td></td>
<td>Controlling work procedures and routines</td>
<td>Developing formal ties, restricting informal communication; weakening friendship ties</td>
<td>Leading to lack of shared cause/effect beliefs</td>
<td>Leading to lack of cooperation between departments</td>
<td>Work/life imbalance reducing opportunities of learning and knowledge sharing</td>
</tr>
<tr>
<td></td>
<td>Organising training</td>
<td></td>
<td></td>
<td></td>
<td>Facilitating learning and knowledge sharing</td>
</tr>
</tbody>
</table>

communicating with others over the head of one’s direct superior was considered improper. However, there was no this kind of unwritten rule to guide people’s communication in the 3G case. Both formal and informal communication was allowed. Hierarchicalism was relatively weak in technology departments, especially in R&D department. The flattened hierarchy facilitated knowledge flow, and increased the opportunity of learning (see Section 7-3.3.2). Therefore, the power of meaning resided in the hierarchicalism culture.
directly influenced learning, and also indirectly influenced knowledge flow through communication networks.

Meanwhile, hierarchicalism culture developed different norms, and those different norms had both positive and negative effects on knowledge flow. In ERP, hierarchicalism culture fostered norms of control and compliance; as a result, department members obeyed the hierarchical rules without putting forward different opinions; and other department managers did not participate in the promoting of the ERP system, as they did not usually intervene in “others’ business” (see Section 8-3.3.2). Contrary to the situation in the ERP case, the hierarchicalism in the 3G case was weak. As a result, the flattened structure fostered ‘companion trust’ (Newell et al., 2002) and norms of cooperation among engineers to facilitate knowledge flow (see Section 7-3.3). Therefore, the symbolic power resided in the hierarchicalism subculture and flatterned structure had contingent effects on knowledge flow through the structural and relational social capital. Meanwhile, as responses to the different subcultures, people’s attitudes towards sharing/hoarding knowledge further underlined the power of meaning embedded in the organisational subcultures (see Figure 10-6).

Figure 10- 6: The influence of hierarchicalism culture & flatterned structure
4.2. Segmentalism vs. Cooperative Culture

In the ERP case, people in different functional departments paid attention to their own work rather than inter-departmental coordination. For them, completing their own work and avoiding being blamed by the leaders was the first priority. Because of this kind of segmentalism subculture, the functional departments had different interests and preferred outcomes, both of which harmed inter-departmental cooperation. And lack of shared interests and cooperation further impeded inter-departmental knowledge flow, and participation in the promoting of the ERP system (see Section 8-3.3.1). However, in the 3G case, different technology departments/units had joint responsibility for developing the 3G products; they had cooperative subculture which helped to develop norms of cooperation as well as shared understanding about their cooperation. Consequently, inter-departmental knowledge sharing in the 3G case became easier than that in the ERP case (see Section 8-3.3.1).

Therefore, the segmentalism/cooperative subculture showed that management’s attempt to influence employees’ attitudes toward work to benefit departments resulted in different and contradictory effects in these two cases: while cooperative subculture benefited the new product innovation, segmentalism seemed to have positive outcomes for one department in task accomplishment, but not for the promoting of the ERP project. The contingent effects were dependent on the interactions between the symbolic power and the cognitive/relational social capital (shared understanding and interests, and norms of cooperation). And as their response to the segmentalism/cooperative subculture, people’s attitude towards knowledge sharing further reinforced the symbolic power of the subcultures (see Figure 10-7)

4.3. Subculture of Learning and Elitism

In the 3G case, engineers in R&D and in CTI-USA had different subculture regarding learning (see Section 7-3.3.1). The power of meaning resided in the subculture related to learning promoted the emergence of a distinct identity of engineers in CTI-USA; because of separate identities, engineers in CTI-USA tended to hoard certain types of specialised
knowledge rather than sharing with those in R&D. In the ERP case, because most people in the functional departments were doing routine work without specialised knowledge, the demand of learning new knowledge for those workers was not as strong as for engineers doing technology related work. The conflicts of the disparity related to the subculture of learning were not found in the ERP case. However, because engineers had specialised knowledge which routine workers did not have, engineers were privileged, and seemed to have higher status than people working in functional departments. This kind of elitism culture developed a strong and exclusive identity of engineers which affected the relations and communication between engineers, and routine workers in other functional departments (See Section 8-3.3.3); as a result, knowledge flow between these two different 'classes' of people was impeded. Therefore, the symbolic power resided in the subculture of learning and elitism had an unexpected negative effect on knowledge flow by developing separate identities. On the other hand, knowledge hoarding behaviour and restricted communication further testifies to the symbolic power resided in the subcultures (see Figure 10-8).

4.4. Discussion

In the literature of knowledge management and innovation, the influence of the power of meaning on knowledge flow and innovation is little discussed. Although the existence of
organisational subcultures related to different groups’ interests are well recognised by management and organisation theory (e.g., Bate, 1994; Hofstede, 1998; Parker, 2000; Sackmann, 1992), scholars (e.g., April and Bessa, 2006; Pan and Scarbrough, 1999; Newell et al., 2002; Zakaria et al., 2004) often see organisational culture as one of the mechanisms which can be used by management to encourage knowledge sharing, and to promote innovation (e.g., Swan and Scarbrough, 2005). However, this research suggests taking a holistic approach to examine the relations between knowledge flow, innovation, and the power of meaning.

In this research, the exercise of the power of meaning, and people’s response to the symbolic power explained the contingent effects of the power of meaning. Different subcultures were developed by managers of different departments with the attempt to achieve work efficiency from their own standpoint, but had contingent effects on knowledge flow and innovation. Hierarchicalism culture in the ERP case was seen as effectively supporting the work of each department, but impeded participation and inter-departmental knowledge flow through communication networks, and norms of control and compliance, and hierarchical norms. Once R&D people discarded hierarchicalism, they had more channels and opportunities at hand to exchange knowledge with and learn from others; and they tended to be more cooperative, and more willing to share knowledge. Meanwhile, the segmentalism culture reflected the situation that different
functional departments protected their own department’s benefits to produce their preferred outcomes; as a result, there was lack of coordination and cooperation between those departments. On the other hand, because of the joint responsibility for developing the new products, and because of the privileged position of the product innovation and production, technology departments developed a shared understanding about their actions, and tended to be cooperative with each other. Moreover, due to the emphasis on product innovation, the important role of knowledge workers – the engineers – in achieving the organisation’s ‘goals’ was emphasised. On that account, the superior status of engineers in CTI was established in relation to the low-skilled workers. Both engineers and the low-skilled workers recognised the status difference between them. The elitism culture fostered strong and exclusive identities of engineers which had an unexpected negative effect on knowledge flow: knowledge sharing between those two different “classes” of people was impeded.

Thereby, it can be concluded that the power of meaning was resided in the organisational culture/subcultures and structure not only directly influenced knowledge flow and networks, but also indirectly affected knowledge flow by developing separate identities and influencing the structural (social networks), cognitive (shared cause/effect beliefs), and relational social capital (norms and trust) to produce contingent effects. The exercise of the power of meaning, and how people responded to it in a particular context of the project can help to understand the contingent effects of the power relations. In addition, it was possible that the effects of the power of the meaning were associated with the cultural context of China. This issue will be handled in Section 10-5.3.

4.5. Summary

Hierarchicalism culture impeded knowledge flow by developing hierarchical norms and norms of control and compliance, and also by restricting the communication networks and participation in innovation, while the flattened hierarchy of communication networks facilitated knowledge flow. Segmentalism culture impeded inter-departmental knowledge flow by affecting shared interest and norms of cooperation, while cooperative culture facilitated knowledge flow by developing shared cause/effect beliefs and norms of
cooperation. Elitism and different learning subcultures impeded knowledge flow by fostering strong and separate identities. (See Table 10-3 for the summary). In a word, the power of meaning resided in the organisational culture and subcultures generated both positive and negative effects on knowledge flow by influencing identity, and the structural, cognitive, and relational social capital. The contingent effects of the power of meaning suggested investigating knowledge flow and innovation by taking into account the power relations and the context in which the power of meaning was exercised.

Table 10-3: Cross-case comparison (the influence of the 3rd dimension of power)

<table>
<thead>
<tr>
<th>Cases</th>
<th>Representation</th>
<th>Influence on social networks &amp; structural social capital</th>
<th>Influence on cognitive social capital</th>
<th>Influence on relational social capital</th>
<th>Direct Influence on knowledge flow and learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Cooperative culture and flattened structure</td>
<td>Increasing density of the formal networks</td>
<td>Fostering shared understanding</td>
<td>Developing norms of cooperation and companion trust</td>
<td>Increasing learning opportunities</td>
</tr>
<tr>
<td></td>
<td>Subculture of learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hierarchicalism</td>
<td>Restricting the development of informal ties</td>
<td></td>
<td>Developing norms of control and compliance</td>
<td>Restricting participation in the ERP project</td>
</tr>
<tr>
<td>ERP</td>
<td>Segmentalism</td>
<td>Leading to lack of shared interests</td>
<td>Leading to lack of cooperation between departments</td>
<td></td>
<td>Restricting participation in the ERP project</td>
</tr>
<tr>
<td></td>
<td>Elitism</td>
<td></td>
<td></td>
<td>Developing separate identities</td>
<td></td>
</tr>
</tbody>
</table>

5. The Influence of the Power of the System

5.1. Competition in the Labour Market and Institutional Context

The power of the system embedded in the competitive labour market, had similar positive effects on learning, and negative effects on the utilisation of the relational and structural social capital in the 3G and the ERP case. Details are as follows.

First, in both two cases, the power of the system embedded in the competitive labour market and institutional context directly stimulated people’s learning. Almost all interviewees, including Chief Engineer, engineers, managers, and low-skilled routine
workers, mentioned about the indispensability of learning new things. Engineers felt that it was important to update their professional knowledge in keeping with the rapid development of telecommunication technology. For the low-skilled routine workers, lack of professional knowledge explained their high turnover. Therefore, learning knowledge and skills from a higher education level was the main concern of those workers to secure their jobs or find better ones.

Second, the power of the system embedded in the competitive labour market had a negative influence on the structural and relational social capital. Because of the competitive labour market, employees had to take on an excessive workload. Not only low-skilled routine workers, but also engineers all mentioned about such a situation. With imbalanced work and life, people had little ‘companion trust’ (Newell et al., 2002): employees had little energy and time left to develop friendship with those in the work place as well as outside the organisation. By contrast, in firms in the inland of China, especially those state-owned enterprises, there was no competition for jobs, so that people led an easy life and tended to be more engaged in developing friendship. Therefore, the competition of labour market in Shenzhen impeded the development of companion trust among people, and lack of companion trust in turn restricted the development of personal social networks. Many people had small and narrow friendship networks in Shenzhen, which had negative effects on knowledge flow. In the 3G case, these kind of negative effects were more severe than in the ERP case. That was because the informal ties were important for engineers to obtain non-redundant knowledge from external ties, whereas the process innovation tended to rely on internal knowledge exchange, and the personal contacts of the low-skilled routine works only offered ‘inferior’ information to the ERP project.

In the literature, the effects of the power of the system on knowledge flow were discussed by focusing on the surveillance effects of ICT, but little attention was paid to how the institutional context and labour market might influence knowledge flow. The surveillance effects of ICT were not significant in this research, because no ICT were designed and used for facilitating knowledge sharing in these two cases. The results of this research
showed that the competitive labour market and institutional context had both positive and negative effects on learning and knowledge flow. It directly stimulated the desire to learn, but it also impeded knowledge flow by affecting norms of professionalism and trust. The desire for learning, as people’s response to the competitive labour market, in turn, confirmed the influence of the power of the system. (See Figure 10-9)

Figure 10- 9: The influence of the labour market and institutional context

5.2. The Change of Social Context

In Sections 7-3.4.2 and 8-3.4.2, how people responded to the changing social context of China has been dealt with. ‘Get rich’ was desired by every Chinese. Earning more money was considered the symbol of personal success. Certain occupations were most desired, such as doing marketing-related work or running one’s own business. Although some engineers and managers were well-paid, they were still on the lookout for better opportunities to earn more money. Even R&D leader had an experience of running his own business. And in the ERP case those who had high positions in management, such as Director of Production and ERP leader (PMC manager), also expressed their future plan of working in the field of marketing. Furthermore, the value of pursuing higher income, shaped by the power of the system, was held not only by engineers and managers, but also by low-skilled routine workers, although the latter did not have as strong an ability to choose jobs and occupations as engineers or managers did. For instance,
"As a do-work-for-others (Dagongzai), we have nothing else without money. Of course, wage is the most important thing (to us)." (Senior planner 1, PMC, CTI-Shenzhen, left CTI to follow ERP leader.)

"The goal of leaving home and working for others is to earn money." (Senior planner 3, PMC, CTI-Shenzhen, left CTI to follow ERP leader)

As Dowling et al. (1998) put it, in Chinese companies, including foreign-invested companies, “employees tend to change jobs frequently in pursuit of higher wages rather than skills development” (p. 271). Naturally, this led to weak commitment. The danger was that when people left the company, the company not only lost the important knowledge for innovations but also the social capital that these people possessed.

In addition, the cultural and social change of China also affected the development of social network ties. As Nolan (2004:45) points out, “the values of the Maoist period had been deeply undermined by the rise of the market economy... the successor generation is confronted everywhere by the values of a selfish, materialistic market economy.” The value of pursuing money to some extent changed some people’s idea regarding the relationship between money and friendship. For instance, in the 3G case, two engineers mentioned about experiences that their friends betrayed (or cheated) them for money, which led to the break-up of the friendship ties. And in the ERP case, several interviewees mentioned that in Shenzhen it was difficult to develop ‘the true friendship’ with others. These showed that the social environment negatively influenced the development of ‘companion trust’ (Newell et al., 2002), and because of lack of companion trust, the development of friendship network ties was restricted in these two cases. Because friendship networks are seen as important channels of knowledge flow, lack of friendship networks negatively influenced knowledge flow. This kind of sequential effects revealed the relations between knowledge flow, people’s value, and the power of the system embedded in the social context. Moreover, the effects (the weakened organisational commitment, lack of companion trust, and friendship networks) reinforced the power of the system. (See Figure 10-10)
5.3. Discussion

In the knowledge management literature, more and more attention was drawn to the influence of national culture on knowledge sharing. Culture’s influence on knowledge flow became an important issue for knowledge management and innovation, because of the increasing cross-country cooperation and, most importantly, globalisation (Murray and Myers, 1997; Quintas, 2003). Cross-cultural studies find that different national cultures directly influenced people’s knowledge sharing behaviour (Michailova and Hutchings, 2006). Inkpen and Pien’s study (2006) also reveals that the difference between Chinese business culture (which places emphasis on relationship) and western-oriented business culture of Singapore impeded the alliance knowledge transfer between partners. However, the power of the system embedded in national cultures was not noticed and discussed by those researchers. The cultural difference is treated only as one of the factors which directly influenced cross-national knowledge sharing. Culture’s deeper and indirect effects on knowledge flow were totally ignored, because of unawareness of the power relations embedded in cultures and the wide social context. The results of this research showed that the change of the value system reflected the influence of the power of the system embedded in cultures, and that such an influence indirectly affected knowledge flow by influencing the utilisation of social capital. This suggested taking a power-based view to examine knowledge flow and innovation.
The national culture and social environment of China was the backdrop of the effects of the power of the system found in this research. Such comprehension was conducive to a better understanding of the direct and indirect influences of the power of the system on knowledge flow, instead of viewing national culture simply as one of the factors which directly affected knowledge sharing behaviour, or considering institutional environment as one of the elements influencing innovation networks (e.g., Furtado, 1997; Nooteboom, 2000).

Firstly, the competitive labour market and industry environment which stimulated learning came from the changing culture and social environment of China. Before the ‘reform and opening-up’, the majority of employees in China worked for the state-owned enterprises in which people enjoyed the ‘iron rice bowl’ - “the guaranteed continuation of employment, along with various welfare and benefits” (Dowling et al., 1998:264). There was no competition in the labour market. The ‘reform and opening-up’ introduced competition into China’s labour market. From then on, employees’ appraisal was connected with their performance, and management had the power to sack unqualified employees. In order to secure their jobs, engineers had to learn new things to achieve the product innovations, and workers needed to obtain new knowledge to improve their performance. Therefore, the competition in the labour market became the impetus to learning. On the other hand, people’s response to the competition in the labour market further reinforced the power of the system. The cultural context of China changed from the ‘iron rice bowl’ - lack of competition in the labour market - to severe competition in the labour market. This made China resemble the West in terms of the competition in labour market, because the competition always exists in most western countries. Therefore, the results of the positive effects of the power of the system embedded in the competitive environment can help to explain how learning might be stimulated in the western countries.

Second, the unique cultural context of Shenzhen, China was the backdrop against which the power of the system indirectly influenced knowledge flow by affecting the development of companion trust. As mentioned before, employees in CTI always had to work overtime because of competitive labour market and pressure from management, and
this led to lack of companion trust and friendship networks. This kind of phenomena was common in many companies in Shenzhen and other special economic zones in China, due to competition among companies and companies’ ambition to maximise profit with minimised investment (e.g., money and manpower). More importantly, in the UK or the USA, the legal system was well-established, and the legislation was relatively holistic. In contrast, China’s Labour Law which legitimates the legal right of employees (including hours of work) did not take effect until 1995, and was not completely implemented by every enterprise. This explained why employees in those companies did not have balanced work and life. Because they did not have time and energy to develop companion trust and friendship networks, knowledge flow was impeded because of lack of companion trust and friendship networks.

Third, the cultural context of China impacted people’s value and perception of organisational commitment. The ‘reform and opening-up’ policy provided opportunities for people to ‘get rich’, as people were no longer bound by ‘iron rice bowl’, and had more opportunities to choose their jobs and occupations which could increase their income. Many people came to Southern China (especially Guangzhou and Shenzhen), as there were many foreign-invested companies which offered higher salary than state-owned enterprises in the inland of China in order to attract the talents they needed. Meanwhile, the transition from the plan economy to the socialist market economy also made it possible for people to run their own business. People’s value was impacted by the massive social change, and this kind of environment encouraged people to believe in the value of pursuing wealth. Unlike China, the UK and the USA had relatively stable social environment in relation to political and economical change. Therefore, the social and cultural context of the UK and the USA might have different effects on knowledge flow because of different value that people held.

Fourth, to some degree the changing cultural context of China was also the backdrop of the effects of social capital on knowledge flow. For instance, the effects of the relational social capital reflected the social context of China. Because of the ‘reform and opening-up’, the pure plan economy of China was transferred to the coexistence of plan and market economy (socialist market economy). Such a change brought in competition to
telecommunication industry in China. Companies (such as CTI, its clients, and its suppliers) were faced with the competition of the market, and with the pressure from the technology development in the telecommunication industry. They depended on as well as competing with each other for survival. Under this kind of situation, norms of professionalism and norms of cooperation were produced to help the organisations to utilise the social capital (knowledge and market share) and to protect the organisations' power resources — specialised knowledge — at the same time. This indicated that the effects of social networks and social capital on knowledge flow to some degree reflected organisational and personal responses to the particular societal environment. This also meant that the context of particular industries and countries should be taken into account in generalising the results of this research. For instance, although there were more or less competitive and dependent relations between companies, it should be noted that the competition and dependency might differ from industry to industry and from country to country, because of various industry regulations, the development of technology, strategies adopted by R&D, and so on.

Last but not least, the power of the system was traced behind the exercise of the other dimensions of power. Understanding the unique cultural context of China helped to explain the effects of the other three dimensions of power, how they were exercised by powerful individuals/groups, and the response of those less powerful. For instance, as above mentioned, because of the reform, competition was brought into telecommunication and other industries in China, aside from her labour market. This kind of change led to the situation that companies relied on and competed with each other for power resources (i.e., knowledge, market share, financial capital, human capital, social capital, and so on).

The cultural context of China also influenced the exercise of the power of processes. For instance, because Chinese emphasised 'guanxi' - good personal relationships, 'guanxi'-based culture had indirect influence on the strong identities of different departments by affecting the way of selecting people. As discussed in Section 10-3.1, the department managers used the power of processes to select their own people, and those selected often had 'guanxi' with the department managers. This kind of 'guanxi'-based
selection helped to develop strong identities of different departments. Because of ‘guanxi’, when there were conflicts between departments/groups, or between the organisations, people tended to protect their group/department’s benefits, in order to maintain the ‘guanxi’-based relationships. Contrary to the ‘guanxi’-based selection in China, selection in the UK/USA was often based on candidates’ knowledge and experience, rather than ‘guanxi’. Therefore, the cultural context of China helped to understand the effects of the power of processes.

The cultural context of China also offered a better understanding of effects of the power of processes related to pay issues. The ‘reform and opening-up’ broke the “iron rice bowl”. The old pay system was discarded in the enterprises in China, especially in foreign-invested companies. However, the pay system and appraisal sometimes still had the problems of subjectivity, static attitude, and lack of communication (Huang, 1994). It was so in the ERP case, because the routine workers’ wage and bonus were not related to their performance. Since to earn more money was the reason why most people chose to work in foreign-invested companies, the unfairness of the pay system easily affected people’s attitude toward cooperation and knowledge sharing. As a planner said,

“As a do-work-for-others (Dagongzai), we have nothing else without money. Of course, wage is the most important thing (for us).” (Senior planner 1, PMC, CTI-Shenzhen)

Again, the cultural context of China served as the backdrop of the effects of the power of processes in organising training and other knowledge sharing activities. As discussed early in this section, because of competition in China’s labour market and telecommunication industry, most employees had an imbalanced work/life. This situation forced employees to rely mainly on the activities (such as training, and inter-departmental/inter-organisational cooperation) organised by the formal organisation to develop networks for sharing knowledge. Therefore, the cultural context of China helped to understand the effects of the power of processes in organising training and knowledge sharing activities as found in this research.
Furthermore, the cultural context of China provided the background in which the power of meaning was exercised. For instance, the different subcultures related to hierarchicalism in the ERP and the 3G case (see Section 10-4.1) reflected the present conditions of organisational culture of foreign-invested companies in China. On the one hand, like many foreign-invested companies in China, CTI recruited local managers and workers; therefore, the management to a certain degree showed hierarchicalism, the historical feature of Chinese culture (see Hofstede, 1991). In other words, among functional departments in the ERP case the management used the power of meaning resided in the hierarchicalism culture to influence people’s perception, and the employees did not even have the will to resist the way of control featured by hierarchicalism. On the other hand, China was in the ongoing process of economy development, a fact which influenced the way people exercised power of meaning: as in the 3G case, the management gave up its hierarchicalism to encourage knowledge sharing (see Section 10-4.1).

In addition, as discussed in Section 8-4.3, there were different subcultures about learning and knowledge sharing between CTI-USA and R&D in CTI-Shenzhen. This discrepancy reflected the value conflicts of people in the course of China’s transition to the socialist market economy. During the Maoist period, the traditional communist values emphasised collective interests which advocated people to help others and share knowledge unselfishly. For instance,

"Before, in our country, we didn’t say ‘studying from others’, but say ‘handing down the classics or sacred books and important knowledge to people’ – I came here to tell you (my) knowledge, and to give you (my) knowledge selflessly. But now, this doesn’t work.” (Senior hardware engineer and adviser, Engineering department, CTI-Shenzhen)

This kind of traditional value underpinned some engineers’ perception about learning and knowledge sharing in CTI-Shenzhen, as they thought engineers in CTI-USA should teach them selflessly. This kind of traditional value was impacted by the different value held by people from CTI-USA. In interacting with people in CTI-USA, the belief of unselfishly offering knowledge to others was wavered.
By and large, the power of the system directly and indirectly influenced knowledge flow. The similar societal effects as found in the 3G and the ERP case showed that the power of the system had such a pervasive feature. The power of the system was also the backdrop against which the other three dimensions of power were exercised and actors interacted with others in the relations of power. It influenced all organisations and individuals, regardless of whether people were aware or unaware of the influence of the power of the system embedded in the changing social context of China. And people’s attempt to resist (such as learning new knowledge to face the competition in labour market and utilising social capital) further confirmed the power of the system (see Figure 10-11). This indicated that knowledge flow and the utilisation of social capital were embedded in the relations of power. Existing studies (e.g., Gray, 2001; Rothschild and Darr, 2005; Swan and Scarbrough, 2005) view the power of the system merely as one of the factors influencing knowledge flow and innovation networks, but ignore the interwoven relations of different dimensions of power which underline the exercise of and response to the power. In this connection, this research tried to advance an understanding of knowledge flow and innovation by taking a more comprehensive approach to view the power relations.

Figure 10-11: The relations between power and knowledge flow
5.4. Summary

This research suggested that the power of the system embedded in the competitive institutional and social context affected knowledge flow by stimulating learning, by weakening organisational commitment, and by impeding the development of companion trust, in order to restrict the development of personal social networks. People's response to the societal effects further reinforced the power of the system. Furthermore, this research showed that understanding the cultural context of China was important to understand the effects of the power of the system; the cultural context of China was also the backdrop against which other three dimensions of power were exercised and actors responded to the power. This suggested that taking a more power-based view to investigate knowledge flow and innovation. Table 10-4 summarises the effects of the power of the system in the 3G and the ERP case.

Table 10-4: Cross-case comparison (the influence of the 4th dimension of power)

<table>
<thead>
<tr>
<th>Cases</th>
<th>Representation</th>
<th>Influence on social networks and structural social capital</th>
<th>Influence on cognitive social capital</th>
<th>Influence on relational social capital</th>
<th>Influence on knowledge flow and other aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>Competition in the labour market</td>
<td>Restricting the development of friendship networks</td>
<td>Leading to lack of companion trust</td>
<td>Stimulating learning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The change of social context</td>
<td>Restricting the development of friendship networks</td>
<td>Leading to lack of companion trust</td>
<td>Weakening commitment</td>
<td></td>
</tr>
<tr>
<td>ERP</td>
<td>Competition in the labour market</td>
<td>Restricting the development of friendship networks</td>
<td>Leading to lack of companion trust</td>
<td>Stimulating learning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The change of social context</td>
<td>Restricting the development of friendship networks</td>
<td>Leading to lack of companion trust</td>
<td>Weakening commitment</td>
<td></td>
</tr>
</tbody>
</table>

6. Chapter Summary

This chapter discusses the effects of the different dimensions of power in the ERP and the 3G case. The results suggested that different dimensions of power affected knowledge flow directly and indirectly through the utilisation of social capital. The effects of social capital and knowledge flow further reinforced the different dimensions of power. The results of
the case comparison also showed that taking into account the cultural context of China was indispensable for understanding knowledge flow.

First, the power of resources had both positive and negative effects on knowledge flow: it impeded knowledge flow (related to specialised knowledge) by influencing norms of professionalism; it also facilitated knowledge sharing (related to work integration) by developing norms of cooperation.

Second, the power of processes also had positive and negative effects on knowledge flow. Selection helped to develop strong identities; the strong identities facilitated intra-departmental knowledge flow, but impeded inter-departmental knowledge sharing at the same time. It also affected knowledge flow because people connected with powerful persons were not willing to accept different opinions. It also directly affected people’s willingness toward learning. Much said, the pay system directly influenced people’s attitude toward knowledge sharing, and also indirectly influenced knowledge flow by developing companion trust and norms of cooperation. Organising training and knowledge sharing activities directly influence knowledge flow. Controlling work procedures negatively influenced knowledge flow by giving rise to lack of shared cause/effects beliefs between people in different functional departments, and by restricting the development of social network ties. It also facilitated knowledge flow through developed formal ties between departments.

Third, the power of meaning resided in the organisational culture and subcultures had both positive and negative effects on different dimensions of social capital. Hierarchicalism culture facilitated internal knowledge flow by developing formal communication networks, and norms of cooperation and companion trust; it also impeded inter-departmental knowledge flow by affecting hierarchical norms and norms of control and compliance, and by restricting informal communication. Different subcultures related to learning and knowledge sharing negatively influenced knowledge flow across different units by developing strong and exclusive identities. Segmentalism culture impeded inter-departmental knowledge flow by affecting the shared interests between functional
departments. By developing distinct and exclusive identities, elitism culture impeded knowledge flow between technology departments and other functional departments.

Finally, the power of the system regarded as competition in the labour market and situated in the social context of China stimulated learning. The change of people’s value reflected the power of the system. It affected the development of companion trust and social network ties, which negatively influenced knowledge flow. China’s unique cultural context provided the background in which the other three dimensions of power took place. ‘Guanxi’-based selection and emphasis on personal relations helped to develop strong internal ties and strong identities which influenced knowledge flow. The ongoing change of social context helped to explain the coexisting but contradictory subcultures in CTI, such as hierarchicalism in functional departments along with lack of hierarchicalism in R&D and CTI-USA. On the other hand, the effects of the power of the system on the utilisation of social capital and knowledge flow confirmed the power of the system.
Chapter 11

Conclusion

1. Introduction

By contrasting the process and project innovation project, the previous two chapters discussed the negative and positive effects of social capital and power relations on knowledge flow and innovation. In this chapter, Section Two discusses the theoretical and practical implications of the findings; Section Three summarises the main contributions of this thesis along with suggestions for further research.

2. The Theoretical and Practical Implications of the Findings

By comparing and contrasting the process and product innovation projects, this research explored the factors affecting knowledge flow and innovation, and the relations between power, social capital, and knowledge flow. There are theoretical and practical implications suggested by the main findings of this research.

First of all, this research demonstrated the complementary relations between the concepts of social networks, social capital, and COP in enhancing the understanding of knowledge flow and innovation. This research confirmed the argument stated in the knowledge management literature that social capital had positive and negative effects on knowledge flow. The results of this research further suggested that based on different norms, the sharing of certain types of knowledge through the network ties was facilitated, while specialised professional knowledge were hoarded, or were difficult to share. Also demonstrated was that strong and separate identities of members of ‘communities of practice’ helped to explain the double-edged effects of internal ties. And, highlighted was the important role of key individuals not only in accessing non-redundant knowledge, but also in overcoming cognitive barriers of knowledge sharing between ‘communities of practice’. The success of product innovation and the problems of the process innovation
can be explained in terms of the effects of identities, cooperative norms, shared understanding and meaning, social network positions, and strategic use of social networks.

Those findings suggested, in practical terms, taking a holistic approach to manage knowledge flow and innovation beyond the limit of networking approach and community approach. Managers should understand the potential benefits as well as drawbacks of strong internal ties, norms, and identities, and make the most of the role of key individuals in facilitating boundary-spanning knowledge flow.

In the literature of knowledge management, the concept of COP seems to be incompatible with other concepts, such as social networks. The findings provided the evidence of the complementary relations between the concept of COP, social capital, and social networks, which therefore allows us to understand the concept of boundary-spanning knowledge flow with a broader definition of boundaries (individual, group, community, organisation, industry, region, or even country).

Furthermore, the different results from the 3G and ERP cases in term of the effects of social capital can be explained by bringing in the concept of different dimensions of power. This stressed the importance of understanding power issues in examining knowledge flow and effects of social capital. The interrelated and interacted relations between power, knowledge flow and innovation, and social capital as found in this research indicated that taking a power-based view was useful and necessary for managing networked innovation and knowledge management. This also suggested that investigating the effects of power relations is essential for the development of the knowledge sharing theory.

More importantly, by illustrating the influence of power on different levels (dimensions), the results of the effects of power relations provided insight for the understanding of knowledge flow and the embedded relations of power. The contradictory results from the two innovation projects highlighted how power relations and exercise of power could produce different effects on knowledge flow and innovation. For instance, it seemed that more political actions and conflicts were involved in the process innovation than in the
product innovation. This difference between the product and process innovation was due to the fact that there were more ‘opposite’ parties involved in process innovation, and that the power of meaning (organisational structure, culture, and subcultures) were used to influence knowledge flow in different ways. From a more pragmatic point of view, these results had several implications for managers. In terms of facilitating knowledge flow for innovation, first, managers need to understand the complex relations between power and knowledge flow, as power relations influence knowledge flow directly and indirectly by affecting different dimensions of social capital. Second, because of the power of system, managers should be aware of the limits of power. To influence knowledge flow and social capital, they should use not only the power of resources (strategic alliance and cooperation) and the power of processes (selection, rewarding, organising knowledge sharing activities, and control processes), but also the power of meaning (organisational culture and structure).

The results regarding the effects of power also had some theoretical implications. Firstly, the results showed the close connections between power, knowledge flow, and the utilisation of social capital. This suggested it is necessary to incorporate notions of power into analysis of knowledge sharing and innovation. Second, discussing the influence of power through different lenses (different dimensions of power), the research showed that a deeper/comprehensive understanding of knowledge flow depended on one’s approaching power from an adequate and pertinent perspective. For instance, the concept of the third dimension of power explained the effects of organisational culture on knowledge flow, while using the concepts of the first and second dimensions of power failed to. The results concerning the effects of the 4th dimension of power also suggested that the power of the system was the backdrop of the exercise of the first three dimensions of power and utilisation of social capital. Similar results reached by analysing knowledge flow in the two innovation projects with the 4th dimension of power, the pervasiveness of the power of the system could be thus proved. Every action (mobilising social networks, control of information, learning, exchanging knowledge, control of process, and shaping culture, and so on) was produced by power relations, and also reproduced the relations of power. Knowledge sharing was embedded in the relations of power. From the 1st and 2nd
dimensions of power to the 3rd and 4th dimensions of power, the level of analysis went deeper, and revealed more about the complexity of knowledge flow. What is particular, bringing the power of the system in the analysis of knowledge flow advanced our understanding about learning and knowledge sharing. In other words, introduce of the concept of the power of the system can shift our understanding about knowledge sharing and innovation from a commodified view to a more holistic and comprehensive view. It improved our knowledge about knowledge flow and innovation by providing the connections between macro-micro actors (between the ‘system’ and individual, group, and organisation).

3. The Contributions of the Thesis and Suggestions for Further Research

By empirically investigating how knowledge flow was facilitated and/or impeded in process and product innovation, this research contributed to the understanding of the relations between knowledge flow, utilisation of social capital, and power relations. In the first place, this research not only illustrated that each of the four different dimensions of power had direct and indirect effects on knowledge flow, but also further disclosed that the power of the system embedded in the cultural context was the backdrop of the contingent effects of social capital and the other three dimensions of power (the power of resources, the power of processes, and the power of meaning). Knowledge flow and effects of social capital in turn confirmed the influence of the power relations. This research went beyond the view that knowledge flow was the consequence of the exercise of the resource/process power and symbolic power. It is suggested that power, social capital, and knowledge flow interacted with each other, and that knowledge flow was embedded in the web of power relations.

This research employed Hardy’s framework (1994; 1996) of the four dimensions of power to examine the power influence at different ‘layers’ - the effects of the exercise of resource/process power and symbolic power, and the power of the system. In spite of simplifying Foucault’s conception of relations of power, Hardy’s framework was still very useful for exploring the relations between power and utilisation of social capital, and for
answering the research questions posed by this research. By revealing the effects of different dimensions of power, this research showed that bringing different notions of power into the analysis of knowledge sharing shed different light on knowledge flow, thereby improving our understanding of knowledge flow and innovation. This research also suggested that a post-structuralistic conception of power opened up our understanding of knowledge flow and innovation. Due to the restriction of the type and the length of this thesis, it could not be more 'Foucauldian'. Further research can go deeper into the investigation of the influence of the power of the system.

Second, this research contributed to the understanding of knowledge sharing in the context of the contemporary China. It was highlighted that the economy development and social change had influence on knowledge flow and innovation. The guan-xi based selection, competitive environment of labour market, and people’s value all had impact on knowledge flow and utilisation of social capital. Because China is more and more closely connected with the rest of the world and plays an increasingly important role in the global economy, understanding knowledge flow and innovation in the contemporary China became crucial for managing knowledge flow and innovation, as well as for developing the literature of knowledge management. Furthermore, the results of this research highlighted the influence of national culture on knowledge flow and innovation. This suggested examining knowledge flow in a different country without losing sight of its national context. This research investigated how power relations influenced knowledge flow and the utilisation of social capital at the micro-level. From the theoretical angle, further research could examine the influence of power at the macro level, such as how power embedded in different national cultures, economy polices, industry regulations, and governance influences knowledge flow. Further work could use cross-cultural comparison study to examine more closely how power relations influence knowledge flow in a different cultural context.

The case study approach was useful for exploring the issues of power related to knowledge flow. It was also very necessary to understand the context and to explain the contingent effects of power relations and social capital. Theoretical sampling and contrasting two
types of cases expand the theoretical generalisability of the results. Of course, this research was limited by the type of the organisation studied. It has been recognised that organisations in a different industry and/or country might have a different context. For instance, in China, different regions and industries varied from one to another, case by case, in terms of economy policies, industry regulations, governance, competitions, and levels of inter-organisational cooperation and cross-nation cooperation. This suggested that a wide range of contexts are worth further analysis. It is advisable to combine both qualitative and quantitative methods in investigating multiple cases in different settings (different industries, regions, and countries) to highly increase generalisability and validity of results. In addition, with the development of economy and technology, power relations change over time. For instance, globalisation increased the degree of interdependence between organisations or countries; on the other hand, the development of technology gives rise to more competition between organisations or between nations. Those affected the power relations between those organisations/counties, as well as boundary-spanning knowledge sharing. It would also be interesting to do a chronicle study on the power issues and knowledge flow to see how power relations evolve over time and affect knowledge flow and utilisation of social capital.
Appendix 1: The outline of the interview questions

1. Asking interviewee’s personal background information: age, education, position in the formal organisation, work experience, and so on.

2. Have you learned some knowledge from the experience of participating in the project? If yes, what kind of knowledge? How do you learn the knowledge – by which way? From whom? And what are the benefits of the knowledge to yourself and to the company? Please give examples.

3. Have you made any contribution (e.g. giving suggestions) to the project? If yes, what kind of suggestions? Please give examples. If no, why?

4. Have you encountered any difficulty in the participation in the project? If yes, what kind of problems? How do you solve it? Please give examples. If no, why? Please give examples.

5. Whom will you seek for advice about the project/your routine work/personal interests/personal life? Why and how? Is the knowledge useful for the project? Please give examples.

6. Is there anyone having asked you for advice about the project/your routine work/personal interest/personal life? If yes, who are they? How do you communicate? Is the knowledge useful for the project? Please give examples. If no, why?

7. How do you describe your social circles? What kind of friends do you have? Are you all working in the same profession? Will you exchange information or knowledge? If yes, please give examples. If no, why?

8. How do you describe the interpersonal relationship in the company? Do people communicate with each other? If yes, how, and how frequently? If no, why?

9. Do you think there is a requirement of renewing knowledge to work in your profession/company? If yes, why? If no, why?

10. Have you felt difficult or easy to communicate with other people (friends and colleagues)? If yes, why? Please give examples.
11. Have you learned something from others outside of the organisation? If yes, who are they and what you have learned? Are they useful for the project or your work? Please give examples. If no, why?

12. How do you view the relationship among people that you nominated? Are they relatives, friends?
Appendix 2: Coding Frame

Social capital and structural dimension of social capital
- Network configuration
  - Size
  - Diversity
- Key roles
  - Gatekeeper
  - Link-pin
  - Liaison
- Types of networks
  - Workflow networks
  - Communication networks
  - Friendship networks
- Characteristics of networks
  - Betweenness centrality
  - Multiplexity

Relational dimension of social capital
- Trust
  - Companion trust
  - Competence trust
  - Commitment trust
- Norms
  - Norms of reciprocity
  - Norms of professionalism
  - Norms of control and compliance
  - Norms of cooperation

Cognitive dimension of social capital
- Shared language
- Shared cause/effect beliefs
- Shared narratives and experience
- Boundary objects

Identity
- Multiple identification
- Exclusiveness
- Connectedness

Communities of practice
- Belongingness
  - Exclusiveness
  - Closeness
- Mutual engagement
• Shared repertoire (shared practice routines, procedures, artefacts, documents, and stories)

**Power relations**

• Source of power
  ■ Power of knowledge
  ■ Power of membership of a particular group/department
  ■ Power of connecting with powerful persons
  ■ Power of centrality of social networks
  ■ Power of hierarchical position

• Dimensions of power
  ■ Power of control resources (e.g. knowledge and information)
  ■ Non-decision-making power
  ■ Power of symbolism and management of meaning
  ■ Power of institutional and social context
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