In Search of a Network Organization for Innovation: A Multilevel Analysis on Transnational Corporations' Global Innovation

Hu, Yimei

Publication date:
2013

Document Version
Early version, also known as pre-print

In Search of a Network Organization for Innovation:

A Multilevel Analysis on Transnational Corporations' Global Innovation

Yimei Hu

PhD Dissertation

International Business Centre

Department of Business and Management

Aalborg University

To my mother Guangqiong Guo

Your love has always been my greatest support

Acknowledgement

A PhD research is a long journey of learning and self-improvement, and it can never be completed without the support and encouragement from others.

First of all, I dedicate my greatest appreciation and gratitude to my supervisor, Prof. Olav Jull Sørensen, for his continuous support and confidence in my potential during the past three years. He offered me an opportunity of being a PhD student in Denmark, and encouraged me during the whole process with vision, trust, courage, ambition and inspiration. I was inspired by his profound knowledge, but more importantly, I benefited and learnt a lot from his professional attitude towards research, strong sense of responsibility, and great personality, which will further influence me in the rest of my life. Whenever I feel frustrated in the research, he can always bring me positive energy. Without his guidance and support, I can never grow into a young researcher with critical thinking and basic research skills.

I would also like to thank my colleagues from the International Business Centre, for providing a friendly, collaborative and inspiring academic environment. They gave me inspirational ideas and comments during various forms of informal and formal research communications and seminars. I would like to thank John Kuada, Svetla Marinova, Romeo V. Turcan, Arnim Decker, Reimer Ivang and Li Thuy Dao, for their valuable suggestions and comments on my PhD project and research papers. In addition, I appreciate the PhD students Jimmi, Rana, Andrea, Daojuan, Eva, Marisol, Heather, Jonas and Charlotte for their friendship and support. I felt really happy and inspirational to work with them. Particularly, I would like to thank Jimmi for his efforts on the Danish summary of this dissertation. Moreover, many thanks to the administration staff, Michael, Birgitte, and Helle, for their everyday administrative support.

Particularly, I would like to thank Prof. Björn Johnson from the IKE group, for his valuable comments and inspirational suggestions during my PhD research. Besides, I thank my Chinese colleagues from Tsinghua University, Jizhen Li, Si Zhang and Jinxi Wu, for their research collaboration, suggestions and friendship, which encouraged me to continue on working in academia.

I am also grateful to the support from the case companies and business managers. Their dedication of resources is essential to the completion of this PhD project. Moreover I would like to express my gratitude to the Sino-Danish Centre for Education and Research (SDC) for the great support during the whole PhD process.

I would also like to take this valuable opportunity to thank my Chinese friends in Denmark. Their friendship has always been an endless support which makes me never feel lonely in this beautiful country. In particular, I am grateful for the support,

accompany, and love from Mr. Lei Shuai. Besides the completion of my PhD, you are the greatest gift over the past three years.

Last but not least, I am thankful for all my family members whom I am proud of. Love and gratitude for all of them, especially my parents Guangqiong Guo and Xiaosha Hu, and my grandparents Cheng Li and Shouling Chen. Every little success of my life can hardly been separated with your continuous love, support and expectations. Your support has always been the greatest motivation in my life.

Thank them all sincerely!

Yimei Hu

June, 2013

Abstract

Network organization has been a popular research topic for a long time, and the literature has shown that there is a positive relationship between network organization and innovation performance of innovation actors. Yet, as a buzzword, network organization is always very loosely defined in the existing literature, and its definition is highly debatable, especially when it refers to companies' internal organizational design. This PhD dissertation is an exploratory study on network organization for innovation, aiming to investigate the following two research questions:

- How do transnational corporations perceive/design a network organization to facilitate their global innovation?
- To what extent and how can we manage a network organization?

Research focus of the dissertation is on transnational corporations' network organization for innovation. The first research question aims to clarify the meaning of network organization for innovation, and based on that, this dissertation further explores the management of a network organization. The two research questions are further discussed and answered within five papers as follows:

Researching the meaning of network organization:

Paper 1 investigates the meaning of network organization for innovation through an extensive literature review, and summarizes a three-level framework to understand network organization for innovation, i.e. contextual level (networks as the global innovation context), interorganizational level and intraorganizational level (internal network organization). Based on Paper 1, the two main research questions are answered using the three levels in the remaining four papers.

The complex triple helix interactions across national borders constitute the global innovation context that transnational corporations are embedded in. Based on the description and analysis of the Danish triple helix's innovation activities in China, *Paper 2* proposes a stage-model of the internationalization of the triple helix, consisting of three stages, i.e. pioneering, exploration and integration stage. In the pioneering stage, we see the establishment of each of the three helix spheres abroad, i.e. internationalization of companies, universities and governments; in the exploration stage, the three spheres start to interact abroad and collaborate with counterparts in the host country; and finally, in the integration stage, helix to helix collaboration emerges.

Paper 4 explores how transnational corporations perceive and design an internal network organization to facilitate global innovation. Based on a multiple case study of three Danish transnational corporations' global R&D organization, this paper shows three types of network organization design that facilitate global innovation, i.e. market-led,

directed and culture-led network organizations. Moreover, different types of network organizations are showing that organizations are dual and even ternary systems of three coordination modes, i.e. the market, the hierarchy and the network modes.

Paper 5 explores how an SME develops a network organization consisting of both interfirm innovation networks and an internal network organization to facilitate its global innovation strategy. Regarding the intraorganizational network organization, market mechanism is adopted to optimize internal resource allocations. It also establishes different types of ties such as formal, informal, deep and wide ties with external innovation partners.

Researching the management of network organization:

Generally speaking, traditional management styles such as commanding and directing are not suitable for network organizations, and therefore new managerial styles such as orchestration, coordination and facilitation are emerging in network organizations. *Paper 3* investigates the management of one specific type of interorganizational network organizations, i.e. strategic technological partnership, and explores how relational competitive advantages are generated from two essential stages, i.e. relational rents generation and relational rents appropriation. In order to successfully generate and appropriate relational rents, partnering firms need to integrate three coordination modes, i.e. resource commitment, contract, and trust. *Paper 5* investigates the management of network organization by exploring the meaning of orchestration capability in network organizations. Orchestration capability ensures knowledge mobility, innovation appropriability and network stability. This paper argues that orchestration capability can and needs to be applied in both intra-and interorganizational network organizations.

The way the dissertation has been designed has given rise to both theoretical and practical implications. Regarding the theoretical contribution, the dissertation expands our knowledge by contributing to the theories of global innovation organization and management. For example, the dissertation expands the triple helix model by adding an internationalization dimension, and elaborates and expands the emerging concepts of relational competitive advantages and orchestration capabilities. The findings of the dissertation also suggest that in order to improve their innovation activities, transnational corporations need to have a network mindset and facilitate global innovation in three ways: searching for innovation resources in the global business environment, establishing technological partnerships, and designing an internal network organization. Therefore, these findings may serve as guidelines for business managers and policy makers.

Resumé (Summary in Danish)

Netværksorganisationer har været et populært forskningsemne I lang tid, og dets positive relationer med centrale virksomheder eller et netværk af innovatørers succes er bevist i litteraturen. Dog er begrebet "netværksorganisation" som et modeord altid løst defineret i den eksisterende litteratur, hvor dennes definition er yderst diskutabel, specielt når det kommer til virksomheders interne organisatoriske design. Denne ph.d.-afhandling er et eksplorativt stadium af netværksorganisationer for innovation, som sigter mod at undersøge de følgende to forskningsspørgsmål:

- Hvordan opfatter/designer transnationale selskaber en netværksorganisation til at facilitere deres globale innovationsaktiviteter?
- Hvordan og i hvilken grad kan vi styre en netværksorganisation?

Denne afhandling afgrænser forskningen til transnationale selskabers netværksorganisationer for innovation. Det første forskningsspørgsmål sigter mod at tydeliggøre forståelsen af begrebet netværksorganisationer for innovation, og baseret på dette vil denne afhandling yderligere undersøge ledelsen af en netværksorganisation. De to forskningsspørgsmål er yderligere operationaliseret i fem artikler:

- Vedrørende betydningen af en netværksorganisation:

Artikel 1 udforsker betydningen af netværksorganisationer for innovation gennem en grundig litteraturundersøgelse, hvilket opsummeres via en tredelt model for at forstå netværksorganisationer for innovation. Denne opdeles i et kontekstuelt niveau (netværk som den globale innovationskontekst), et interorganisatorisk niveau og et intraorganisatorisk niveau (intern netværksorganisering). Baseret på *Artikel 1* bliver de to primære forskningsspørgsmål besvaret gennem de tre niveauer i de sidste fire artikler.

De komplekse triple helix interaktioner på tværs af nationale grænser udgør den globale innovationskontekst som transnationale selskaber er indlejret i. Udsprunget af dansk triple helix innovationsaktivitet i Kina viser *Artikel 2* en fase-model af internationaliseringen af triple helix, som består af tre faser, navnligt "pionér-, udforsknings- og integrations-fasen". I pionérfasen ser vi etableringen af hver af de tre helix sfærer i udlandet, dvs. internationalisering af virksomheder, universiteter og regeringer. I udforskningsfasen starter de tre sfærer med at interagere i udlandet og samarbejde med sine pendanter i værtslandet. I integrationsstadiet begynder et helix til helix samarbejde at opstå.

Artikel 4 udforsker hvordan transnationale selskaber opfatter og designer en intern netværksorganisation til at facilitere global innovation. Denne artikel viser, baseret på flere case studier af danske transnationale globale R&D organisering, tre typer af netværksorganisationsdesigns som kan facilitere global innovation: markedsdrevne-,

styrede- og kulturbaserede netværksorganisationer. Ydermere viser forskellige typer netværksorganisationer at organisationer er dobbelte eller endda tertiære systemer bestående af tre koordinationsprincipper: marked, hierarki og netværk.

Artikel 5 undersøger hvordan en SMV udvikler en netværksorganisation bestående af både eksterne innovationsnetværk og interne innovationsnetværk for at facilitere dennes globale innovationsstrategi. Vedrørende den intra-organisatoriske netværksorganisering bliver markedsmekanismer adopteret mhp. at optimere intern ressourceallokering. Denne etablerer også forskellige typer bånd såsom formelle, uformelle, dybe og brede bånd med eksterne innovationspartnere.

- Vedrørende ledelsen af netværksorganisationer:

Generelt set er traditionelle lederstile såsom den administrerende lederstil ikke passende til netværksorganisationer, hvorfor nye lederstile så som orkestrering, koordinering og facilitering udspringer fra netværksorganisationer. *Artikel 3* undersøger ledelsen af en specifik type inter-organisatorisk netværksorganisation, et strategisk teknologisk partnerskab, og udforsker hvordan relationelle konkurrencemæssige fordele bliver skabt gennem to essentielle stadier: relationel værdiskabelse og relationel værdiappropriering. For successfuldt at kunne skabe og appropriere relationelle værdier skal partnervirksomheder undersøge tre koordinationsformer: ressourceengagement, kontrakt og tiltro. *Artikel 5* undersøger ledelsen af netværksorganisationer ved at undersøge betydningen af orkestreringsevne i netværksorganisationer. Orkestreringsevne sikrer vidensmobilitet, innovationsappropriering og netværksstabilitet. Denne artikel viser at orkestreringsevne kan og skal anvendes i både intra- og interorganisatoriske netværksorganisationer.

Denne afhandling har både teoretiske og praktiske implikationer. Vedrørende det teoretiske bidrag udvider denne afhandling teorier om globale innovationsorganisationer og ledelse heraf. Resultaterne fra denne afhandling indikerer at transnationale selskaber skal have et netværksmindset og kan facilitere global innovation på tre måder: søgen efter innovationsressourcer i den globale forretningsverden, etablere teknologiske partnerskaber og designe en intern netværksorganisation. Derfor kan denne afhandling også give indsigt for forretningsledere og til udvikling af nye politikker på området.

List of Tables

List of Figures

Table of Contents

1. Introduction

The aim of Chapter 1 is to initiate this dissertation on network organization, including an explanation of the background behind the selection of this topic; the empirical manifestations of network organization for global innovation; and a discussion of the theoretical conceptualizations that the research communities have developed.

The topic of this dissertation focuses on three buzzwords: transnationalization, innovation, and network organization. These buzzwords are used by both business managers and researchers, however, they are often loosely defined by many (even researchers) while at the same time research communities take the concepts seriously. Furthermore, these three buzzwords are widely used in a number of scientific disciplines, making the task of identifying the main research streams complex.

In Chapter 1, the buzzwords will be presented, and at the same time, they will be grouped in order to outline the topic for the dissertation. On the basis of discussing the research background, two major research questions of this dissertation will be presented. At last, the structure of this PhD dissertation will be introduced.

1.1 Research Background

1.1.1 Globalization

Globalization, on the one hand, refers to the actual structural changes, for example "the broadening and geographical inter-linkages of products, markets, firms and products" (Papaconstantinou, 1995), that are occurring within the sphere that the global economy is organized and integrated; and on the other hand, globalization means the neo-liberal, free-market ideology of the globalization project (Dicken, 2011). With the ongoing trend of globalization, the world nowadays is flat (Freidman, 2005). Yet, when did globalization start? According to Friedman (2005), we may trace it back to the fifteenth century, when Christopher Columbus set sail and discovered the New World. Since then, the trade between the Old and New world, and colonization driven by countries and governments unveiled the mysterious "Orient", and integrated the world for the first time in human history. This is what we call the Globalization 1.0, which was driven by countries and governments, and lasted until the nineteenth century. The second wave of globalization (Globalization 2.0) is reducing the size of the world further still. The driving force behind this is multinational corporations that are seeking overseas markets and labor forces. In this era, the world is connected by massive material, financial and informational flows. It results in a growing world-wide integration and interpenetration of economic activities.

As we entered the new millennium, the Globalization 3.0 arrived quickly and quietly, shrinking the world to a tiny one and leaving no business as an island (Håkansson et al.

2009; Håkansson & Snehota, 1989). Due to the revolution of information and communication technology, we can get in touch with friends who are thousands kilometers away by clicking on keyboards; we may work with colleagues located in another continent seamlessly; and we are able to know the latest news as soon as it happens with the help of the World Wide Web. Individuals all over the world are connected by the information network. Nowadays, individuals, together with newly-emerged small and medium-sized enterprises (SMEs) are empowered to act globally and transnationally in a borderless world market, together with big global companies.

1.1.2 Going transnational

Along with the globalization trend, the competitive landscape and global business environment is being reshaped. This brings about new challenges and requirements for transnational corporations in terms of both strategic and organizational changes (Bartlett & Ghoshal, 2002). On one hand, the fast-changing global business environment has drawn more and more companies beyond their national borders. On the other hand, the increasing complexity of relationships between companies or other organizations challenges the ways to manage across organizational boundaries. In order to keep a competitive position nowadays, a "transitional solution" emerges to be the solution for more and more companies according to Bartlett and Ghoshal (2002).

Table 1.1. Multinational, global and international companies.

Organizational Characteristics	International	Multinational	Global	Transnational
Configuration of assets and capabilities	Sources of core competencies centralized, others decentralized	Decentralized and nationally sufficient	Centralized and globally scaled	Dispersed interdependent, and specialized
Role of overseas operations	Adapting and leveraging partner company competencies	Sensing and exploiting local opportunities	Implementing parent company strategies	Differentiated contributions by national units to integrate worldwide operations
Development and diffusion of knowledge	Knowledge developed at the center and transferred to overseas units	Knowledge developed and retained within each unit	Knowledge developed and retained at the center	Knowledge developed jointly and shared worldwide.

Source: Bartlett & Ghoshal, 2002, pp: 75

From Table 1.1, we can see that international, global, multinational and transnational corporations have different organizational characteristics in terms of the configuration of assets and capabilities, roles of overseas operations, and development and diffusion of knowledge (Bartlett and Ghoshal, 2002). Transnational organization evolves from its predecessors, i.e. the international, multinational, and global organizations, but has many different features. Ostensibly, transnational corporations (TNCs) are located within different national contexts and knowledge networks. The globally distributed subsidiaries of TNCs are interdependent to each other in terms of competencies and knowledge resources, and one key task of these subsidiaries is to both exploit and explore knowledge resources from host countries. Yet, Bartlett and Ghoshal (2002) argues that,

> The transnational is not a specific strategic posture or a particular organizational form. In essence, the transnational is a new management mentality.

Under such a transnational management mentality, more and more companies evolve into TNCs and emerge to be a main actor of the global business. Since TNCs are facing a high-velocity market and a higher degree of complexities and uncertainties, they are firstly required to develop the strategic capabilities of global competitiveness and worldwide learning through various forms of innovation, i.e. developing new products or services to adapt to customer's new needs, opening new markets, improving production processes, and designing new organizational forms. This makes critical and valuable knowledge resources as sources of competitive advantages. Global companies that are used to functioning in a market-seeking and labor force-seeking manner are now turning to knowledge-seeking with the purpose of enhancing their innovation capabilities and competitive stances. As a result, we see an increase in the R&D offshoring activities such as home-base exploiting and home-base augmenting activities (Kuemmerle, 1999) implemented by globally distributed R&D subsidiaries under different strategies (Nieto & Rodr ́guez, 2011). More and more TNCs are establishing R&D centers in emerging economies such as China (Reddym 2011; von Zedtwitz, 2004) and those Chinese R&D subsidiaries or laboratories are evolving from support laboratory, to locally integrated R&D laboratory and international interdependent R&D subsidiaries (Dicken, 2011).

As strategies evolves from international, global and multinational to transnational, companies' organizational structures respectively evolve from a functional and divisional structure, to a matrix structure and network model (Dicken, 2011, pp: 139-140). In order to establish transnational organizations with multidimensional management perspectives and organizational capabilities that can facilitate innovation, companies need to adjust their internal organizational design to a more flexible and efficient one that enhances learning, knowledge sharing and adaptability to an external complex environment (Child & McGrath, 2001; Feneuille, 1990). No wonder we see that the traditional mode of vertical integration is being substituted by vertical disaggregation and different forms of networks among globally distributed business units. Regarding TNCs' global R&D

organization, a centralized R&D is now being transformed into a polycentric R&D with multiple R&D centers or hubs, and is becoming further developed into an integrated network R&D model with a more flexible coordination (Gassmann & von Zedtwitz, 1999). However, since organizational design and arrangement are contingent on different firms, and the situations are even more complicated when regarding TNCs that are embedded in different contexts, there is no universal "best practice" for a network organizational design.

Moreover, globalization is a strong force that helps to introduce collaboration among various types of organizations, since it opens a door for TNCs to identify and seek resources, in particular knowledge resources for innovation on a global scale (Rycroft & Kash, 2004). Due to increasing uncertainties, costs and risks of the innovation or R&D related tasks, it is almost impossible for a firm to do everything by itself. Furthermore, since critical and specialized knowledge resources required for innovation may not lie within the boundaries of a particular firm, firms need to utilize external knowledge resources by cooperating with external partners. Close relationships with other companies or organizations are potentially useful external R&D resources which can be used in various ways in order to achieve internal innovation purposes (Håkansson & Laage-Hellman, 1984). Based on this logic, the transnational mentality is no longer the privilege of big companies. Small and medium-sized companies can also be transnational through establishing innovation networks with global partners.

In general, the collaborative relationships among firms or other institutions, and TNC's globally distributed business units aiming at innovation can be referred to as innovation networks or network organization for innovation. To some extent, innovation networks are coevolving with the globalization trend (Rycroft & Kash, 2004). Transnational technological partnerships and other forms of innovation networks bring more globalized markets and institutions into being; while on the other hand, the globalization trend encourages more collaborative innovation due to increasing uncertainties and dispersal of valuable knowledge resources.

1.1.3 Network organization and innovation in theory

Schumpeter's definition of innovation covers five aspects: 1. introduction of a new good or an improved quality of product; 2. the introduction of a new way of producing; 3. opening new markets; 4. finding new supply resources; 5. designing a new industry organization (Schumpeter, 1934). These five aspects of innovation can be summarized as: product innovation, process innovation, market innovation, input innovation and organizational innovation (Drejer, 2004). Similarly, OECD (2005) defines innovation as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations". Though most research is focusing on product and process innovation, we should not ignore other forms of innovation such as

organizational innovation through developing network relations with external partners. It is also worth noting that innovation is different from invention which is "the first occurrence of an idea for a new product or process" (Fagerberg, Mowery, & Nelson, 2006). Innovation must be something that has already come into reality and brings about changes. Thus, the process of innovation can be regarded as the commercial application of new or existing knowledge (Love & Roper, 2001), while a new idea is not an innovation or is just the early stage of an innovation.

Apart from the definition, scholars have noted a set of ongoing transitions in the innovation paradigm and concepts since the 1980s (Freeman, 1991; Powell & Grodal, 2005): from information to knowledge, from training and development to learning, from national to transnational, from technology push to market pull, from linear to evolutionary (Doz, 1996), from competitive to collaborative or "coopetition" (Bengtsson & Kock, 2000), from single innovative hero to "networks of innovators" (Freeman, 1991), from core competence to relational competitiveness (Dyer & Singh, 1998), and corresponding organizational change from vertical integration and hierarchy to network organizations (Håkansson & Laage-Hellman, 1984; Miles & Snow, 1992; Rothwell, 1994)

Imai and Baba (1989) define a network organization as a basic institutional arrangement to cope with systemic innovation, and there has been a substantial amount of research showing the positive relationships between network organization and firms' innovation performances (Hagedoorn, 2002; Nieto & Rodríguez, 2011; Powell et al., 1996). The two key elements of a network are nodes (or actors) and ties (or relationships). Networks and network organizations comprehend the following concepts, as taken from the existing literature: inter-firm or multi-firm alliances or communities, strategic alliances or partnerships, strategy networks (Jarillo, 1988), interorganizational networks, dynamic networks (Miles & Snow, 1992), value networks, joint ventures, consortia, clusters, etc. However, it is hard to track the theoretical origins of the concepts of innovation networks and network organization, since they are inter-disciplinary concepts that appear in different theoretical domains, i.e. innovation theories, economic theories, organizational theories, sociology, marketing and international business theories.

Innovation theories such as national systems of innovation, triple helix, open innovation, user innovation, and innovation diffusion are all taking "networks" into account. In the national systems of innovation theory, inter-firm relationships including informal exchange of technical know-how are key elements of an innovation system (Lundvall, 2010). Furthermore, industrial networks are a description of sub-systems of national innovation systems (Gelsing, 1992). The triple helix theory in essence is the network that comprises university, industry and government (Etzkowitz 2002). Open innovation suggests that firms utilize external knowledge resources to facilitate innovation, and different networks are shaping open innovation, i.e. in an interorganizational context, knowledge networks, value networks, etc. (Chesbrough, 2003;

Chesbrough, Vanhaverbeke, & West, 2006). In addition, open innovation scholars specify different inter-firm ties for exploitation and exploration (Chesbrough et al., 2006). User innovation theory emphasizes the bottom-up innovation potential of users and declares the coming of democratized innovation (von Hippel, 2005). Rogers (1995) argues that innovation is communicated and diffused by different social networks and channels.

Organizational and strategic management scholars are moving from firms' internal organizational design and management to an interorganizational level of analysis. One of the main arguments is that innovation tends to be limited in mechanistic forms of organization where high levels of hierarchical control, clearly defined roles and tasks, and centralized decision-making impede flexibility and creativity (Hatch & Cunliffe, 2006). Thus organizations respond to the high-velocity global business environment and rapid technological development by evolving from centrally-coordinated hierarchies into network organizations that are characterized by flexibility, flatness, dynamism, and vertical-disaggregation (Biemans, 1996; Miles & Snow, 1986, 1992). Network organization can be regarded as an example of organizational innovation, which not only refers to the minimization of firms' internal layers of hierarchies, but also suggests various newly-emerging quasi-organizations that consist of multiple organizations, such as outsourcing, strategic alliances, strategic technological partnerships, global value chains, virtual organization, etc. (Child, Faulkner, & Tallman, 2005; Child, 2005; Gereffi, Humphrey, & Sturgeon, 2005; Scott & Davis, 2007; Sydow & Windeler, 1998). However, the definition of network organization is still ambiguous and confusing. Some scholars think the so-called "network organization" is nothing new other than "bureaucracy-lite" (Hales, 2002), since hierarchy continues to "perform a number of seemingly indispensable functions" (Child, 2005, pp: 59). Some think that an organization is in nature consisting of social networks and economic networks (Borgatti & Foster, 2003).

In line with the organizational scholars that move from an intraorganizational to an interorganizational level of research, strategic management scholars also suggest that a firm's sustained competitive advantages not only comes from valuable, rare, inimitable and nonsubstitutable resources that an individual firm holds (Barney, 1991), but also from idiosyncratic long-term oriented strategic alliances and relational rents that are generated jointly with partners (Dyer & Singh, 1998; Lavie, 2006). In order to successfully establish innovation networks and maintain them, firms are required to cultivate some network-related capabilities, such as relational capabilities (Capaldo, 2007), orchestration capabilities (Dhanaraj & Parkhe, 2006; Ritala, Armila, & Blomqvist, 2009), and partner-specific absorptive capacities (Dyer & Singh, 1998).

The emerging networks have also attracted the research interests of scholars from economics, international business and marketing, which triggered discussions on the differences between networks and traditional market and hierarchies. Though some

economists regard network as an intermediate form that lies in between market and hierarchy (Imai & Baba, 1989; Thorelli, 1986; Williamson, 1991), more and more scholars are regarding network as a distinct organizational form and organizing mechanism with its own rationales (Powell, 1990; Powell & Grodal, 2005). Moreover, some scholars are trying to break firms' existing boundaries and integrating firms' intraorganizational networks and networks with external partners. International business environment and global market are then regarded as network organizations and context that firms are embedded in (Achrol, 1997; Ford & Håkansson, 2006; Håkansson et al., 2009; Johanson & Vahlne, 2003). Under such a network perspective, a TNC's intraorganizational networks of globally distributed business units are seen as "interorganizational networks" (Ghoshal & Bartlett, 1990), and this network is embedded in a global business and market with massive networks of knowledge flows, physical resources and interfirm relationships. As a result, we can say that TNCs are "networks within networks" (Dicken, 2011).

1.2 Research Questions and Delimitation

Based on the above discussions, we can see that: firstly, innovation has been the new requirements for TNCs to achieve competitiveness in the global market; secondly, designing a network organization to facilitate innovation has become a common/popular understanding by companies and researchers, and in particular, TNCs are leveraging competitive advantages from its global network organizations (Papanastassiou & Pearce, 2009); thirdly, the research attempts on conceptualization and theorization of network organization have resulted in diversified and even contradictory findings and conclusions (Borgatti & Foster, 2003; Sydow & Windeler, 1998). As a result, this PhD dissertation will try to explore the concept of "network organization" by investigating the following two main research questions:

1. *How do transnational corporations perceive/design a network organization to facilitate their global innovation?*
2. *To what extent and how can we manage a network organization?*

Regarding the first research question, I firstly try to find a meaning for the concept of network organization based on reviewing the existing literature, and then explore how business managers understand the network organization in practice. Having refined the concept of network organization, I will go one step further to investigate an even more ambiguous problem, the management of network organization. In order to answer the second research question, I raise the question of whether a network organization is "manageable". Next, I will explore whether the management of a network organization involves new concepts compared to traditional management principles in hierarchical organizations. Finally, I will explore the key issues related to the management network organization.

Since network organization is an interdisciplinary research topic, in this PhD dissertation the empirical setting is delimitated in TNCs' network organizations aiming at innovation. Innovation here is loosely understood as value-adding activities that make a change to existing products, process, business relations, organizational structures, market segmentations, etc. Thus, network organization in nature can be seen as an organizational innovation that further facilitates product and process innovation and developing new markets. As the two research questions are exploratory in nature, case studies will be chosen as the research strategy of this PhD research. A detailed methodological discussion will be provided in Chapter 2.

This dissertation is based on Schumpeter (1934) and OECD (2005)'s definition of innovation which has five categories, i.e. product innovation, process innovation, input innovation, market innovation and organizational innovation. In simple words, innovation brings about value-adding changes. In line with this, R&D mainly refers to the concepts of product innovation and process innovation in this research. Management in this dissertation is broadly understood as purposeful human activities aimed at orchestrating and coordinating people to accomplish desired objectives and goals through utilizing resources effectively and efficiently.

1.3 A Paper-based Dissertation

This PhD dissertation is paper-based and comprises five papers. The five papers aim to contribute to the understanding of network organization and its management through several specific topics and sub-research questions. All five papers have been presented in conferences, and some have been submitted to or published in journals. An overview of the five papers is provided in Table 1.2.

As we can see from Table 1.2, each paper has its own research aims and questions, while at the same time it contributes to either one or both main research questions of this dissertation. The research questions of Paper 1, 2, 4 and 5 are listed as follows:

- Paper 1
    - *What is the current research status of network organization for innovation?*
    - *What is the theoretical foundation of network organization for innovation?*
    - *What does "network organization" mean in the existing literature?*
- Paper 2
    - *How can we understand the Triple Helix model from an internationalization perspective?*
- Paper 4
    - *How do business managers understand the concept of network organization for innovation?*

- *Are there any different ways of designing a network organization other than adopting an internal market?*
- *How can we understand the relationship between market, hierarchy and network within an organization in business practice?*

- Paper 5
  - *How can an SME foster open innovation through a network organization?*

These four papers mainly contribute to the first main research question of this dissertation, i.e. how do transnational corporations perceive/design a network organization to facilitate their global innovation? This question is answered both from the theoretical perspective (Paper 1) and practical perspective (Paper 2, 4, 5).

The second main research question of this dissertation, i.e. to what extent and how can we manage a network organization, is answered in Paper 3 and 5 by investigating the following sub questions:

- Paper 3
  - *How are relational competitive advantages generated through rents generation and appropriation on a dyadic (relational) level?*
- Paper 5
  - *How can we make sense of orchestration capability in both multifirm innovation networks and an internal network organization for an SME?*

Paper 3 and 5 seek mainly to understand the management of network organizations through the exploration of two specific topics, i.e. generating relational competitive advantages from a technological partnership (Dyer & Singh, 1998; Lavie, 2006), and orchestration capability (Dhanaraj & Parkhe, 2006; Ritala et al., 2009).

From the above discussions, we can see that the three research questions can be grouped according their contributions to the two main research questions of this dissertation. In line with Table 1.2, the five papers shown in Figure 1.1 are colored with blue, red and yellow corresponding to the two main research questions. The blue papers, i.e. Paper 1, 2 and 4, mainly contribute to the first research question from both a theoretical and a practical perspective; while the red paper (Paper 3) answers the second research question. Of the five papers, Paper 5, which is colored yellow, contributes to both research questions.

In addition, the five papers differentiate according to their level of analysis as shown in Figure 1.1. In general, the five papers cover three levels of network organizations, i.e. network context, interorganizational and intraorganizational levels.

Paper 1 entitled “In search of a network organization for innovation: A literature review” is a literature review aiming to understand the meaning and research status of network organization for innovation from the theoretical perspective. This paper provides an overview of different arguments on network organization, including the definition, main research topics and theoretical background. In particular, this paper identifies three levels’ of understanding of a network organization. The first level is intraorganizational network organizational design which refers to a TNC’s global R&D network organization in this research. The second level is interorganizational networks between the focal firm or business unit and its innovation partners. The third level is constituted by the whole business environment/system as overlapping networks that firms and other innovation actors are embedded in (Forsgren & Johanson, 1992).

The following four research papers focus on different levels of network organizations (See Figure 1.1). Intraorganizational network organization refers to a TNC’s organization for globally distributed R&D subsidiaries and laboratories. Interorganizational networks refer to the collaboration between TNC’s R&D subsidiary and local firms, universities or other institutions. The overlapping networks of innovators are regarded as the context that provides innovation opportunities for TNCs’ R&D subsidiaries.

Paper 2 aims to integrate the internationalization theory together with the triple helix model for innovation, and proposes a stage model for the triple helix internationalization, which can be regarded as the internationalized triple helix model as network context for global innovation. Paper 3 explores one specific type of interorganizational network organization, i.e. strategic technological partnership between companies from developed and developing countries, by focusing on the generation of relational competitive advantages. Paper 4 explores the intraorganizational network organization by investigating TNCs’ global R&D organization. Paper 5 integrates both intra-and inter-organizational networks, and explores a specific managerial concept: orchestration capability.

Table 1.2. An overview of papers.

Paper No.	Title	Focus on research questions	Research Aims	Research method	Dissemination status
1	In search of a network organization for global innovation: A literature review	1	Investigate the meaning as well as the research status and theoretical background of network organization for innovation in existing literature.	Literature review.	Conference paper
2	Triple Helix Going Abroad? The Case of Danish Experiences in China	1	Try to propose a framework of the internationalization of the triple helix model.	Theory building through empirical evidences from Danish Triple Helix actors' innovation-related activities in China.	Conference paper, and then submitted to Journal
3	Gaining relational competitive advantage: A case of China-Denmark strategic technological partnership	2	Investigate the generation of relational competitive advantages on a dyadic (relational) level by focusing on two essential stages: rents generation and appropriation.	An explorative case study on a strategic technological partnership between a TNC and a Chinese corporation. Expand existing theories.	Conference paper, and then submitted to Journal
4	Exploring Network Organizations in Practice: the Duality and Triplicity of Market, Hierarchy and Network	1	Explore TNCs' internal network organizations in practice.	Multiple case studies on three TNCs' organizational design for global innovation, with the aim of expand existing theories.	Conference paper
5	Specifying Orchestrating Capabilities in a Network Organization: A single case study on SME's open innovation	1&2.	To show how an SME fosters open innovation by designing a network organization, and try to make sense of orchestration capability in both multifirm innovation networks and an internal network organization.	An explorative case study on an SME's practice on both intra-and inter-organizational network organizations.	Published in journal

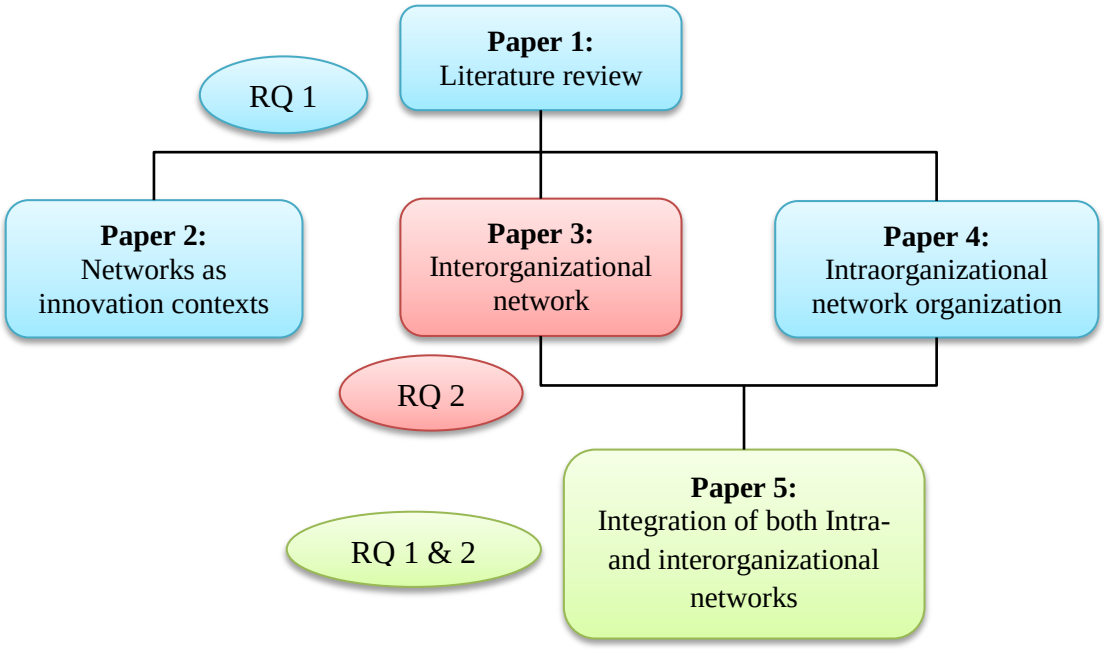


Figure 1.1. Research focus and relationships of the five papers.

1.4 Dissertation Structure

Figure 1.2 shows the overall structure of the dissertation. This dissertation consists of eight chapters, including the five papers shown in Figure 1.1.

After the introduction chapter, the author will discuss methodology. Since the two research questions are "how" questions with the aim of "understanding" and "exploration" rather than "explanation", the case study strategy will be adopted with the purpose of theory building (Eisenhardt, 1989; Yin, 2008). The rationale of the case study, the data collection, data analysis and theory building process will be discussed in detail in Chapter 2.

Following the methodological discussions, there will be five chapters (Chapter 3-7) showing five papers. Each of the five chapters is comprised with three parts: an introduction to the paper, the paper, and a reflection on the paper. Chapter 3 (Paper 1) will provide an overview of existing research on network organization and its theoretical background. Chapter 4, 5, 6 and 7 consist of four empirical research papers that provide answers to the two main research questions of this dissertation together with Chapter 3. Each paper will be introduced firstly in its respective chapter, and then reflected after.

The final chapter will summarize the main findings of this dissertation and reflect on the research questions. This will also include discussions on the theoretical and empirical contributions of this dissertation. Moreover, the limitations of this dissertation will be reflected, and based on that, future research possibilities will be presented.

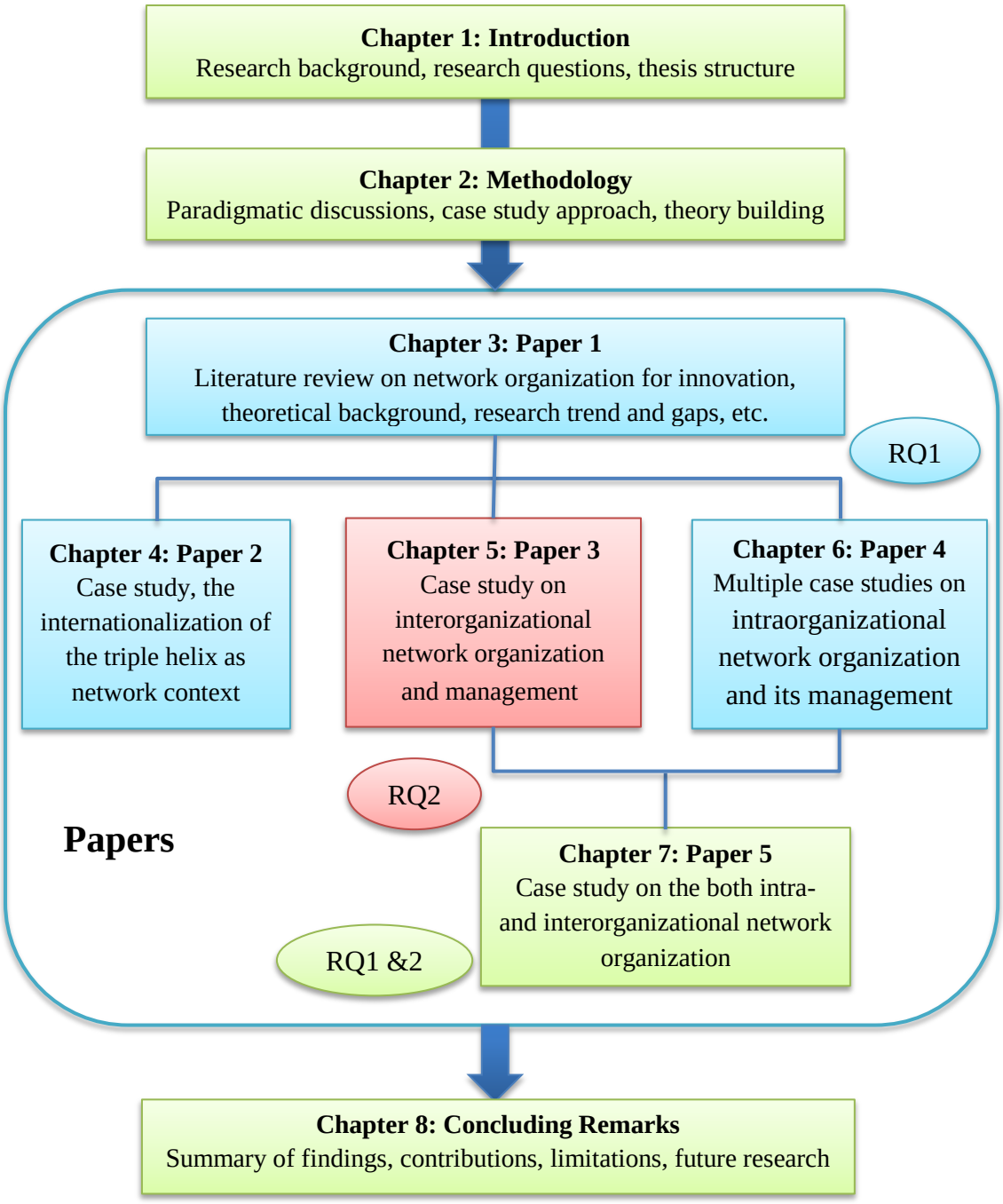


Figure 1.2. Dissertation structure.

References

Achrol, R. S. (1997). Changes in the theory of interorganizational relations in marketing: Toward a network paradigm. *Academy of Marketing Science Journal, 25*(1), 56-71.

Bartlett, C. A., & Ghoshal, S. (2002). Managing Across Borders: The Transnational Solution. Harvard Business Press.

Bengtsson, M., & Kock, S. (2000). " Coopetition" in business networks—to cooperate and compete simultaneously. *Industrial Marketing Management, 29*(5), 411-426.

Biemans, W. G. (1996). Organizational networks: Toward a cross-fertilization between practice and theory. *Journal of Business Research, 35*(1), 29-39.

Borgatti, S. P., & Foster, P. C. (2003). The network paradigm in organizational research: A review and typology. *Journal of Management, 29*(6), 991-1013.

Capaldo, A. (2007). Network structure and innovation: The leveraging of a dual network as a distinctive relational capability. *Strategic Management Journal, 28*(6), 585-608.

Chesbrough, H. W. (2003). The era of open innovation. *MIT Sloan Management Review, 44*(3), 35-41.

Chesbrough, H. W., Vanhaverbeke, W., & West, J. (2006). *Open innovation: Researching a new paradigm*. New York: Oxford University Press.

Child, J., Faulkner, D., & Tallman, S. (2005). *Cooperative strategy: Managing alliances, networks, and joint ventures*. New York: Oxford University Press.

Child, J., & McGrath, R. G. (2001). Organizations unfettered: Organizational form in an information-intensive economy. *Academy of Management* Journal, 44(6), 1135-1148.

Child, J. (2005). *Organization: Contemporary principles and practice*. Blackwell, Oxford.

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *The Academy of Management Review, 31*(3), 659-669.

Dicken, P. (2011). *Global shift: Mapping the changing contours of the world economy*. London: Sage.

Doz, Y. L. (1996). The evolution of cooperation in strategic alliances: Initial conditions or learning processes? *Strategic Management Journal, 17*(S1), 55-83.

Drejer, I. (2004). Identifying innovation in surveys of services: A Schumpeterian perspective. *Research Policy, 33*(3), 551-562.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review, 23*(4), 660-679.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532-550.

Etzkowitz, H. (2002). Incubation of incubators: Innovation as a triple helix of university-industry-government networks. *Science and Public Policy, 29*(2), 115-128.

Feneuille, S. (1990). A network organization to meet the challenges of complexity. *European Management Journal*, 8(3), 296-301.

Ford, D., & Håkansson, H. (2006). IMP–some things achieved: Much more to do. *European Journal of Marketing, 40*(3/4), 248-258.

Forsgren, M., & Johanson, J. (1992). *Managing networks in international business*. Amsterdam: Gordon and Breach.

Freeman, C. (1991). Networks of innovators: A synthesis of research issues. *Research Policy, 20*(5), 499-514.

Freidman, T. (2006). *The world is flat*. London: Penguin.

Gassmann, O., & von Zedtwitz, M. (1999). New concepts and trends in international R&D organization. *Research Policy, 28*(2), 231-250.

Gelsing, L. E. (1992). Innovation and the development of industrial networks. *Innovation and the Development of Industrial Networks*, 116-128.

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy, 12*(1), 78-104.

Ghoshal, S., & Bartlett, C. A. (1990). The multinational corporation as an interorganizational network. *Academy of Management Review,15*(4), 603-625.

Hagedoorn, J. (2002). Inter-firm R&D partnerships: An overview of major trends and patterns since 1960. *Research Policy, 31*(4), 477-492.

Håkansson, H., Ford, D., Gadde, L. E., Snehota, I., & Waluszewski, A. (2009). *Business in networks*. West Sussex: Wiley.

Håkansson, H., & Laage-Hellman, J. (1984). Developing a network R&D strategy. *Journal of Product Innovation Management, 1*(4), 224-237.

Håkansson, H., & Snehota, I. (1989). No business is an island: The network concept of business strategy. *Scandinavian Journal of Management, 5*(3), 187-200.

Hales, C. (2002). 'Bureaucracy-lite'and continuities in managerial work. *British Journal of Management, 13*(1), 51-66.

Hatch, M., & Cunliffe, A. (2006). *Organization theory: Modern, symbolic & postmodern Perspective*. New York: Oxford University Press.

Imai, K., & Baba, Y. (1989). Systemic innovation and cross-border networks. *International Seminar on the Contributions of Science and Technology to Economic Growth at OECD*, Paris.

Jarillo, J. C. (1988). On strategic networks. *Strategic Management Journal, 9*(1), 31-41.

Johanson, J., & Vahlne, J. E. (2003). Business relationship learning and commitment in the internationalization process. *Journal of International Entrepreneurship, 1*(1), 83-101.

Kuemmerle, W. (1999). The drivers of foreign direct investment into research and development: An empirical investigation. Journal of International Business Studies, *30*(1): 1–24.

Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of resource-based view. *Academy of Management Review, 31*(3), 638-658.

Love, J. H., & Roper, S. (2001). Location and network effects on innovation success: evidence for UK, German and Irish manufacturing plants. *Research Policy*, *30*(4), 643-661.

Lundvall, B.-Å. (2010). *National systems of innovation: Toward a theory of innovation and interactive learning*. London: Anthem Press.

Miles, R., & Snow, C. C. (1986), Organizations: New concepts for new forms, *California Management Review*, *28*, 62-73

Miles, R. E., & Snow, C. C. (1992). Causes of failure in network organizations. *California Management Review*, *34*(4), 53-57.

Nieto, M. J., & Rodr ǵuez, A. (2011). Offshoring of R&D: Looking abroad to improve innovation performance. *Journal of International Business Studies*, *42*(3), 345-361.

OECD (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data (3rd edn.). Paris: OECD Publishing.

Papaconstantinou, G., 1995. Globalisation, technology and employment: characteristics and trends. STI Review, 15, 177.

Papanastassiou, M., & Pearce, R. (2009). *The Strategic Development of Multinationals: Subsidiaries and Innovation*. Hampshire: Palgrave Macmillan.

Powell, W. W. (1990). Neither market nor hierarchy: Network forms of organization. *Research in Organizational Behavior, 12*, 295-336.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly, 41*(1), 116-145.

Powell, W. W., & Grodal, S. (2005). Networks of innovators . *The oxford handbook of* innovation. Oxford: Oxford University Press.

Reddy, P. (2011). *Global innovation in emerging economies*. New York: Routledge.

Ritala, P., Armila, L., & Blomqvist, K. (2009). Innovation orchestration capability - Defining the organizational and individual level determinants. *International Journal of Innovation Management, 13*(4), 569-591.

Rogers, E. M. (1995). *Diffusion of innovations*. New York: Simon and Schuster.

Rothwell, R. (1994). Towards the fifth-generation innovation process. *International Marketing Review, 11*(1), 7-31.

Rycroft, R. W., & Kash, D. E. (2004). Self-organizing innovation networks: implications for globalization. Technovation, *24*(3), 187-197.

Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. Cambridge, MA.: Harvard University Press.

Scott, W. R., & Davis, G. F. (2007). *Organizations and organizing: Rational, natural, and open systems perspectives*. New Jersey: Pearson Prentice Hall.

Sydow, J., & Windeler, A. (1998). Organizing and evaluating interfirm networks: A structurationist perspective on network processes and effectiveness. *Organization Science, 9*(3), 265-284.

Thorelli, H. B. (2006). Networks: Between markets and hierarchies. *Strategic Management Journal, 7*(1), 37-51.

von Hippel, E. (2005). *Democratizing innovation*. Cambridge, Massachussats: MIT Press.

von Zedtwitz, M. (2004). Managing foreign R&D laboratories in china. *R&D Management, 34*(4), 439-452.

Williamson, O. E. (1991). Comparative economic organization: The analysis of discrete structural alternatives. *Administrative Science Quarterly, 36*(2), 269-296.

Yin, R. K. (2008). *Case Study Research: Design and Methods*. California: Sage.

2. Methodology

This chapter discusses the methodology of this PhD dissertation. Methodology is a theory of "the modes of thinking and acting for knowledge creation" (Abnor & Bjerke, 2008, pp: 423), which is guided by researchers' philosophical positions and guides the research design and methods. Though research methods will be discussed respectively in different papers later on; it is of benefit to give an overall methodological discussion on important issues: the philosophical foundation of this research; the formulation of research questions; case study strategy and the theory building process; and evaluation of the PhD dissertation.

2.1 Research Philosophies：Some Concepts

The choice of research method is secondary to the choice of *paradigm* which is the basic belief of the reality including fundamental perceptions of ontology and epistemology. In simple words, paradigm means pattern, model or mode (Arbnor & Bjerke, 2008, pp: 392). The concept of paradigm is developed by Thomas Kunh in his influential book *The Structure of Scientific Revolutions* (Kuhn, 1970/1962). Paradigm refers to a philosophical and theoretical framework of the ultimate presumptions and guiding principles which governs the creation of knowledge. A paradigm cannot be logically or empirically tested (Arbnor & Bjerke, 2008, pp: 424). According to Törnebohm (1974), a paradigm consists of a conception of reality (ontology), a conception of science (epistemology), a scientific ideal, and some ethical/aesthetical aspects. *Ontology* concerns the nature of reality. *Epistemology* is the philosophical presumptions concerning what constitutes human knowledge and learning (Saunders, Lewis, & Thornhill, 2009, pp: 112).

2.1.1 Objectivism and Subjectivism

The two opposite extremes of ontological positions are objectivism and constructivism (subjectivism). *Objectivism* asserts that social phenomena and their meanings are independent of and pre-given to human beings and social actors. Under this ontological position, an organization is regarded as a tangible object with certain principles, rules and regulations to be learnt and applied by individuals that inhabit it (Bryman & Bell, 2007, pp: 22). Similarly, culture and subculture are a set of widely shared customs and values that constrain human behaviors. Thus, according to this concept, what we need to do is to internalize these beliefs and values rather than change them. In contrast to objectivism, *constructivism* (or social constructivism) views the reality as purely subjective. Social phenomena and their meanings are socially constructed, produced and revised by human beings and social actors through continuous interactions. Thus instead of regarding them as pre-existing, organizations and its

regulations and rules are in constant change and continuous stage of construction and reconstruction (Bryman & Bell, 2007, pp: 23).

2.1.2 Positivism, Interpretivism, Realism

Based on different ultimate assumptions on reality, there exist diversified research philosophies that include distinctive ontological and epistemological assumptions. In existing literature, a lot of terminologies have been developed to differentiate research philosophies. This dissertation will mainly introduce three basic research philosophies, namely positivism, interpretivism, and realism (Saunders et al., 2009).

Positivism affirms that researchers should imitate and apply the methods of natural sciences to the study of social reality. The purpose of research is to generate a hypothesis that can be tested, and the relation between theory and practice is mainly deductive. Research and science are value-free (objective), and researchers should maintain an objective stance and be independent of the collected data. Thus, usually quantitative methods such as surveys will be adopted, and the data collection process is highly structured.

In contrast to positivism, *interpretivism* argues that social sciences are subjective in nature, and are thus fundamentally different from natural sciences. The purpose of research is to understand different roles of social actors and grasp the subjective meaning of social phenomenon. Researchers are value bound and are part of what is being researched. Indeed, we as researchers can never be objective about the interpretation made by others, since our understanding of others is "filtered through our own experiences" (Hatch & Cunliffe, 2006, pp: 12). Research is usually based on qualitative data collected from interviews, observations, documentaries, etc.

Realism also believes there is an external reality that is separate from our descriptions. (Bryman & Bell, 2007, pp: 18). *Empirical realism* asserts that reality can be understood fully as long as we use appropriate methods; while *critical realism* argues that we are only able to understand, and then change the social world if we can identify and explain the structures and the mechanisms that generate events and their discourses (Bryman & Bell, 2007, pp: 727). According to critical realism, the process of experiencing the reality includes two steps: firstly there is the research object itself and the sensation it conveys; then an explanation process goes after the sensation and reaches our senses (Saunders et al., 2009, pp: 115). A researcher is biased by his or her cultural background, personal experiences, and the research contexts. These will inevitably influence the research.

Regarding whether we should adopt only one philosophical position and to what extent we can integrate different paradigms, Rossman and Wilson (1985) develop three major schools, namely purists, situationalists, and pragmatists.

*Purist*s assert that each paradigm is grounded on fundamentally different principles, thus cannot be mixed with others. This can be referred to as the incommensurability of paradigms (Kuada, 2009). Based on this consideration, qualitative and quantitative methods are associated respectively with interpretivism and positivism, and they cannot be mixed due to their incompatible ontological positions (Onwuegbuzie & Leech, 2005). *Situationalists* agree with purists on the adoption of mono-paradigmatic stance, while they think that different paradigms contribute complementarily to a business phenomenon. Thus, situationalists agree that one research question can be analyzed from different angles, and it is possible to integrate qualitative and quantitative methods.

Unlike purists and situationalists, *pragmatists* argue that we do not need to adopt one single philosophical position. The most important determinant on ontology, epistemology and role of researchers is the research questions. Thus we may have variations in our ontological and epistemological positions based on different research questions. Based on these considerations, qualitative methods do not need to be associated with interpretivism, neither do quantitative techniques need to be associated with positivism. Thus, pragmatists advocate the integration of both qualitative and quantitative techniques within one study.

2.1.3 Paradigms

Continuing the discussions on paradigm, scholars have developed different classifications on research paradigms based on different ontological and epistemological presumptions. Burrell and Morgan (1985) classify paradigms into functionalist paradigm, interpretive paradigm, radical humanistic paradigm, and radical structuralist paradigm (See Figure 2.1).

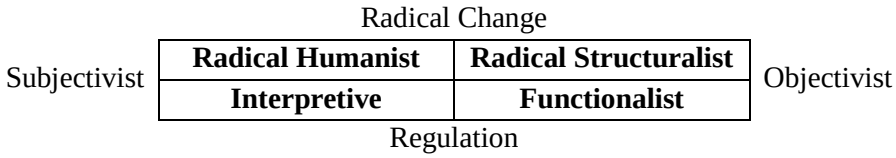


Figure 2.1. Bruell and Morgan's (1985) four paradigms.

The four paradigms are classified corresponding to four dimensions: subjectivists, objectivist, radical change and regulation. Here, radical change refers to how organizational activities should be conducted in order to make a fundamental change; while the regulatory dimension seeks to explain how organizational activities are regulated in order to achieve improvements within existing frameworks.

Unlike Bruell and Morgan's dichotomy between subjectivism and objectivism, Abonor and Bjerke (2008) find that there exists a continuum that links subjectivism and objectivism. They develop three methodological views, i.e. the analytical view, the systems view, and the actors view (See Figure 2.2).

According to Abnor and Bjerke (2008), the three views have different conceptions of reality. The *analytical view* regards the reality as objective and is the sum of different parts, and the purpose of research is to explain the causal-relations between causes and effects. As opposed to the analytical view that is grounded in objectivism, the *actors view* is based on the subjective assumption on reality. The business reality is socially constructed by actors and exists as meaning structures. Based on the actors view, knowledge depends on human beings and the reality is understood through the actors' finite provinces of meaning. Thus the analytical view and actors view are respectively in line with the positivism and interpretivism.

The *systems view* believes that a reality consists of fact-filled systematic structures, and the whole is different from the sum of parts. Thus the main research purpose is to both explain and understand the structural relations between parts, which is in line with realism, especially critical realism which argues that human beings cannot understand the reality unless we identify and explain the structures in and the mechanisms of social phenomenon. Generally speaking, two fundamental principles of the systems view are holism and structuralism. The *holism* principle argues for the importance of emphasizing the totality of the complicated business world. *Structuralism* asserts that individual elements of the system cannot be explained and understood before the relationships among them (the underlying structures) have been uncovered.

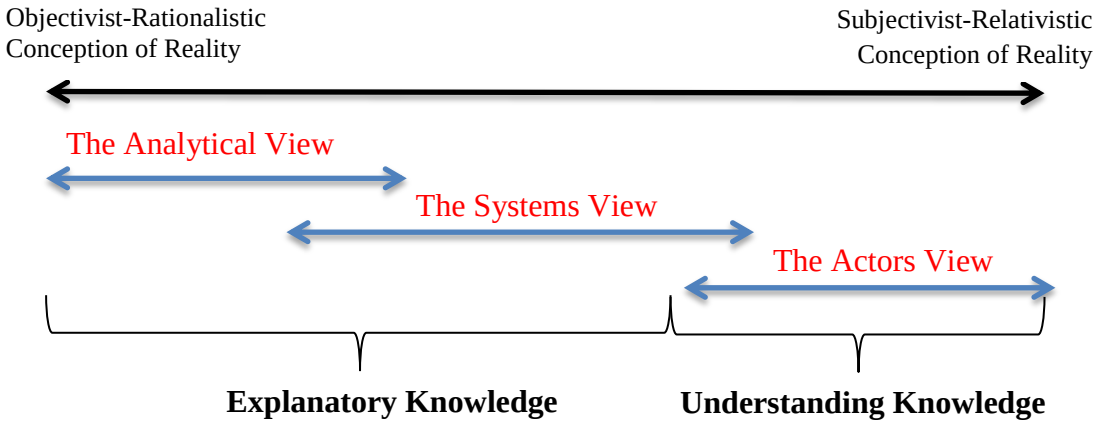


Figure 2.2. Three methodological views.

Source: Abnor & Bjerke, 2008, pp: 51.

2.2 The Philosophical Position of the Dissertation

2.2.1 Dualism of Objectivism and Subjectivism

Facing these philosophical concepts, I considered where I stand. I am not very comfortable with regarding the reality as a dichotomy between objectivism and subjectivism. I would rather accept that there exists a continuum in which objectivism

lies at one end and subjectivism at the other. Thus, to some extent, reality can be *both objective and subjective*.

In basic terms, I believe that business organizations and regulations are constructed and emergent from interactions between human beings, and can be reconstructed and changed. Yet, I believe that there are certain patterns, aspects or rules of the business world that are shared by organizations or business actors. These shared understandings or rules can be seen as *objectified* facts of subjectivity. Then these shared aspects can be seen as facts and given meaning as concepts. These concepts then act as relatively stable constructs of the reality that cannot be changed dramatically in a short period.

The key concept being explored in this dissertation is network organization, thus I will discuss in detail the dualism of objectivism and subjectivism in organizations. Functional, divisional and matrix structures represent different organizational designs that are guided by different underlying principles. For example, a vertically integrated functional organization aims to achieve efficiency and economies of scale through specializing resources, activities and employees by common functions from the bottom to the top of an organization. Large organizations usually have a divisional structure to meet different customer needs and adapt to different markets with differentiated product lines. Within a divisional structure, divisions are organized according to products, services, or projects. Taking advantages of both functional and divisional organizations while remedying their weaknesses, a matrix organization lays equal emphasis on product and function. These organizational structures are seen as stabilized patterns that are adopted by many organization designers. Throughout the business world, these characteristics, principles, and mindsets are commonly shared by business managers and different organizations, which can be regarded as relatively fixed rules that are external and independent of individuals embedded inside and can hardly be changed by daily interactions. Therefore, this is the *objective* or *objectified side of organizations*.

Yet on the other hand, if we trace the history of the development of different organizational forms, we can see that they are all *designed* by companies. For instance, functional organization was firstly designed by Andrew Carnegie to specify functions from railroads to steel production; the earliest divisional structure was designed by Alfred Sloan at GE; and one early Matrix design attempt was carried out at TRW (Miles & Snow, 1992). Thus, the organizational structures are *subjective* in nature. In practice, different firms usually have some variance in designing the same type of organization, while remaining the most important features. For instance, a divisional structure may be based on either products or different markets, i.e. product division and geographical division. Similarly, a functional structure can be very hierarchical, or involves more horizontal networking across functional departments.

In summary, it makes sense to think that organizations and related principles and regulations are subjectively designed and constructed; yet some commonly accepted aspects can be objectified as determined rules that can exist independently. Based on these considerations on ultimate presumptions, I find it's not easy to place myself in one single box of Bruell and Morgan's framework. Thus I myself was confused. Do I need to restrict myself into one box? According to principles of pragmatism, the determinant of ontological and epistemological considerations is the research questions themselves. As briefly proposed in Chapter 1, this research has two major research questions:

1. *How do transnational corporations perceive/design a network organization to facilitate their global innovation?*
2. *To what extent and how can we manage a network organization?*

As we can see from the two research questions, the key concept to be explored is "network organization." As indicated previously, organization has the duality of subjectivism and objectivism from my point of view. On the one hand, I believe there are certain patterns and rules that exist independently. Yet on the other hand, the objective principles appear differently under different contexts, and I believe that there is no single, effective way of designing and managing an organization. For example, regarding the network organization, business managers can make different attempts to create their own version of "network organization", while still keeping some basic characteristics of a network organization the same, characteristics such as knowledge sharing, delayering, autonomy, interdependence among business units, etc.

As a researcher, my interests start with interpreting some unique stories of network organizations, but the final purpose is not to investigate human behavior or to show the interactions between human beings in general. Based on case organizations' experiences, my intention is to find the underlying common patterns and principles that can be seen as facts from investigating case organizations. Thus, identifying systematic relations (objectified facts) among the complicated business reality is the main task of my research. Based on the above discussions, I found my ontological presumptions and research purpose in line with *critical realism* and Abnor and Bjerke's *systems view*. Critical realists, as mentioned before argue that researchers' tasks are to identify and explain the structures in social reality and the mechanisms that generate social phenomenon. Similarly, the main arguments of Abnor and Bjerke's systems view are that business reality consists of fact-filled systematic structures and the whole is different from the sum of parts.

2.2.2 Organization as Open Systems

Continuing the discussion on organization, in this dissertation, an organization is regarded as a system of its components, which is commonly accepted organizational

researchers (See Daft, Murphy, & Willmott, 2010; Hatch & Cunliffe, 2006; Hillman, Withers, & Collins, 2009; Scott & Davis, 2007).

Scott and Davis (2007, pp: 19-25) define organization as "social structures created by individuals to support the collaborative pursuit of specified goals", and an organization is comprised of ingredients such as environment/business context, strategies/goals, formal structure, information organization, technology/activities, and people (See Figure 2.3). Hatch and Cunliffe (2006) develop a similar graph showing four subsystems that comprise an organization, i.e. culture, physical structure, technology, and social structure.

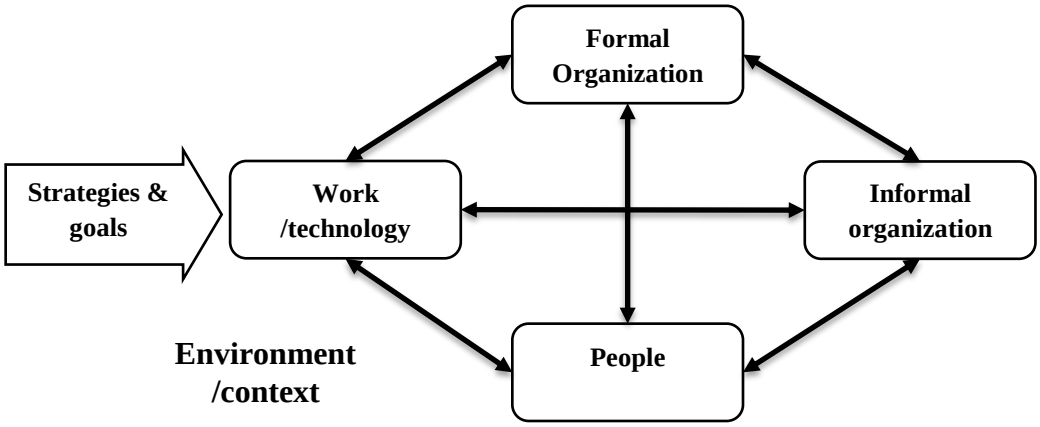


Figure 2.3. Organization as systems.

Source: Scott and Davis 2007, pp: 20.

Work and technology refer to activities that an organization performs in order to turn goals into reality. The explicitly codified aspects that show how employees work and how different business units collaborate with each other can be labeled as formal organization. A formal organization includes human resource practices, job design, and organization structure. Organization structures determine authority relations and describe how groups of jobs and people are allocated into different business units. Informal organization includes organizational culture, values, norms, organizational politics, and interpersonal social networks. In general, the interaction and systematic relations among these subsystems on the one hand are directed by corporate strategies and goals, while on the other hand facilitate the achievement of strategies and goals.

Based on the systems presumption of organization, Scott and Davis (2007) further summarize three types of systems perspectives or paradigms toward organization, i.e. rational system, natural system and open system (See Table 2.1). Organization can be defined differently based on the three perspectives. These different presumptions of organization will influence and guide the ways we think and organize. Under the *rational system* perspective, an organization can be seen as a machine whose input and output can

be precisely calculated and controlled by rational managers. As opposed to the rational system perspective, the *natural system* perspective emphasizes the irrational and complex aspects of an organization. Though formal rules are developed, participants' behaviors are usually not guided by them. The behavioral and informal structures show the "real" picture of an organization.

Table 2.1. Definition of organization according to rational, natural and open systems' perspectives.

Perspective	Definition of Organization
Rational system	"Organizations are collectivities oriented to the pursuit of relatively specific goals and exhibiting relatively highly formalized social structures."
Natural system	"Organizations are collectivities whose participants are pursuing different interests, both disparate and common, but recognize the value of perpetuating the organization as an important resource".
Open system	"Organizations are congeries of interdependent flows and activities linking shifting coalitions of participants embedded in wider material-resource and institutional environments."

Source: Adapted from Scott and Davis, 2007, pp: 27-34.

As opposed to *closed systems* that focus exclusively upon the focal organization without considering its interdependence on external elements such as partners or business contexts (Daft et al., 2010, pp: 14; Scott and Davis, 2007, pp: 31), I regard organization as *open systems* in this research. An organization is viewed as a system of interdependent subsystems such as activities and business units. Since the boundary is open, an organization is able to interact with the external environment, and the interaction is a key factor underlying its viability. In order to act on the increasing uncertainties of the business environment, or influence the business contexts, an organization needs to actively change its strategies and organizational design, and reduce its dependence on external environment in order to survive (Hillman et al., 2009).

Two key activities are particularly relevant to my research questions, i.e. innovation and management. Innovation is broadly understood as providing changes or something new that brings about value-adding through purposeful managerial activities. Management is broadly understood as purposeful human activities aiming to orchestrate and coordinate people to accomplish desired objectives and goals through utilizing resources effectively and efficiently. One important managerial action is to establish network organizations to facilitate innovation. On the one hand, business managers can encourage internal networking by reducing hierarchies, giving more autonomy to business units, establishing cross-function interactions, advocating bottom-up innovation incentives, etc. Another way to facilitate innovation is to establish networking relations

such as strategic technological partnership with external partners that hold complementary knowledge resources.

2.3 Formulation of Research Questions and Research Purpose

I have proposed the two main research questions in Chapter 1 and I have briefly explained why I choose these two research questions. In reality the process of the problem formulation was not smooth.

When I started my PhD project, I decided to do research within the innovation management domain, focusing particularly on innovation networks. I thought that since the main topic was "innovation networks", I would only need to refer to literature on innovation and networks. However, when I started to review the literature, I found that some types of innovation networks are referred to as *network organizations* by scholars. The so-called network organization appears in so many "disguises": it can be interorganizational networks consisting of innovators such as strategic technological partnerships; it can be a specific organizational design for an organization pursing the strategy of innovation; and it can even be the industrial cluster or market. As a result I became confused and wondered whether there was any specific meaning of a network organization, or whether was just a word that scholars used unconsciously. Some people hold to the view that network relations always exist among employees, different teams and departments within an organization, and therefore, the concept of network organization does not even make sense. Besides, there are so many different research topics on network organization and innovation network, that I felt it was extremely difficult to focus on one or two specific research areas.

When I almost lost my direction among the extensive amount of literature, I got opportunities to talk to companies with the hope of clarifying the concept of network organization and discuss my research interests. Interestingly enough, some business managers expressed that their companies were trying to design a network organization or had already done it. However, the meaning of network organization was still under exploration. As a result, I decided to collaborate with companies that were exploring the concept of network organization, just as I was eager to do, to see how they understood this concept and put it into practice.

It is worth noting that though there have been many calls from academia saying that companies should evolve to a network organization and substitute hierarchical structure with other mechanisms such as adopting an internal market (e.g. Miles and Snow, 1992). We seldom see a company or a transnational corporation radically changing its internal organization and adopting a market mechanism to optimize internal resource allocation. Some may have tried, but then changed back to a previous organizational structure such as matrix due to the complexity of managing a network organization (See the case of Oticon, (Foss, 2003)). As a result, in the face of so many research directions, I asked

myself: "why not start with investigating the meaning of network organization?" I convinced myself that without understanding the meaning of network organization, I could not investigate and explain the management of it. As a result, I developed the following two main research questions:

1. *How do transnational corporations perceive/design a network organization to facilitate their global innovation?*
2. *To what extent and how can we manage a network organization?*

There exist two distinctive research purposes, i.e. explanation and understanding. Guided by a positivism philosophy, knowledge creators from both natural and social sciences are only interested in explaining, and the logic of explanation in natural and social sciences is the same (Arbnor & Bjerke, 2008, pp: 395). As opposed to positivism, interpretivism regards knowledge in social sciences as internal to man. Thus, the main task and interests of social science researchers are to develop meanings for social phenomenon and the findings are only for actors within that research area. Yet, Abnor and Bjerke (2008) further argue that explaining and understanding are mixed nowadays, meaning that understanding is no longer associated solely with interpretivists and explaining is not the sole prerogative of positivists.

Based on the above discussions, I found my research involves both explaining and understanding, or rather, it is a process moving from understanding to explaining. As a researcher, my first task is to firstly *understand* the meaning of network organization. I intend to find the answer from both the existing literature (Paper 1) and business practices (Paper 2-5). In particular, I want to understand how business managers perceive this concept. After understanding their intention of designing a network organization, I will then investigate the management of network organization. However, my research is not going to end with understanding and interpreting the business stories, the main task is to develop abstract systematic frameworks that show the meaning or the management of network organization, and *explain* the relations among elements and theoretical constructs of the frameworks.

What I am going to do is also associated with the *sensemaking* theory (Weick, 1995; Weick, Sutcliffe, & Obstfeld, 2005). According to Weick (1995, pp: 6), sensemaking is about "placement of items into frameworks, comprehending, redressing surprises, constructing meaning, integrating in pursuit of mutual understanding and patterning". In particular, Weick emphasizes that sensemaking is not a synonym for interpretation (Weick, 1995, pp: 6). In terms of sensemaking in organizational studies, Tsoukas and Chia (2002) assert that "organization is an attempt to order the intrinsic flux of human action, to channel it toward certain ends, to give it a particular shape, through generalizing and institutionalizing particular meanings and rules." From these definitions, we can see that sensemaking includes a process of identifying and abstracting meaningful

constructs from chaotic and flux organizational practices, and then labeling and categorizing these constructs into stabilized systematic frameworks (Weick et al., 2005). Thus the sensemaking process is also in line with the systems view and critical realism. The research findings, i.e. systematic frameworks with logical relations among constructs, will expand existing theories on network organization. Thus I can conclude here that my research purpose is about *theory building* from massive empirical data rather than testing existing theories.

2.4 Qualitative or Quantitative Research

Quantitative research and qualitative research are two distinctive strategies to carry out research. It is worth noting that qualitative and quantitative researchers are not equal to qualitative and quantitative data. A summary of the main differences between qualitative and quantitative strategies is shown in Table 2.2.

Table 2.2. Comparisons between qualitative and quantitative research strategies.

	Qualitative	**Quantitative**
Relation between theory and research	Inductive; generation of theory.	Deductive; testing of theory.
Epistemological orientation	Interpretation, narratives.	Natural science model, positivism
Concept	"Concepts-in-use" from social members; words, texts, conversations are representations of concepts.	Distinct variables show different concepts.
Data	Data are in the form of observations, transcripts, words, and texts from documents. Quantification can be used in qualitative research.	Data are in the form of numbers. Data are coded, counted, and quantified from standardized measurement.
Research Procedure	Research procedures are specific and particular, bounded in contexts; rely highly on observation and researcher's interaction with the case. Replication is difficult.	Standardized research procedure, assumed to be replicable.
Main Advantages	Humanistic focus, able to understand and describe the actual human interactions, meanings and actions in real-life settings. Able to uncover complex process.	Embodies a view of business reality as an external, objective reality, reduce researcher's bias and intervention.
Main Disadvantages	Hard to get access; time and resource consuming; data analysis is difficult; hard to convince readers.	Highly abstract, inflexible and artificial; difficult in understanding process and dynamics; neglecting contexts and human natures.

Source: Adapted from (Bryman & Bell, 2007; Easterby-Smith, Thorpe, Jackson, & Lowe, 2008; Gephart, 2004; Yin, 2009).

Generally speaking, qualitative researchers investigate how social phenomena are created and given meanings (Gephart, 2004), and also seek to explain the reality through building social science constructs from members' "concepts-in-use" inductively (Schutz, 1972). Moreover, many scholars have discussed one particular merit of qualitative studies, i.e. its theory building function (Bryman & Bell, 2007; Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Siggelkow, 2007; Yin, 2009). Quantitative researches, in contrast, emphasizes the quantification in data collection and analysis, and seeks to explain the causal relations and test existing theories deductively. Considering my research purpose of this dissertation, i.e. theory building, qualitative research strategy is more suitable.

2.5 Case Study Strategy

2.5.1 Why a Case Study

A case study strategy focuses on "understanding the dynamics present within single settings" (Eisenhardt, 1989, pp: 534). According to Yin (2009, pp: 2), using case studies is preferential when: 1. the research questions are "how" and "why" questions; 2. the researcher has little control over the phenomena or events; c. the research focuses on contemporary events within real-life contexts. In particular, some scholars emphasize the importance of building theory from case studies (Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Siggelkow, 2007). As opposed to large-sample testing that adopts a deductive approach; case studies generate theoretical constructs and propositions from rich case-based evidences inductively (Eisenhardt & Graebner, 2007). Moreover, case studies can not only provide contrary evidences to existing theories and then revise them, but also help sharpen existing theories by identifying research gaps and filling them (Siggelkow, 2007).

"How" and "why" questions are usually aiming to explain complex processes and events that can hardly be examined by hypothesizing simple causal relations (Yin, 2009). I post two "how" questions in this dissertation. My purpose is to understand, and more importantly, to explain how managers perceive and design a network organization to facilitate global innovation and how they manage such an organization. The research objects are contemporary organizations that are embedded in real-life contexts. Thus, the case study strategy is particularly pertinent for network research in which it is difficult to isolate organizations from the complex realities in which they operate. As a researcher, I cannot control case companies' organizational change. In order to get in-depth data and understanding, a social science researcher will struggle to stay out of the phenomenon and be completely neutral (realism), so I tried to stay critical and reflective during the whole research process. Therefore, case study strategy is the suitable choice of this research. With the aim of theory expanding and building, I will, as indicated before, develop theoretical constructs, recognize categories, and formulate frameworks and propositions from case studies.

It is difficult for me to imagine this research being done by using other research methods such as surveys, experiments, and historical research. For instance, since changing an internal organizational design to a network organization is still a relatively unusual phenomenon, it is difficult to generate data to population levels, and thus a survey method is not applicable. As a result, I regard case studies as the most suitable strategy to fulfill my research purpose.

2.5.2 Types of Case Studies and Case Selection

Types of case studies

Based on different criteria, there are different types of case studies. According to the number of cases and the unit of analysis, case studies can be respectively classified into single and multiple case studies, and holistic and embedded case studies (Yin, 2009). Based on different research purposes, there are descriptive, explanatory and exploratory case studies (Yin, 2009). Moreover, according to the logic of data analysis (deduction and induction), there are theory-testing (deductive) and theory-building (inductive) case studies (Alaranta, 2007).

Single case study and multiple case studies have distinctive rationales of research design. Yin (2004, pp: 47-49) summarizes it by saying that we can choose a *single case study* design based on the following five rationales: 1. a critical case that can confirm, challenge or expand existing theories; 2. a case that represents a unique or extreme situation; 3. a typical or representative case; 4. a revelatory case when researchers have the opportunity to analyze an inaccessible social phenomenon; 5. a longitudinal case. *Multiple case studies* are usually considered more compelling and thus more robust, since it involves multiple sources of evidences from more than one case (Eisenhardt & Graebner, 2007; Herriott & Firestone, 1983). Multiple case studies need to follow the *replication* principle. We can either select cases that predict similar results (*literal replication*), or cases that predict different and contrasting results that are anticipatable (*theoretical replication*) (Yin, 2009, pp: 54).

Based on different units of analysis, there are *holistic* and *embedded* case study designs, meaning that we take the whole organization (single unit) or some sub units as selected research objects. Thus, we can have a holistic single case study, holistic multiple case studies, an embedded single case study, and an embedded multiple case designs.

Descriptive case studies seek to accurately describe and illustrate a phenomenon or a key concept and related contexts. Usually, a descriptive case study takes a narrative form (Zainal, 2007). A descriptive case study on network organization might start with posting a research question such as “what are the main characteristics of a network organization?” and then showing and illustrating what a typical network organization looks like.

Explanatory case studies try to examine the reasons or causes of a phenomenon and explain the certain causal relations. For an explanatory case study, the key concepts/factors and relations are clearly defined. An explanatory case study on network organization may be led by research questions such as "why can a network organization facilitate innovation?" and "what is the relationship between a firm's position in a network and its innovation performance?".

An *exploratory* case study aims to investigate a relatively unclear issue or phenomenon and identify key factors and variables as well as the relations between them. The exploration process can enlighten researchers to better understand a phenomenon and develop new theories or frameworks to be tested in the future.

According to Alaranta (2006), based on different ways of analyzing data, case studies can be divided into theory-testing or deductive case studies and theory-building or inductive case studies. In general, theory-testing and theory-building case studies are respectively associated with positivism and interpretivism. Theory-testing case studies may follow the natural science research methods, and both quantitative and qualitative data of the cases can be used to test hypotheses derived from existing theories. On the other hand, a theory-building case study aims to abstract and generalize theoretical frameworks or propositions from case data, thus following the inductive logic and falling in line with exploratory case studies. Yet, Alaranta (2006) further argues that theory-testing and theory-building analyses of case data can be and always are integrated in case studies. Firstly, we can test existing theories through pattern matching, i.e. comparing the predicted pattern based on the literature and the empirical pattern emerging from practice (Yin, 2009). The theory testing stage may follow the positivist paradigm. Secondly, based on different findings, we build theories through rich case data.

From the two research questions of this dissertation, we can see that this research is mainly exploratory. As introduced before, this dissertation consists of five papers. One of them is a literature review (Paper 1), and the others are either single case studies (Paper 2, 3, 5) or a multiple case study (Paper 4). The four research papers are mainly exploratory case studies aiming to find the meaning and management of network organizations, and the findings may expand existing theories in this research area. Further, this dissertation is also qualitative in nature, which is in line with the research purpose of theory building as shown in Table 2.2.

Regarding the distinctions between deduction and induction, this dissertation is mainly inductive. However, it is really difficult to be completely inductive since as a researcher, I went into reality with a relatively open and critical mind rather than an empty mind. "Going back and forth between theory and practice" is a suitable description of the research process of this dissertation. Therefore, the theoretical frameworks and concepts from the existing literature helped me with examining the cases and identifying

theoretical constructs deductively, and then the emerging new relations among theoretical constructs provided potential of theory expanding and building.

Case selection

One misunderstanding about case selection is that researchers should choose representative cases that show the population (Eisenhardt & Graebner, 2007; Siggelkow, 2007). A case is chosen because it is very special in terms of allowing researchers to discover something new or gain insights that other cases may not able to provide. As a result, it may even be wrong for case study researchers to claim that they are using "representative samples" (Siggelkow, 2007). A case study is never about statistical generation; rather it is about analytical generation (Eisenhardt, 1989; Yin, 2009). Following this consideration, even though multiple case studies have many advantages compared to a single case study, the purpose of designing multiple case studies is not about using a larger sample, but rather to provide more empirical evidences, reduce bias, gain a more comprehensive picture of the phenomenon, and generate more accurate propositions.

Yin (2004) clearly states that multiple case studies in general are more convincing than a single case study. Yet, as cases should be somehow special, we may not easily find a lot of suitable cases, especially when the research purpose is about theory building. Other scholars argue that even a single case study can be a very power tool for theory building (Dyer & Wilkins, 1991; Eisenhardt & Graebner, 2007; Siggelkow, 2007). In particular, Dyer and Wilkins (1991) argue that single case studies are superior to multiple case studies for theory expanding and building. As explained by Eisenhardt and Graebner (2007), the concern is not with a specific number of cases; the appropriate number of cases depends upon how much is already known and how much new data one are likely to get when increasing the number of cases.

Table 2.3 gives an overview of case selection and the underlying rationales of each paper. Generally speaking, the main reasons for selecting these cases are: 1. they are suitable for solving my research questions; 2. most of these cases are unique in a sense of providing insights into existing situations and can fulfill my research purpose of theory building. Before collaborating with the three case companies, i.e. InnoFlex, Circular, and Biozyme, I heard that they fell into one of three categories- either they had already changed to, were currently trying to change to , or had always been a part of a network organization. Then I had a discussion with business managers or R&D directors from these three companies. The purpose of the discussion was to see whether my research intention made sense to them, explore the challenges they were facing regarding network organization design and management, and see how my research could help them. After choosing the cases, I wrote a *case protocol* for each case to specify my research purpose, the key concepts to be investigated, my data collection plan, and my background

knowledge about the case, etc. In addition, I used Nvivo 10[1] to establish a database for each case.

From Table 2.3, we can see that the four papers have different case study designs guided by different rationales. For instance, Paper 4 (Chapter 6) provides a holistic multiple-case study showing three TNCs' network organization for global innovation. In contrast, Paper 2 (Chapter 4) is an embedded single case study aiming to propose a new theoretical perspective, i.e. internationalization of triple helix. The single case analyzes not only each triple helix actor's innovation activities in another country and the interactions among them, but also interactions between two triple helixes. Paper 3 (Chapter 5) employs an embedded single cases study design that focuses on two essential stages of relational competitive advantage generation, i.e. relational rents generation and appropriation. Similarly, an embedded single case study design is chosen in Paper 5 (Chapter 7) to show how a company designs and manages a network organization to facilitate its global innovation strategy. Three units are analyzed: the internal network organization, interorganizational innovation networks, and the management (orchestration capability) across both intra- and interorganizational levels. This single case study mainly contributes to the literature on designing network organization and related challenges as well as to orchestration capability.

[1] More information on Nvivo 10: http://www.qsrinternational.com/products_nvivo.aspx

Table 2.3. An overview of case study design and case selection.

Paper	Research Design	Cases	Rationale of Case Selection	Unit of Analysis
Paper 2	Embedded single case study	Danish Triple Helix's Innovation activities in China.	Unique case showing internationalization of Triple Helix, which provides possibilities of expanding the Triple Helix theory.	Innovation activities of each triple helix actors in China, interactions among different triple helix actors, and interactions between two national triple helixes.
Paper 3	Embedded single case study	A strategic technological partnership between a Danish TNC (Circular) and a Chinese solar company (Sunshine).	A unique case in the sense that within the strategic technological partnership, both firms have equal stance in terms of R&D, meaning that the Chinese counterparty is not regarded as only the marketing or production partner. This case provides insights into how a TNC collaborate with a Chinese local firm on R&D, and how to gain relational competitive advantages together.	Relational rents generation, and relational rents appropriation.
Paper 4	Holistic multiple case study	Three Danish TNCs: InnoFlex (textile industry), Circular (pump industry), Biozyme (biotechnology industry).	All three firms declare that they have an internal network organization. The purpose of designing a network organization is to facilitate knowledge sharing and global innovation. Yet, the three case companies' managers have different understandings of network organization and their network organizations show different features (theoretical replication), which can show different patterns of network organization.	Each case company's network organization for global innovation.
Paper 5	Embedded single case study	InnoFlex: A Danish SME from the textile industry.	A unique case of an SME's transnational strategy of utilizing global innovation resources. It has an internal network organization which involves market mechanism. It also acts as an orchestrator in the interfirm innovation networks. This case contributes to expanding theories on orchestration capability.	Internal organizational design, interorganizational networks, and its management (orchestration capability).

2.5.3 Data Collection

Data collection and sources of evidences are presented in each paper. Therefore I will introduce only some very general considerations regarding my data collection here. It is worth noting that data discussed here are mainly those related to my case studies, since I used journal articles as my "raw data" in Paper 1.

Table 2.4. Documentation, interviews, direct observation, and participatory observation: strengths and weakness.

Sources	Strengths	Weakness
Documentation	• Stable: can be reviewed repeatedly • Unobtrusive: not created as a result of the case study • Exact: contains exact information such as names, references, and details of an event. • Broad coverage: long span of time, many events and settings.	• Retrievability: can be difficult to find. • Biased selectivity, if collection is incomplete. • Reporting bias created by authors. • Access: may be deliberately withheld.
Interviews	• Targeted: focuses directly on case study topics. • Insightful: provides perceived causal inferences and explanations.	• Bias due to poorly articulated questions. • Response bias. • Reflexivity: event may process differently because it is being observed. • Inaccuracies due to poor recall.
Direct Observation	• Reality: covers events in real time. • Contextual: covers context of "case".	• Time and cost consuming. • Selectivity: broad coverage, difficult without a team of observers. • Reflexivity: event may proceed differently because it is being observed.
Participatory Observation	• Same as direct observation. • Insightful into interpersonal behavior and motives.	• Same as direct observation. • Bias due to participant observer's manipulation of events.

Source: Adapted from Yin (2009), pp: 102.

According to Yin (2004), one important data collection principle is using multiple data sources, which is often referred as *triangulation of data*. Generally speaking, there are six types of data that are used in case studies, i.e. documentation, archival records, interviews, participatory and direct observations, and physical artifacts (Yin, 2009, pp: 101-114). Based on whether the data is collected by the researcher themselves, data can be classified into *primary data* (first-hand data) and *secondary data* (second hand data). In this research, I mainly used four sources of data: documentation, interviews, direct

observation and participatory observation (data triangulation). Yin (2009) indicates the main strengths and weaknesses of the six sources of evidences. In this dissertation, I mainly focus on the three sources that I used in the dissertation (See Table 2.4).

As described in Table 2.3, the selected cases of this dissertation are mainly Danish organizations. My data collection was done in both Denmark and China, and there are mainly three reasons for this. Firstly, as the biggest emerging economy, the Chinese market is regarded as strategically important, or even the "second home market" by the three case companies. For example, Circular calls China its "second home market". Biozyme established its Chinese R&D subsidiary in Beijing at the early 1990s, which is one of the earliest TNCs that entered the Chinese market. InnoFlex's first overseas business unit was located in China, and now the unit is the representative for the Asian Pacific market. Therefore, as a dissertation that contributes to TNCs' global innovation organization and management, collecting data from TNCs' R&D subsidiaries located in both the developed country (Denmark) and emerging economy (China) enables data triangulation. Secondly, the PhD project is carried out in Denmark and I am Chinese, so it is more logical for me to move back and forth between these two countries with the purpose of getting insights from both Chinese and Danish R&D managers. Thirdly, though these TNCs have R&D subsidiaries all over the world, it was impossible for me to travel extensively over the past three years due to a limitation of resources.

Documentations

Multiple sources of evidences were collected during this research. Primary data were collected from interviews and direct observation, while secondary data were collected from various forms of documents. *Documentations* mainly include case companies' annual reports, information from companies' websites, mass media news, government documentations, and documents such as PowerPoint presentations for customers or stakeholders. Before stepping into the field and collecting my primary data, I read all the three Danish case companies' ten-year-annual reports in order to get as much background knowledge as possible. This partly avoids the possibilities that I use scarce interview time collecting simple data.

Moreover, I found media information extremely important when it was difficult for me to get access to high level executives. Take Paper 3 (Chapter 5) as an example; I watched some TV interviews and presentations of the CEO of the Chinese company called Sunshine since it was impossible to get an in-depth face-to-face interview with him. Yet I found that the information from the media helped me to understand Sunshine's strategy and motivation of collaborating with TNCs on R&D better. In particular, some interviews mentioned the strategic technological partnership with Circular, which partly compensates for the disappointment of not being able to interview him.

Interviews

The most important sources of my case study data were *interviews*. In the words of Siggelkow (2007, pp: 21), "an open mind is good, an empty mind is not". As mentioned before, before doing interviews, I read the ten-year' annual reports of the case companies with the purpose of getting as much background knowledge as possible. In addition, I did an extensive literature review (Paper 1) to strengthen my theoretical background, which also made me more confident when facing the business managers. I interviewed R&D managers from both the Danish headquarters and Chinese R&D subsidiaries. In order to get multiple evidences and cross-check my data, I interviewed three levels of R&D related people: R&D directors, middle or senior level R&D managers (project coordinators), and R&D engineers. This interview style also reflects the data triangulation principle. Interviews usually lasted 1 to 2.5 hours and were recorded and transcribed afterwards. I did some of the interviews in Chinese, and these interviews were firstly transcribed in Chinese and then translated into English.

Unstructured interviews are very much similar to conversations (Bryman & Bell, 2007, pp: 474). I used a few unstructured interviews in the early stage of this research. When I was trying to establish research collaborations with case companies, I initiated some open discussions with business managers to hear about their opinions on network organization and stories in management. These unstructured interviews gave interviewees chances to talk about the most important and interesting issues from their point of views rather than being guided by my questions. The findings of these unstructured interviews also helped confirm my research purpose and aided in identifying topics in the semi-structured interviews that followed.

Most of my interviews are *semi-structured interviews* that are guided by interview guidelines that cover the main topics. Most questions are open-ended that encourage interviewees to speak freely. For example, I asked questions such as "can you share with us a story of R&D collaboration with external partners", and "according to your managerial experiences, can you give us some advice on facilitating internal knowledge sharing and networking". Though there was a list of questions in my interview outline, I did not ask questions exactly according to the outline. For example, I changed the order of questions since sometimes interviewees had already answered questions that I had planned to ask. Furthermore, I added some questions that were not listed in the outline since the interviewee might mention something interesting. However, I asked almost all the important questions using the same wording to all interviewees. An example of my interview outline is attached as an appendix to this chapter.

My questions were mostly open-ended and interviewees were encouraged to share their insights. One interesting point is the way in which interviewees answer your questions. I do not always send my interview outline in advance since my interviewees are very busy. Yet I find that when my interviewees get the outline in advance, they will usually start telling a long story that covers most of the topics that I want to investigate.

Then the interview turns out to be a story telling (*narrative*) plus additional questions, rather than an assumed Q & A. Interviewees' narratives provide a story that includes the whole process of an event, interactions among key actors, details, and interviewees' own insights, which can be used as rich data for theory building (Pentland, 1999). For example, when I was investigating the strategic technological partnership between Circular and Sunshine (Paper 3), the project manager from Circular told a story of this collaboration that included many details and that lasted for around 1.5 hours, details such as how this collaboration was initiated, the negotiation/communication process, how both companies shared knowledge and worked together, how they distributed value, and how Circular China manages its R&D projects, etc. The whole story gave me an in-depth understanding, and I would have missed a lot of details if I had chosen to ask my prepared questions since the prepared questions only reflect the aspects that are regarded as important by the researcher. Moreover, I believe that interviewees' narratives are extremely important for theory building, since serendipitous findings may emerge from the interesting stories being told.

Another interesting issue is the different perceptions of researcher's identity. When interviewing, I regarded myself as an outsider trying to investigate the business reality. However, it did happen sometimes that interviewees asked me for advice on innovation management in China. I guess the reasons are: firstly I am Chinese so they suppose that I know a lot about China; secondly I am a researcher, so they suppose that I must know a lot about business management. I had to explain to them that I was a young researcher and was not able to be a consultant. However, I was open to engage in discussions on innovation management after I had all my questions answered, and I was happy that on one occasion an R&D director said that he was happy that he had also learnt something new from me.

A third issue is about note-taking. People say that it is always better to take notes while interviewing. Yet it is not easy to take notes while maintaining a courteous eye contact with the interviewee. Therefore I did not take a lot of notes during the interviews and chose to write some reflective notes right after the interview. It also means that I relied very much on the voice recorder to record all data. I can still remember that on one occasion I finished a two-hour interview and felt happy with the informative discussion, and I found out nothing had recorded. I tried my best to memorize answers to my questions and sent my notes to the interviewee to check the validity, but I still lost many details. This incident reminds me of the possibility of unexpected accidents.

Direct and participatory observations

Both direct and participatory observations were adopted in this research. Since case studies take place in the case companies, I get the opportunities for *direct observations*. A director observer is an outsider of the case, and can collect rich additional information to complement or cross-check other sources of data. Take one experiences in one of my

case companies as an example. I observed R&D directors, managers and engineers sitting around the same table in the canteen having lunch, which seems to show that no strict hierarchy exists inside the organization.

Participatory observation is a special way of observing in which researchers are proactively participating in the events. In this research, I only used participatory observation when exploring the internationalization of the triple helix (Paper 2 in Chapter 4). My co-author and I have been involved in the research collaboration with Chinese researchers and the establishment of SDC (Sino-Danish Centre for Education and Research) in Beijing. Moreover, my co-author has been working and communicating with Danish triple helix institutions, especially their Chinese branches (e.g. Danish Innovation Centre in Shanghai, and Nordic Centre at Fudan University) for many years, and has witnessed the trend of triple helix internationalization before writing the paper. These rich experiences give us an in-depth understanding and provide us with a solid foundation for exploratory research.

2.5.4 Data Analysis and Theory Building Process

Ambiguity of Theory Building

When reviewing the journal articles that employ case study strategy, we find that case study design and data collection are usually clearly stated in the section of "research methods", while data analysis and the process of theory building are missing or ambiguously explained. Compared with quantitative hypothesis testing that follows a standardized research procedure, qualitative data analysis and the inductive theory building process relies much on a researcher's internal logic, thus making these processes highly tacit and less easy to track the reliability of the research (Eisenhardt & Graebner, 2007; Miles and Huberman, 1994; Siggelkow, 2007)..

Though many scholars appeal to the rigor of data analysis of case studies, the process remains highly tacit and debatable. Eisenhardt's (1989) paper on theory building from case studies has been highly influential and cited by many case study researchers. In that paper, Eisenhardt mainly focuses on how to generate theoretical constructs from multiple case studies. She proposes a process of theory building that starts with defining a clear research question and even prior theoretical constructs.

However, Dyer and Wilkins (1991) criticize Eisenhardt's arguments and propose that a carefully done single case study may enable researchers to see new theoretical relations and question old ones. Besides, they think that the emphasis on general theoretical construct misses the contexts of each case, and thus loses the essence of a case study. Moreover, they point out that clear research questions and theoretical constructs emerge from cases, and therefore cannot be pre-defined. Actually, what Dyer and Wilkins advocate is the classic way of conducting a case study, which follows the interpretivism

paradigm. Telling enlightening stories, as opposed to describing theoretical constructs from cases, is their main argument.

Later on, Eisenhardt (1991) responds to the critique and argues that telling good stories does not make a persuading and rigorous study. A good case study, whether single or multiple, needs to be methodologically rigorous. Moreover, she states that good story-telling does not conflict with rigorous methodology and generating theoretical constructs. Besides, due to a limitation of the length of this manuscript, it is difficult to show a detailed case story. Actually, storytelling (narratives) is the first step, but generating good theory is fundamentally the result of following a rigorous case study methodology.

The Eisenhardt-Dyer & Wilkins debate shows that the case study processes are less structured and standardized than quantitative researches such as survey. Yet, where do I stand in this debate? Firstly, according to my research process, the research questions were formulated after I had had some discussions with business managers, and thus I am not convinced with Eisenhardt (1989)'s argument that we should have clearly defined research questions and even theoretical constructs before collecting case data. However, I agree that a key task of theory building is identifying theoretical constructs that emerge from rich case data. Regarding presenting case stories and identifying theoretical constructs, I regard the theoretical constructs as grounded in case stories, and therefore both of them are important to a case study. Case descriptions or stories for each case are written, but it is always difficult to balance their weight within a paper.

Theory-Building Process

Despite these debates on the theory-building process of case studies, Figure 2.4 shows the theory-building process of my four exploratory case studies (Paper 2-5, Chapter 4-7), which is also the main component of my whole PhD research process. Generally speaking, my theory-building process consists of ten steps which can be categorized into three major steps: formulation of research questions; generating primary propositions and frameworks; and constructing theories.

Research questions formulation (Step 1) has been discussed in detail in Section 2.3. As mentioned before, I disagree with Eisenhardt's (1989) argument that we need to clearly define our research questions before data collection when our research purpose is theory building. Rather, before entering the field, I only had a rough idea of my research topic. As mentioned in Section 2.3, the two final research questions emerged after I had done some discussions with business managers and analyzed some data. As a result, the formulation of research questions, data collection and data analysis are combined in an exploratory case study.

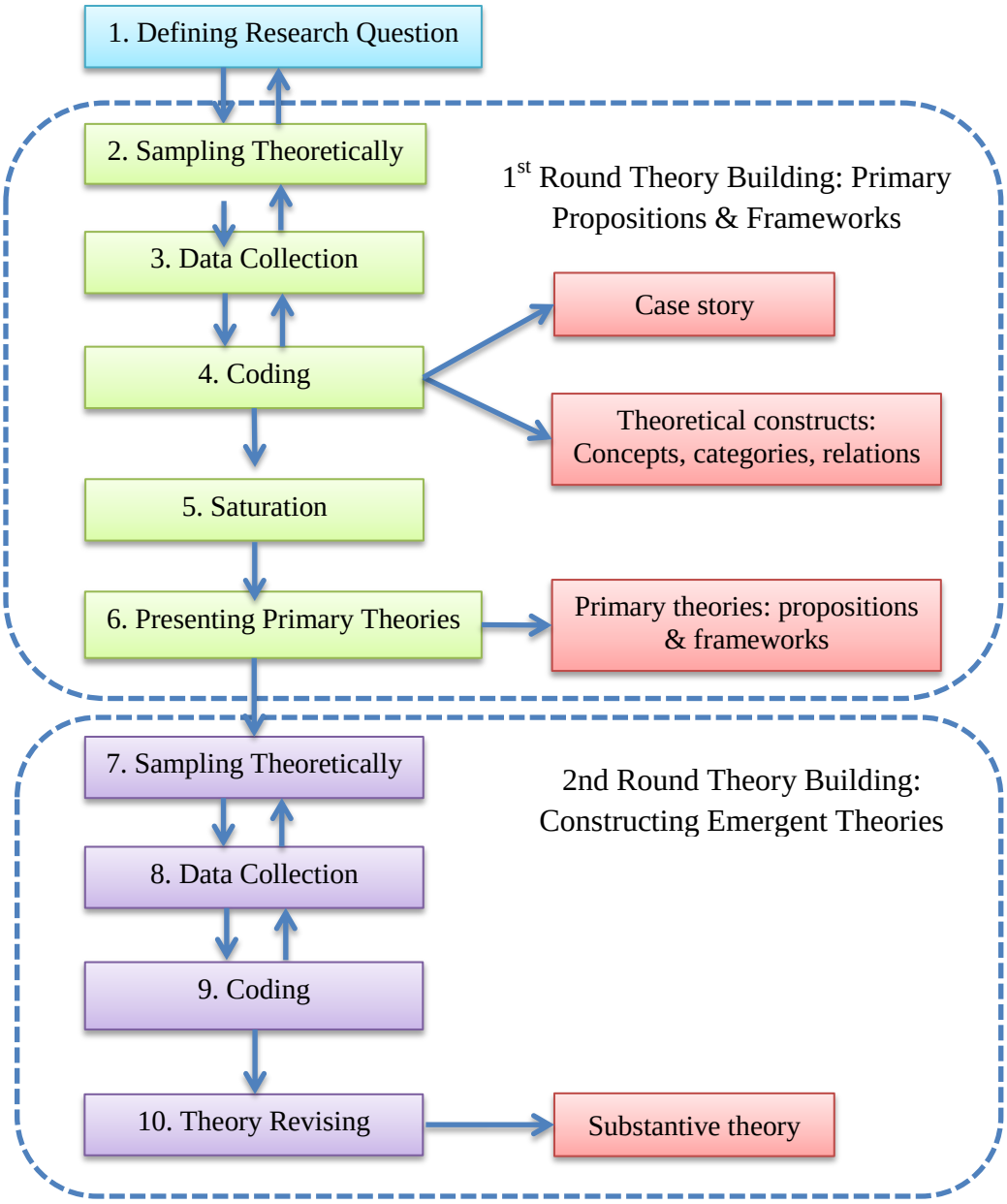


Figure 2.4. Theory building process of my PhD research

Theoretical Sampling and Coding

Since theories and the relationship between theoretical constructs derive from rich case data that are systematically collected and analyzed in this research (Glaser & Strauss, 1967, pp: 1), I find that the qualitative data analysis principles such as theoretical sampling, coding and theoretical saturation associated with grounded theory are extremely helpful in exploratory case studies.

Theoretical sampling is "the process of data collection for generating theory whereby the analyst jointly collects, codes, and analyzes his data and decides what data to collect next and where to find them, in order to develop this theory as it emerges" (Glaser & Strauss, 1967, pp: 45). As shown in Table 2.3, I selected my samples (relevant cases, incidents, and key informants such as my interviewees) purposefully after I had roughly defined research questions (*Step 2: Sampling Theoretically*). After selecting my samples, I collected my data from three different sources (documentation, interviewees, direct and participatory observations) as discussed in Section 2.5.3 (*Step 3: Data Collection*). Transcriptions and field notes are created after data collection.

Coding (Step 4) started right after data collection. Coding is usually the start point for qualitative data analysis, and is the key process in theory building (Bryman & Bell, 2007; Mills & Huberman, 1994; Strauss & Corbin, 1998). According to Mills and Huberman (1994, pp: 56), codes are "tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study", and codes can be words, phrases, sentences or even a whole paragraph.

Informed by grounded theory, the coding process can be divided into three rounds: open coding, axial coding and selective coding (Bernard & Ryan, 2009; Strauss & Corbin, 1998). In this research, I used Nvivo 10 to assist my coding process. However, even though computer software is able to help arrange data, it cannot do the logical analysis.

Open coding is the first round of coding, in which case data such as documentation, interview transcriptions, and field notes are labeled with meanings and concepts (Bryman & Bell, 2007; Strauss & Corbin, 1998). A *concept* is "an abstract representation of an event, object, or action/interaction that a researcher identifies as being significant" (Strauss & Corbin, 1998, pp: 102). Some concepts from the existing literature are deductively used as labels such as absorptive capacity (See Paper 3 and 5) and market mechanism (See Paper 4 and Paper 5), while others are named by extracting keywords from the data. For example, one manager mentioned that it is very important to find a key person that can either make decision or influence the decision maker (See Paper 3). I hereby labeled this phenomenon as "finding the key person." Therefore, the open coding actually involves both deduction from existing theories and induction from case data.

After open coding, the data are rearranged according to their labels (concepts). In the second round of coding, i.e. *axial coding*, different concepts are categorized into more inclusive concepts (subcategories and categories) (Strauss & Corbin, 1998, pp: 123). The main purpose of axial coding is to reassemble data that are fragmented in the open coding stage (Bernard & Ryan, 2009, pp: 271). For example, in Paper 3, resource endowment fit, strategic fit, business model fit and identifying organizational differences are categorized into a new concept called "in search of fit." Then "in search of fit" and another subcategory called "trust building" are further categorized into "finding the right partner."

In the axial coding process, relations among categories start to emerge and provide foundation for the third round coding, i.e. selective coding. Here the word "category" is in line with what is called "theoretical constructs" by Eisenhardt (1989). In the *selective coding* stage, firstly core categories that are key to answering my research questions were selected, and secondly categories were linked and integrated together systematically around the core categories. Thus, the relationships between categories are identified roughly and the primary theoretical framework is established in the selective coding stage. Examples can be seen in all four case study papers, in which internationalization of triple helix, relational competitive advantages, duality of network organization, orchestration capability are so-called core categories.

Based on axial coding and selective coding, the case data look less chaotic and the emergent core concepts allowed me to: firstly identify clear research questions for each paper, and secondly formulate a case narrative according to my research questions. As mentioned in Section 1.3, I came up with my two major research questions after I had had some discussions with business managers. For each paper, my detailed research questions were formulated when I had already collected some data from case companies and coded the transcriptions and field notes. This also reflects what I have mentioned before that defining research questions, data collection and analysis are combined in an explorative case study.

Moreover, since key theoretical constructs are defined, I am able to write a case story that reflects upon my research questions. For example, in order to investigate how companies gain relational competitive advantages from strategic technological partnerships, I wrote a case story telling how such a partnership was initiated and coordinated, how both companies jointly created relational rents and how they distributed the created rents (See Paper 3, Chapter 5). The case story is arranged around the some key constructs such as partner selection, relational rents generation, and relational rents distribution.

Theoretical Saturation and Presenting Primary Theories

From Figure 2.4, one can see that I move back and forth many times between the first four steps, and the theory-building process is rather more iterative than linear. The problem here is knowing when a researcher should stop collecting more data, or more specifically, how many qualitative interviews are enough for a case study (Baker & Edwards, 2012). The criterion is whether theoretical saturation is achieved. In simple words, *theoretical saturation* means that I need to carry on theoretical sampling and collecting more data until: 1. no new data are needed regarding a category; 2. no new categories are needed in order to have a full picture of the case or the emerging theory (Baker & Edwards, 2012; Bryman & Bell, 2007; Strauss & Corbin, 1998).

In this dissertation, I find there are two situations to ensure that I have achieved saturation in both single case studies and multiple case studies. Firstly, if I cannot get more new information for one category during my interviews, I do not need to collect more data on that category. Secondly, if I find my case story is already logically complete and can well reflect my research questions, I do not need to discover more categories. People may question whether theoretical saturation can be achieved within a single case study. Actually, theoretical sampling within a multiple case study means both finding more cases and more data sources, while theoretical sampling within a single case study mainly means finding more data sources such as new key informants. Thus, a purposefully done single sampling (single case study) is able to generate saturate theories as long as the researcher collects enough data and follows the rigor of the data analysis process (Baker & Edwards, 2012; Coyne, 1996; Siggelkow, 2006).

After theoretical saturation is achieved, I can formulate both an interesting case story and an emergent theory. The next step is to present the emergent theory in a draft paper (*Step 6: Presenting Primary Theories*). Yet the biggest challenge is how to present the emergent theory in a persuasive way, so as to avoid the chosen format being queried. In this dissertation, I use two ways of presenting the emergent theories. The first way is to link each theoretical proposition and arguments to the supporting case evidences (e.g. Paper 2 and 5). The second way is to first present the case narratives, and then reflect on the existing literature and explain the main theoretical constructs abstracted from the case narratives. Finally, a visual theory diagram consisting of boxes and arrows will be presented and followed by propositions showing relations between the constructs (See Paper 3 and 4).

Constructing Emergent Theories

The theory-building process can end at Step 6, since the emergent theories have already been presented. However, in order to ensure the reliability and validity of the primary theories, another round of theoretical sampling (finding new cases or new interviewees), data collection and coding were carried out in this research (*Step 7, 8 and 9*). After I got my primary theoretical frameworks and propositions, I had discussions with some key informants to see whether the framework and propositions made sense. Though sometimes I got their confirmation, I would sometimes also get suggestions to interview another informant, or I found that more cases were needed. In the latter situation, I needed to collect more data to revise my primary theories (*Step 10*). After several rounds of theoretical sampling, data collection and coding, I reached my final substantive theoretical frameworks and propositions that could stand on their own feet, which are shown in each paper.

2.6 Evaluation of the Research Design

The triangulation principle can be used to evaluate a research project (Patton, 2002; Yin, 2009). We have discussed data triangulation before, yet triangulation is not merely about using different data sources. Patton (2002) summarizes four types of triangulation: 1. Data triangulation; 2. investigator triangulation; 3. theory triangulation; and 4. methodological triangulation. In this research, data, investigator and theory triangulations have been adopted.

Investigator triangulation is mainly used in Paper 3. Four researchers from either Chinese or Danish universities engaged in the data collection and analysis of this single case study. We first interpreted the data and found out the main theoretical constructs separately. Then we cross-checked the main theoretical constructs of the final framework together. Finally we confirmed the final framework. This improved the quality of the theory building. *Theory triangulation* means that researchers need to analyze the data from different theoretical perspectives. This triangulation principle is shown in all four empirical research papers. An integration of different theories is used as background knowledge for my research, which also created the possibilities of generating new theories. For example, by interpreting triple helix actors' activities in another country from both internationalization theories and triple helix theories, we found an underlying trend of internationalization of triple helix (Paper 2).

Besides different types of triangulations, researchers usually use four tests to evaluate case studies, i.e. construct validity, internal validity, external validity, and reliability (See Table 2.5) (Yin, 2009, pp: 40-45).

Table 2.5. Evaluation of case study.

Tests	Tactics	Phase of research in which tactic occurs
Construct validity	• Use multiple sources of evidence • Establish chain of evidence • Have key informants review draft, case study report	Data collection Data collection Case composition
Internal validity	• Look for pattern matching • Explanation building • Address rival explanations • Use logic models	Data analysis
External validity	• Use theory in single-case studies • Use replication logic in multiple-case studies	Research design
Reliability	• Use case study protocol • Develop case study database	Data collection

Source: Yin, 2009, pp: 41.

According to my previous discussions, *construct validity* is mainly shown in triangulation of data. In addtion, I sent some transcriptions and draft versions of papers to key informants to review in order to ensure the construct validity. For example, I developed three categories of network organizations in Paper 4 (Chapter 6) based on a multiple-case study of three cases. I showed this to the case companies to check whether I put the company in the right basket.

Internal validity mainly refers to whether researchers are able to develop causal rationships to explain a phenomenon; thus it is only related to explanatory case studies. My research is exploratory, and internal validity is, therefore, not considered here.

External validity deals with whether a case study's findings can be generalized beyond the chosen cases and to other situations. Findings of case studies cannot be generalized statistically (*statistical generalization*), but they are generalizable to theoretical propositions that can expand existing theories. This is referred to as *analytic generalization* (Eisenhardt, 1989; Siggelkow, 1997; Yin, 2009). If we take a look at the four case study papers (Chapter 4-7), we may find that these papers start with asking research questions that are related to business activities, then carry out exploratory case studies, and end with reflecting on the existing literature and posting new conceptual frameworks, categorizations or patterns, and theoretical propositions. The proposed frameworks or propositions can be regarded as highly abstract new theories, so they are no longer strictly bound within the chosen cases' contexts. For example, Paper 4 is a multiple case study following the replication strategy, and the findings show a novel way of categorizing firm's internal network organization based on the relationship between hierarchy, market, and network. The categorization is then no longer representing the three case companies, but logically reflects existing theoretical debates on hierarchy, market and network. Thus, the proposed categorization can stand on its own feet conceptually and can be generalized to other companies.

The goal of *reliability* is to minimize bias and error in a case study (Yin, 2009, pp: 45). As mentioned before, I created databases for each case, and applied the principle of investigator triangulation in some papers to reduce bias and error. In addition, I composed case protocols for each case company as mentioned in Section 2.5.2. Thus, the dissertation has a high reliability in the sense that other researchers can review the databases and the steps of the research. However, if another researcher attempts to repeat what I have done, he/she may not come to the exact same propositions/theoretical framework since qualitative researches are always highly dependent on researcher's logical thinking. In line with my position as a critical realist, I think we cannot eliminate bias completely. However, I believe that some important theoretical constructs could be identified by other researchers if they were going to replicate my research. These common constructs are the "objectified truth" as I discussed before.

References

Alaranta, M. (2006). Combining theory-testing and theory-building analyses of case study data. *ECIS 2006 Proceedings.* Paper 175.

Arbnor, I., & Bjerke, B. (2008). *Methodology for creating business knowledge*. London: SAGE Publications.

Baker, S. E., & Edwards, R. (2012). How many qualitative interviews is enough? *National Center for Research Methods*. Available at: http://eprints.ncrm.ac.uk/2273.

Bernard, H. R., & Ryan, G. W. (2009). *Analyzing qualitative data: Systematic approaches*. Thousand Oaks: Sage.

Bryman, A., & Bell, E. (2007). *Business research methods*. New York: Oxford University Press.

Burrell, G., & Morgan, G. (1985). *Sociological paradigms and organisational analysis*. London: Heinemann.

Coyne, I. T. (1997). Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries? *Journal of Advanced Nursing, 26*(3), 623-630.

Daft, R. L., Murphy, H., & Willmott, H. (2010). *Organization theory and design*. Hampshire: South-Western/Cengage Learning.

Dyer, W. G., & Wilkins, A. L. (1991). Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of Management Review, 16*(3), 613-619.

Easterby-Smith, M., Thorpe, R., Jackson, P., & Lowe, A. (2008). *Management research*. London: SAGE.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532-550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal, 50*(1), 25-32.

Foss, N. J. (2003). Selective intervention and internal hybrids: Interpreting and learning from the rise and decline of the Oticon spaghetti organization. *Organization Science, 14*(3), 331-349.

Gephart, R. P. (2004). Qualitative research and the academy of management journal. *Academy of Management Journal, 47*(4), 454-462.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.

Hatch, M., & Cunliffe, A. (2006). *Organization theory: Modern, symbolic & postmodern perspectives*. Oxford: Oxford University Press.

Herriott, R. E., & Firestone, W. A. (1983). Multisite qualitative policy research: Optimizing description and generalizability. *Educational Researcher, 12*(2), 14-19.

Hillman, A. J., Withers, M. C., & Collins, B. J. (2009). Resource dependence theory: A review. *Journal of Management, 35*(6), 1404-1427.

Kuada, J. (2009). Paradigms in international business research - classifications and applications. *Working Paper Series: International Business Economics*, (53), 1-29.

Kuhn, T. S. (1970/1962). *The structure of scientific revolutions*. Chicago: University of Chicago press.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks: Sage.

Miles, R. E., & Snow, C. C. (1992). Causes of failure in network organizations. *California Management Review, 34*(4), 53-57.

Onwuegbuzie, A. J., & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International Journal of Social Research Methodology, 8*(5), 375-387.

Patton, M. Q. (2002). *Qualitative evaluation and research methods* (3rd ed.). Thousand Oaks: Sage.

Pentland, B. T. (1999). Building process theory with narrative: From description to explanation. *Academy of Management Review, 24*(4), 711-724.

Rossman, G. B., & Wilson, B. L. (1985). Numbers and words combining quantitative and qualitative methods in a single large-scale evaluation study. *Evaluation Review, 9*(5), 627-643.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students (5th ed.)*. Edinburgh: Pearson Education.

Schutz, A. (1972). Concept and theory formation in the social sciences. In M. Natanson (Ed.), *Alfred schutz collected papers I: The problems of social reality* (pp. 48-66). Netherlands: Springer.

Scott, W. R., & Davis, G. F. (2007). *Organizations and organizing: Rational, natural, and open systems perspectives*. New Jersey: Pearson Prentice Hall.

Siggelkow, N. (2007). Persuasion with case studies. *Academy of Management Journal, 50*(1), 20-24.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks: Sage.

Törnebohm, H. (1974). *Paradigm i vetenskapernas värld och i vetenskapsteorin*. Gothernborg: Avdelningen för Vetenskapsteori. Göteborgs Universitet.

Tsoukas, H., & Chia, R. (2002). On organizational becoming: Rethinking organizational change. *Organization Science, 13*(5), 567-582.

Weick, K. E. (1995). *Sensemaking in organizations*. London: SAGE Publications.

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science, 16*(4), 409-421.

Yin, R. K. (2009). *Case Study Research: Design and methods* (4th ed.). California: Sage.

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan, 9*, 1-6.

Appendix 2.1. An Overview of Interviews and Discussions.

Here is an overview of my interviews done in four companies, i.e. InnoFlex, Circular, Biozyme, and Sunshine. It is worth noting that:

1. Field data for Paper 2 is not included since most discussions are informal, and the main data sources are participatory and direct observations;
2. Most of my interviews are semi-structured, and some open discussions are also included. In the Cicurlar case, two "interviews" are actually two presentations on global network organization by R&D managers followed with Q&A, which provide extremely rich data and therefore are also included as my data.
3. Notes were taken for all interviews and discussions.

Cases	Interviews	Job Title	Time (hours)	Date & Venue	Description
InnoFlex 5 key informants In total: 11.75 hours	1.	General manager of InnoFlex China	1.5	27.04. 2009, Beijing, Denmark	Interview on organization of InnoFlex China and its relations to headquarter, also its local networks.
	2.	Business development manager & business developer	0.25	12.11.2010, Copenhagen, Denmmark	In a business forum on creating business in Asian, I had a short discussion on InnoFlex's innovation organization and achievements.
	3.	Business development manager & business developer	1.5	28.09.2011, Aalborg Denmark	An informal interview on innovation networking and management challenges.
	4.	General manager of InnoFlex China	1.5	20.10.2011, Beijing, China	Interview on InnoFlex' strategic roles and core competences, innovation capability and innovation management.
	5.	Quality assurance engineer	0.75	31.10.2011, Beijing, China	Interview on InnoFlex China's innovation management and organization, relations to headquarter, and networks with external partners.
	6.	Key account manager	0.75	31.10.2011, Beijing, China	Interview focusing on cultivating bottom-up innovation, and successfully establishing and managing innovation networks with customers and suppliers.
	7.	Business developer	2.5	21.11.2011, Aalborg, Denmark	An in-depth interview on innoFlex's network organization and management.

	8.	Business development manager	0.5	22.11.2011, Aalborg Denmark	Follow-up questions on the Nov.11's interviews
	9.	Business development manager & business developer	2.5	08.11.2011, Aalborg Denmark	An open discussion on how to make employees learn faster and how to cultivate bottom-up innovation. Two informants from InnoFlex, and three researchers.
Circular 8 informants In total: 13.5 hours	10.	Business development manager	1.5	16.03.2011, Aalborg Denmark	One hour presentation on Cicular's global network organization design given by Circular's manager, 0.5 hours of additional questions.
	11.	R&D director of Circular China	1	20.10.2011, Beijing, China	General questions on Cicular China's strategic role, innovation capabilities, organizations and management, and local R&D collaboration with Chinese partners.
	12.	R&D director of Circular China	2.5	13.02.2012, Suzhou, China	Circular's global R&D organization and management, Circular China's internal organization and innovation management, collaboration with Chinese local partners.
	13.	Technical key account manager	2.5	13.02.2012, Suzhou, China	Focusing on Circular's R&D partnership with Chinese key accounts, initiation and management of such networks.
	14.	Manager for globalization of technology	1	13.02.2012, Suzhou, China	Circular's global network organization, focusing on global project management, cross-subsidiaries' R&D collaboration.
	15.	Technology manager	1.5	01.03.2012, Aalborg, Denmark	One hour presentation on Cicular's global network organization design given by Circular's manager, 0.5 hours of additional questions.
	16.	Technology director	2	14.07.2012, Bjerringbro, Denmark	In-depth interview on the principle and design of Circular's global network organization, challenges and management, including R&D networking among global R&D subsidiaries and networking with external partners.
	17.	Commercial director	1	04.04.2013, Bjerringbro, Denmark	Focusing on business model and innovation process, and R&D partnership with external partners.
	18.	Technical key account manager	0.5	28.03.2013, Telephone interview	R&D networking with Chinese partners.

Biozyme 6 key informants In total: 10.25 hours	19.	Senior R&D director	1.5	17.10.2011, Beijing, China	General discussion on Biozyme's global R&D organization, innovation process and management, internal networking and innovation networks with external partners.
	20.	Senior R&D director	1.5	31.10.2011, Beijing, China	Global R&D organization and management, global R&D projects, local networking, knowledge sharing within the organization.
	21.	Senior R&D director	1	30.08.2012, Beijing, China	It was a presentation of 1.5 hours on BioZyme's China's innovation footprints, organization and management for students of innovation management, after that followed a 1 hour & A session.
	22.	Senior manager	1	13.11.2012, Beijing, China	General discussions on innovation management and networking in Challenges.
	23.	R&D manager	1.25	18.12.2012, Beijing, China	Termination and success of R&D projects with either internal or external partners. Focusing on managing radical innovation projects and partnerships.
	24.	Senior manager	1	07.01.2013, Beijing, China	Termination and success of R&D projects with either internal or external partners. Focusing on managing radical innovation projects and partnerships.
	25.	Senior R&D manager	1	07.01.2013, Beijing, China	Termination and success of R&D projects with either internal or external partners. Focusing on managing radical innovation projects and partnerships.
	26.	Patent manager	1	17.01.2013, Beijing, China	Termination and success of R&D projects with either internal or external partners. Focusing on managing radical innovation projects and partnerships.
	27.	Senior manager	1	22.01.2013, Telephone interview	Termination and success of R&D projects with either internal or external partners. Focusing on managing radical innovation projects and partnerships.
Sunshine 5 key informants In total: 7 hours	28.	Technological director	0.5	10.01.2012, Beijing, China	Innovation strategy of Sunshine and R&D partnerships with Circular
	29.	Director of technological center	2	08.02.2012, Dezhou, China	General discussions on innovation challenges, organization and management.
	30.	Stand-alone research department director	2	09.02.2012, Dezhou, China	Innovation management of Sunshine, focusing on the R&D partnership with Cicular
	31.	Engineer	0.5	09.02.2012	Experiences in collaborating with Circular.

32.	Manager	1.5	10.02.2012	A guided tour by a technical manager, informal discussions on Sunshine's innovation management and R&D strategy.
33.	Technological director	0.5	09.03.2012	Collaboration with Circular, challenges and success.
In total: 33 interviews (including some open discussions); 24 key informants; 42.5 hours.				

Appendix 2.2. An Example of Interview Outline

Interview Outline for BioZyme China (BC)

Through the interview, I hope to understand:

- The meaning of network organization
- The strategic role of BC's R&D and its relationship with other Global R&D subsidiaries
- The organizational design of BC and its internal R&D management
- BC innovation networks in China and its management.

Interviewee: Mr. X, R&D Director
Interviewers: Yimei Hu, Department of Business Management, Aalborg Unversity
Time and Venue: Oct. 30, 2011, BC, Beijing

Motivations of Setting BC

1. BC was established in 1994, and according to the annual report, China has become one of most important R&D subsidiaries of Biozymes, so, what are the original purposes for Biozyme to have a R&D subsidiary in China? Could you recall how it was determined?
2. Why choose Beijing rather than other areas?

Strategic Roles

3. In terms of global R&D, Could you describe the role of the Chinese R&D subsidiary compared to other R&D subsidiaries? Is BC's R&D aiming at Chinese market, global market or both?
4. When this R&D subsidiary was established, what is the designed main function of it? Does the strategic role changed within these years? Could you recall the incidents that related to the changes?
5. To what extent do you think Biozyme Denmark will globalize its R&D in the future and will the core R&D be kept in Denmark forever?

Relationships with Headquarter and other global R&D subsidiaries

Collaboration with Danish R&D headquarter

6. In terms of resource configuration, do you think:
    - BC has decentralized and nationally self-sufficient knowledge, or
    - Specialized and interdependent resources and capabilities?
7. In terms of autonomy, how do you describe BC's power and autonomy?
8. Does BC cooperate with other global R&D subsidiaries in R&D? What are the global R&D subsidiaries that are most frequently talked with? Can you share one project as an example?
9. How does BC usually communicate with other global R&D subsidiaries? Who is responsible for communicating with those subsidiaries, or is there a specific business unit that is aiming at coordinate Biozyme's globally distributed R&D?

Decision Making and Reporting

10. In terms of decision making on R&D activities, does BC: makes its own decision, or cooperate with other R&D subsidiaries, or just implement headquarter's decision?

11. What is the reporting relationship between BC and the R&D headquarter in Denmark?
12. Does BC share the same information system to communicate and measure process with Gabriel DK?

Goal Setting and Decision Making

13. How would you describe the goal setting in BC?
14. In terms of R&D activities, how do you describe the decision making process within NCN:
    - Autocratic: the leader makes the decision all alone
    - Consultative: The leader makes the decision after consulting with subordinates to collect information and perspectives
    - Inclusive: The leader involves subordinates in a process of decision-making by consensus.

Internal Organization, R&D Management and Competitive Advantage

Organization in China

15. Besides BC, Biozyme also has some production units in other cities; can you describe how Biozyme developed its organization inside China, and what is the relationship between R&D in Beijing and other production units in China?
16. In terms of R&D management, how do you define you, as a director's role in BC?
17. Does BC share the same culture as other R&D subsidiaries or has introduced its own mind-set?

Knowledge Management

18. Can you introduce how does BC carry out its internal knowledge management: e.g. how do employees of BC cooperate and share knowledge with each other; how does BC enhance its overall R&D capability; or how does BC encourage new knowledge?
19. What are the main challenges to manage NCN?

Competitive Advantage of NCN

20. BC has been quite successful, and could you describe the competitive advantages and core technical competences of BC?

Innovation Networks in China

Nature and Function of Innovation Networks

21. As we know that BC has a set of Chinese partners and constructed its local innovation networks, why does BC cooperate with local partners? Can you share one story?
22. Are there different types of network? Could you describe how did they formed: by contract, or by informal socialization?

Partners and Ties

23. What are the major partners in China? What are the criteria of selecting partners in China?
24. What kind of knowledge or expertise do they have?
25. What are the partners' main functions within the network?

Goal Setting

26. Do all actors in the innovation network adopt the same goal or they compromise between separate interests?

Decision Making and Power

27. Do Chinese partners join the development of ideas and decision making process together with BC? How? What is the power distribution in the innovation network: is it centralized to BC or is it more dispersed?
28. Where does BC's power come from?

Trust

29. How does BC develop trust with Chinese partners and avoid free riding and opportunism?

Knowledge Management: Sharing, interaction and mobility

30. Do BC and its Chinese partners have a knowledge-sharing routine? How do you communicate with each other?
31. How does BC absorb knowledge from Chinese partners and China?

Network Stability: Duration of the Network and Conflict Solving

32. Are there any conflicts within BC's innovation network? How does BC usually solve the conflicts?
33. What are the main challenges of managing innovation networks in China?
34. Are the Chinese networks temporary or long-term? How does BC maintain the partners?

Relational Capabilities

35. How does BC sustain its innovativeness by creating and managing the overall architecture of its innovation network in China?

General understanding on network

36. In this interview, we discussed a lot of networking, and as I can see from Biozyme's annual reports, you regard your organization as a highly network one, how do you, as an R&D director understand the concept of network organization?
37. According to your experiences, what are the key issues to successfully manage a flexible network organization?

3. Literature Review and Theoretical Background

3.1 Introduction to Paper 1

As proposed in Chapter 1, the first main research question of the dissertation is:

> *How do transnational corporations perceive/design a network organization to facilitate their global innovation?*

In order to answer this question, firstly, we need to study network organization deeply enough to form a meaningful definition. During the past three decades, a substantial amount of research has been carried out on the subject of innovation networks and network organizations. However, researchers have different perspectives and have drawn different conclusions, some of which conflict with each other. Thus, a systematic literature review will help to partly answer the first main research question from a theoretical perspective. In this chapter, I will try to investigate the meaning of "network organization for innovation" drawing on existing literature, by posing the following three sub questions:

1. *What is the current research status of network organization for innovation?*
2. *What is the theoretical foundation of network organization for innovation?*
3. *What does "network organization" mean in the existing literature?*

Based on a systematic literature review, a three-level framework to understand network organization, i.e. intraorganizational network organization, interorganizational network organization, and networks as innovation contexts, will be proposed by way of structure within which to place the other four papers.

As a supplement to this paper, I will also reflect on some research topics related to network organization for innovation in the reflection section (Section 3.3). Besides exploring the meaning of network organization for innovation from existing literature, this chapter provides an overview of the theoretical foundation of this dissertation.

3.2 Paper 1: A Literature Review[2]

In Search of a Network Organization for Innovation: A Literature Review

Yimei Hu

Department of Business and Management, Aalborg University

Abstract:

During the past three decades, there has been a substantial amount of research discussing an organizational innovation: designing a network organization to facilitate innovation. However, researchers have different perspectives and have drawn different conclusions, some of which conflict with each other. The aim of this paper is to review the literature in order to clarify different perspectives on network organization. A three-level framework is summarized, consisting of intraorganizational network organization, interorganizational network organization and network as innovation contexts. Since a network is a different organizational form compared with market and hierarchy, both theoretically and practically, new managerial perspectives need to be adopted, requiring advancement in theoretical development.

Keywords:

Innovation Network, Network Organization, Network Context, Transnational Corporations

1. Introduction

Literature on network organization has been extensive in recent years. In the last three decades, researchers have realized that a transition is occurring in innovation, i.e. innovation is being carried out within various forms of network organization and innovation is recognized as an evolutionary and networking process rather than a linear process carried out by a single organization or innovative hero. However, there are many different definitions of network organizations, some of which are even contradictory. For example, some scholars regard network organization as a new form of companies' intraorganizational design. In order to be an innovator or a prospector in the corresponding industry, a firm's organizations are evolving from hierarchy or matrix organization to network organization (Child et al., 2005; Child, 2005; Miles & Snow, 1992; Podolny & Page, 1998; Powell, Koput, & Smith-Doerr, 1996). In particular, TNCs

[2] Previous version presented at CICALICS Workshop 2011: Innovation Systems in Transformation of Economic Development Pattern. August: Beijing, China

that expand their technological capabilities globally and face fast-changing market environments in different countries can barely maintain a hierarchical and centrally-coordinated organization. Thus, an "integrated network model" is being increasingly adopted by TNCs (Bartlett, 1986; Bartlett & Ghoshal, 2002). Conversely, some scholars think that organizations naturally consist of different networks such as hierarchical networks and employee networks, and from their point of view, the so-called network organization is just a bureaucracy-lite organization which has no special characteristic (Borgatti & Foster, 2003; Hales, 2002).

Besides debating over an organization or a firm's boundary, more and more scholars tend to regard interorganizational networks or interfirm networks as network organizations, since different organizations share a common goal and even the same coordination system that is accepted by all members, which is in line with some basic principles of an organization. A network organization can be seen as "a basic institutional arrangement to cope with systematic innovation" (Imai & Baba, 1989). Moreover, some scholars view the market as networks or network organization, for example, "industrial market as an interfirm organization" (Reddy & Rao, 1990), and an industrial market is constructed by networks of actors, resources and activities (Håkansson, et al., 2009). Here, network organization is more a perspective or paradigm of the business world (Achrol, 1997; Borgatti & Foster, 2003), rather than just a specific structure or organizational form. Under such a network perspective, an organization is a social entity consisting of various forms of networks rather than a production or economic function (Podolny & Page, 1998; Podolny, 2001).

Therefore, it's no wonder that "the studies of network organizations have generated diverse, varied, inconsistent and contradictory findings" (Borgatti & Foster, 2003; Powell et al., 1996; Sydow & Windeler, 1998). Different definitions of network organization make us feel confused and we cannot help but wonder: "what is a network organization?" There have been a few review papers on "networks" with different focuses (Borgatti & Foster, 2003; Osborn & Hagedoorn, 1997; Provan, Fish, & Sydow, 2007). Provan et al. (2007) review and discuss empirical literature on "whole networks", i.e. interorganizational networks at the network level rather than at the focal organizational level of analysis, and they also review the evolution and governance of such whole networks. Borgatti and Forster (2003) review the network paradigm emerging in organizational research, and try to analyze different dimensions of network research such as direction of causality, levels of analysis, explanatory goals, and explanatory mechanisms. Osborn and Hagedoorn (1997) review the different schools of thought, methodological approaches, modes of cooperation between different research projects on interorganizational networks and alliances. However, these reviews lack of a focus on innovation. This paper aims to investigate the meaning of network organizations through a literature review that focuses especially on innovation-related network organizations.

From the literature review, the author will seek to find common denominators to frame a definition or to deepen understandings of network organization for innovation. The current research status and theoretical background of network organization will also be identified.

This paper is organized as follows: in the next section, the design and method of this literature review will be discussed. Then search findings will be presented, constituting three areas: number of articles, research methods and data type, and level of analysis. This will be followed by a summary of the main research topics. In Section 5, this paper will discuss the theoretical foundation of a network organization and show the interdisciplinarity of this concept. Section 6 will summarize the understandings of network organization into three levels of understanding. In the last section, the author will draw conclusions for this paper.

2. Research Design and Methods

A systematic review strategy is adopted in this paper. A systematic review can be defined as "a review with a clearly stated purpose, a question, a defined search approach, stating inclusion and exclusion criteria, producing a qualitative appraisal of articles" (Jesson, Matheson, & Lacey, 2011). A systematic literature review is different to a traditional literature review which usually has no clear protocol or method and allows the authors to discuss in an exploratory or flexible way. A systematic review requires a rigorous method and is replicable, which substantially reduces author's bias.

The systematic literature review has two approaches: i.e. database searches and snowballing (Jajali & Wohlin, 2012). The former approach mainly means searching and reviewing literature from databases after defining research questions and search criteria. The latter approach suggests that based on some starting material (usually top journal articles), additional literature should be identified and reviewed through forward snowballing (identifying articles that have cited the starting articles) and backward snowballing (identifying articles cited in the starting articles). However, a complete snowballing may include huge amount of literature and be very time-consuming, so most systematic literature reviews do not include the snowballing approach as a compliment to databases searches.

I will mainly use database search in this systematic literature review, while being aware that a database search may not include all important literature due to the design of search criterion. Informed by the backward snowballing strategy, though without a complete mapping, some additional influential items of literature are cited in this paper in order to support the analysis and give a more comprehensive understanding on network organization for innovation. In general, the systematic review method has six essential stages (Jesson et al., 2011) as shown in Table 3.1 and each stage will be elaborated upon below.

Table 3.1. Key steps in systematic literature review.

Step	Actions
1. Define the research question	Defined three research questions.
2. Design the plan	Database search as the main approach. Wrote a protocol including the following items: type of literature, database, keywords for searching, time span of literature, search criteria, etc. Also, decided to include additional literature following the backward snowballing approach.
3. Search for literature	Search for all literature in the database according to keywords and time span.
4. Apply exclusion and inclusion criteria	Focus on top journal articles in order to reduce data. Screened top journal papers' titles and abstracts, and excluded those that are not related to network organization for innovation. Also, following the backward snowballing approach, additional items of influential literature are included.
5. Apply quality assessment	Following the ABS journal ranking, and defined 15 top journals.
6. Synthesis	Composed a summary of all selected papers.

The first step of a systematic literature review is to define the research questions. As mentioned in the introduction section, scholars hold different perspectives of network organization though they may all use the same terminology. This triggered my interest to explore the meaning of network organization for innovation through answering the following research questions:

1. *What is the current research status of network organization for innovation?*
2. *What is the theoretical foundation of network organization for innovation?*
3. *What does "network organization" mean in the existing literature?*

After formulating the research questions, an overall plan for the systematic literature review was developed. In this systematic review, academic journal articles are used as the data to be reviewed. Firstly, I conducted a search for journal articles in the ABI/Inform Database. *Network organization* and *innovation* were the key terms used, in accordance with the review purpose. However, bearing in mind the result number is so large when conducting a search using these two terms without defining specific locations within which the two terms appear[3], I limited the search to article titles. Similar terms such as innovation network, interorganizational network, technological partnership, innovation alliance, multifirm network, interfirm network, networks of innovators, and multinational networks were also included as alternative search terms. I did not restrict the publication

[3] When searching *network organization* AND *innovation*, in the ABI/Inform database, there are 52175 journal articles all together.

date in order to track a history of the research on network organization for innovation. Based on the above search criteria, 601 journal articles were found in total[4].

In order to screen the 601 articles and ensure the quality of the articles, I identified the top 15 journals within six research domains according to the ABS journal ranking[5], i.e. general management, strategic management, international business and area studies, innovation, organization studies, and social science (See Table 3.2). This was to increase the chance of ensuring the quality of the published articles in terms of academic views and rigor of research methods. Other journals such as marketing, economics or international relations journals were deselected since the main focus of this review is on innovation management and business management. 138 articles from those top 15 journals were found.

I culled through the titles, abstracts and keywords of the 138 articles, which is the third round of data selection. Usually, titles, abstracts and keywords provide us with a purified profile of the research purpose, research methods, level of analysis and key findings. Based on the process of going through abstracts and keywords, I was able to eliminate those articles that are not within the sphere of business research or innovation research domains. I restricted the definition of innovation on R&D and organizational innovation; thus, those that study government reorganization, public management or marketing innovation were discarded.

After the third round of data selection, 74 papers were finally selected to be reviewed. All the selected articles fulfilled the requirements of focusing on network organization for innovation. I read each of the 74 articles and summarized the basic information (authors, publication year, and journal), abstracts and keywords along with the research methods and data type, research questions, definition of network organization, and main findings of each article. A simplified summary is shown in Appendix 3.1.

[4] Searches conducted in January, 2013.
[5] Academic journal quality guide version 4, online access:
http://www.myscp.org/pdf/ABS%202010%20Combined%20Journal%20Guide.pdf

Table 3.2. List of selected top journal articles.

Selected Journals	All	Selected	Research Domain
Academy of Management Review	9	5	General management
Academy of Management Journal	10	5	
Administrative Science Quarterly	10	4	
Journal of Management	2	2	
Journal of Management Studies	0	0	
Harvard Business Review	0	0	
British Journal of Management	3	1	
Strategic Management Journal	9	8	Strategic management
Journal of International Business Studies	18	5	International business and area studies
Journal of Product Innovation Management	2	2	Innovation
Technovation	17	9	
R & D Management	15	9	
Organization Science	8	3	Organization Studies
Organization Studies	5	3	
Research Policy	30	18	Social science
Total	138	74	

In order to classify the 74 papers according to the research methods, level of analysis, and main research topics, I used Nvivo 10 to code the summary of the selected articles. Nvivo is usually used to help with collecting, organizing and analyzing contents from interviews, focus group discussions, reports, and surveys, etc.[6] However, I found it to be a useful tool to assist in the literature review. For example, in order to identify research methods, I coded the column of "research method and data type" in Appendix 3.1 into nodes such as: quantitative-hypothesis testing based on survey or database; qualitative-multiple case study; mixture of quantitative & qualitative methods, etc. Then I categorized the 15 nodes into five sets of research methods, i.e. conceptual, literature

[6] Nvivo: http://www.qsrinternational.com/products_nvivo.aspx

review, mix of qualitative and quantitative methods, qualitative, and quantitative. Similarly, in order to summarize the research levels of the papers, I coded my data into four nodes: actor or focal organization level, dyadic level, network level, and cross-level.

Though a database search ensures the review process is thorough, it may cause several biases as well. Firstly, according to the ABS journal ranking, most of the top journals are American journals. Secondly, the search findings shown in Table 3.2 suggest that most authors are American scholars. Thus, the selected journal articles may tend to have a common research paradigm such as positivism. Thirdly, the definitions or perspectives on network organization in selected papers may originate from other literature that is not included in this review.

Therefore, in order to remedy the biases, I also include some influential literature as additional data (backward snowballing). The additional data was sampled in two ways: firstly, by tracking key references given by selected papers; secondly, by identifying key scholars referred to in selected papers and then tracking the key scholars' publications.

3. Search Findings

Search findings including the number of published journal articles, research methods and data type of selected particles, and level of analysis will be summarized in this section.

In general, the amount of literature on network organization for innovation has been increasing rapidly (See Figure 3.1). Taking the last three years (2010-2012) as an example, there have already been approximately 200 academic publications in this area of research. If we sort the selected 74 articles by their year of publication, we can also see a significant increasing trend in Figure 3.1.

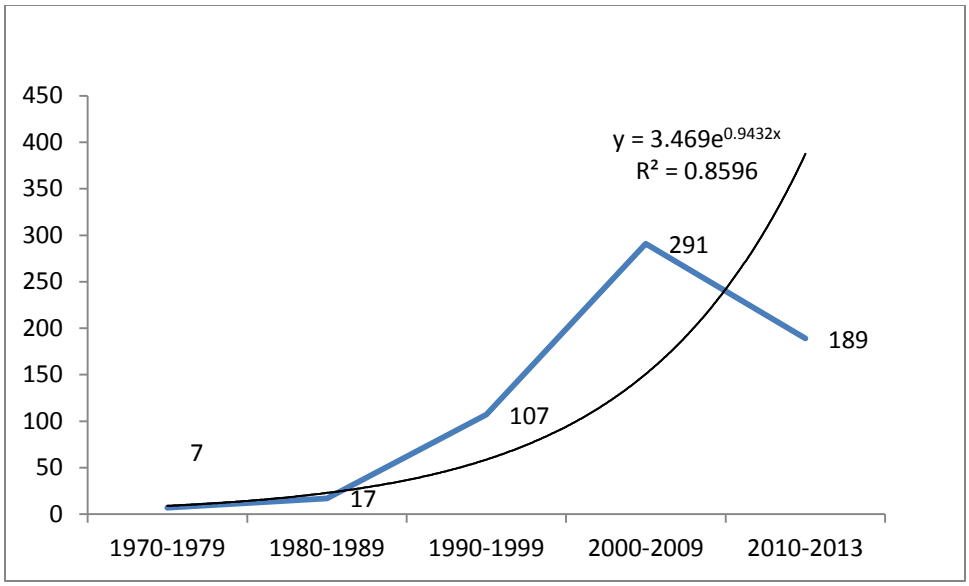


Figure 3.1. Found articles (1975-2012).

Quantitative and qualitative are two distinctive methods of research when conducting business research. Based on a differentiation of quantitative and qualitative data analysis, I summarized the research types and methods used by the selected articles. As seen in Figure 3.1, literature reviews, conceptual articles, and empirical research articles are three of the basic types.

There are 15 articles, (comprising 20% of the selected articles) which are conceptual or theoretical discussions aimed at proposing or building new concepts or theories. This shows that theories on network organization are still developing. Conceptual articles published in the 1980s and early 1990s are mainly focused on proposing the conceptualization of a network organization. For example, the special issue on "networks of innovators" published in 1991 in Research Policy (Bianchi & Bellini, 1991; DeBresson & Amesse, 1991; Freeman, 1991), was concerned with the development of "strategic networks" as a distinctive mode of organization that can position firms in more competitive stances (Jarillo, 1988); Ghoshal and Bartlett's study (1990) was concentrated on conceptualizing multinational corporations as interorganizational networks.

Later on, theorists attempted to investigate more aspects of network organization for innovation. In order to explore the management "black box", scholars proposed different capabilities with regards to network organization for innovation, for example, orchestration capability for innovation networks (Dhanaraj & Parkhe, 2006) and relational capability to establish and maintain innovation networks (Capaldo, 2007). Moreover, scholars have recognized that network organizations are evolutionary rather than static, and the change of network organization is influenced by the institutional environment. For example, Kim et al. (2006) conceptualize the constraints on network

change as network inertia; Robertson and Langlois (1995) argue that neither market nor vertical integration are the panacea; Koka et al. (2006) and Robertson and Langlois (1995) develop a framework showing the interaction between environmental change and patterns of network change.

Table 3.3. Research methods and types of data.

Research methods & Article types	Number of articles
Literature review	1
Conceptual articles	15
Empirical research articles	
Mix of quantitative & qualitative data analysis	6 • *Social network analysis: 1* • *Case studies:2* • *Survey or database + interview: 2* • *Text analysis: 1*
Qualitative	14 • *Interviews without focusing on specific cases: 2* • *Longitudinal case study: 1* • *Multiple case study: 6* • *Single case study:5*
Quantitative	38 • *Longitudinal: 2* • *Computer simulation: 1* • *Hypothesis testing based on survey or existing databases: 27* • *Modeling: 5* • *Social network analysis: 3*

Various research strategies have been adopted: survey (longitudinal or cross-sectional data), computer simulation, case studies (single or multiple), archival analysis, social network analysis, etc. According to Table 3.3, of the 58 empirical research articles, most of them are quantitative, especially hypothesis testing based on survey data or from databases; that said, purely qualitative research is increasing, using such methods as multiple or single case studies with the purpose of theory building are expanding. This also reflects the biases discussed in Section 2. Since most top journals are American journals, it is no wonder most of the published articles are quantitative in nature.

Interestingly, an emerging trend is to integrate both quantitative and qualitative data. In my search, I found five articles that use various methods of combining qualitative and qualitative data. A first way is to utilize both quantitative and qualitative data. For example, Capaldo (2007) carried out a longitudinal comparative case study of three case companies with the aim of making sense of "relational capability of lead firm" by

identifying and showing the evolution of innovation networks. Five sources of data were collected: archival records, retrospective individual interviews, focused individual interviews, direct observation, and documentary information. From among this data, qualitative data such as CEO's insights or managerial experiences on establishing and coordinating innovation networks with external partners, and quantitative data such as the number of new products, profit, duration of network, and patents obtained were combined in order to facilitate the analysis. A second way of combining both quantitative and qualitative data is to quantify qualitative data by using research techniques such as social network analysis (SNA). SNA aids in the visualization and analysis of network relations by collecting data from qualitative interviews and archival documents and then quantifying them. For example, Salman and Saives (2005) collected data on strategic partnerships through 40 interviews, and then used social network analysis to investigate the relationship between a firm's position and ties within a network and its innovation performance. A third way is to do a text analysis by using quantitative methods such as mapping the co-occurrence words (Liyanage, 1995). A fourth way is to integrate deductive and inductive approaches. Scholars can firstly test a hypothesis and then explain the findings by qualitative data such as interviews, or they can do things the other way around, by firstly using qualitative data such as interviews of field observations to develop theory and hypothesis, and then test the findings against the quantitative data (See Gulati & Gargiulo, 1999).

Following the discussions on research methods, the empirical research articles cover three levels of analysis, i.e. focal firm level or actor level (ego network), dyadic level and network level. According to Table 3.4, most empirical articles focus either on the focal firm level or the network level.

Table 3.4. Level of analysis.

Actor or focal organization level	Dyadic or alliance level	Network or group level	Cross level
24	5	23	6

Focal firm level analysis usually takes the organization's features as dependent variables, e.g. a firm's innovation performance, and tests or shows how the dependent variables are influenced by external or internal factors. A structural approach of focal firm level analysis may examine how outcomes of an organization or a focal actor are influenced by network variables such as centrality, multiplicity, broker and cliques (Provan et al., 2007). For example, Ahuja (2000) examines the relationship between a firm's network position in the industry and its innovation performance. Gulati and Garguilo (1999) hypothesize that the extent of a firm's network resources from prior alliances and its alliance formation capabilities will influence its decision of whether to enter into alliances. Stuart (2000) investigates whether alliances with predominant

partners upgrade a focal firm's reputation and performance, and he shows that the advantage of alliances is determined by the characteristics of the firms that a focal organization is connected to. Though these three examples examine network factors' influences, they are still focused on the focal organizational level.

However, when it comes to examining the influential factors of knowledge creation or innovation performance of alliances (Karamanos, 2012), it becomes a dyadic level of analysis. Networks are fundamentally constructed by pairs of nodes (Borgatti & Foster, 2003). A dyadic analysis would focus on the ties or resource flows between two nodes. Network level analysis takes networks as a whole and considers the innovation outcomes at the network level rather than at the single firm level or at a dyadic alliance level. Thus, the structural characteristics such as density, structural holes, and centralization are examined across the entire network. Cantner and Graf (2006) describe the evolution and competencies of the innovation networks in Jena by focusing on geographical proximity between actors through social network analysis. Moreover, the governance issues are about how to make the whole network feasible and efficient (Provan et al., 2007). For example, Snow et al. (2011) shows how an innovation-oriented multifirm organization is designed and coordinated, and Perks and Jeffery (2006) investigate why and how to configure international innovation networks for the fabric industry.

Though most articles focus on a single level analysis, there are seven cross-level analyses among the selected 74 articles, meaning that they either analyze from two levels or cover all three levels. Love and Roper (2001) examine the importance of firm-specific, regional and national industrial factors in determining both firms' R&D and regional networking. Capaldo (2007) investigates the relational capability of an innovating firm from lead firm level, dyadic level and network level.

4. Main Research Topics

Based on coding the main research questions and research findings of selected articles, the research topics of selected articles can be categorized into five main streams: conceptualization of network organizations; innovation performance of network organizations; structure, design and management of network organizations; formation, change and evolution of network organizations; and TNCs and network organizations (See Table 3.5). The concept of network will be discussed in detail in Section 6, and the other four main streams of researches will be summarized below.

Table 3.5. Paper summary based on research topics.

Topics	Nodes	Number of Articles
Conceptualization of network organizations: 8	*Concept*	7
	Literature review	1
Innovation performance of network organizations: 24	*Innovation performance*	24
Design, structure and management of network organizations: 17	*Complexity*	1
	Design	6
	Structure	6
	Management capabilities	5
Formation, change and evolution: 13	*Innovation diffusion in networks*	1
	Network change and evolution	7
	Network formation	5
TNCs and network organization: 11	*TNCs network organization for innovation*	11
	Total	**74**

4.1 Innovation Performance of network organizations

Many research projects have confirmed the positive relationship between network and innovation performance, i.e. the locus of innovation is usually found in networks rather than in individual firms (Narula & Hagedoorn, 1999; Powell et al., 1996), though there are some opposing views (See Joshi & Nerkar, 2011). Among the selected articles, there are 24 articles focused on the influences of various factors on the innovation performance of network organizations such as interorganizational networks and interpersonal networks.

On the one hand, some articles argue that a focal firm's network-related features such as position (centrality) in networks, network structure, network composition, and geographical propinquity will influence the innovation performance of either the focal firm or the whole network (Ahuja, 2000; Phelps, 2010; Whittington, Owen-Smith, & Powell, 2009). For example, Schilling and Phelps (2007) carried out a longitudinal study on patent performance of 1,106 firms in 11 industry-level alliance networks, and show that firms embedded in alliance networks that exhibit both high clustering and high reach (short average path lengths to a wide range of firms) will have greater innovative output than firms in networks that do not exhibit these characteristics. Nieto and Santamaria (2007) notice the features of actors may influence the innovation novelty of networks: collaboration with suppliers, clients and research institutions has a positive impact on the novelty of innovation, while collaboration with competitors has a negative impact.

Karamanos (2012) points out that the leveraging of both a dense network centered by a few key firms and a macro network with short and indirect path to other firms will lead to explorative innovation output, which further develops Capaldo (2007)'s research argument that the integration of a large periphery of heterogeneous weak ties and a core of strong ties will have a positive impact on lead firm's innovation performance.

On the other hand, some articles explore the proper management or interaction patterns of networks that lead to better innovation performances (Bouncken, 2011; Hage & Hollingsworth, 2000; Kijkuit & van den Ende, 2010; Löfsten & Lindelöf, 2005; Whittington et al., 2009). For example, Bouncken (2011) explores the relationship between the management of project alliances and their performances, and he discovers that emergent operating practices improve planned and serendipitous innovation.

4.2 Design, structure and management of network organizations

This stream is about the design and structure of network organization and related managerial issues. Under complex, rapidly changing, and turbulent environments, more and more organizations have shown a transition from hierarchical bureaucracy to network organizations (Baker, 1993; Gassmann & Von Zedtwitz, 1999; Hatch & Cunliffe, 2006; Josserand, 2004; Miles & Snow, 1992). Child and McGrath (2001) describe how traditional organization forms have changed in terms of three major organizational activities, i.e. setting goals, maintaining integrity, and differentiating rights and duties. The results reveal some "network" features such as decentralization, flexibility, fuzzy boundaries, interdependence and an innovation-oriented mindset.

Snow et al. (2011) offer a single case study (Blade.org) to show how firms have moved from stand-alone organizations to a multifirm network design. They argue that such a network organization not only facilitates knowledge sharing between members, but also adopts an institutional mechanism that supports direct interfirm collaboration. Some scholars suggest that such a network model is extremely suitable for SMEs that adopt an open innovation strategy or compete in the global market by continuous innovation (See Calia, Guerrini, & Moura, 2007; Lee, Park, Yoon, & Park, 2010).

Some scholars use the concept called "network configuration", which means in order to stimulate knowledge interaction and achieve innovation among network actors, the focus must be on how the organizations design, arrange shape and balance different resources and actors' roles within a network (Calia et al., 2007; Cantner & Graf, 2006; Perks & Jeffery, 2006). Perks and Jeffery (2006) carry out a multiple case study exploring how organizations configure industrial networks in the innovation processes, and they identified three types of network configuration rational: outsources network configuration with overlapping dyadic relations, centralized network configuration that is controlled or dominated by a central firm, and specified network configuration with restricted network memberships and knowledge flows. Debresson and Amesse (1991)

concluded that there are different configurations for innovation networks: supplier-user networks, networks of pioneers and adopters, regional inter-industrial networks, international strategic technological alliances and professional inter-organizational networks. In order to utilize knowledge resources from networks, managers need to find the appropriate level of investments and mechanisms, as well as the suitable combination of core partners and indirect partners.

Table 3.6. Capabilities related to networks.

Capabilities	Definition	References
Combinative Capability	A type of dynamic capability which refers to the capability of the firm to "exploit its knowledge and the unexplored potential of the technology by recombining their current capabilities".	Kogut and Zander, 1992
Absorptive Capacity	The ability of a firm to "recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities".	Cohen and Levinthal, 1990
Multiplicative Capability	Complementary to absorptive capability, which is based on a learning perspective which transfers technology and know-how to the whole firm to benefit.	Gassmann and Keupp, 2008
Network Capability	Firm-specific partnering capability that "enables a company to place itself in a particular position in a broader network of partnerships with multiple companies, and it plays a crucial role in enabling companies to continue to interact with other companies through partnerships in a complex network setting".	Hagedoorn et al., 2006; Kogut, 2000
Relational Capability	The lead firm's capability to "sustain its innovativeness by creating and managing the overall architecture of its network over time", which will provides ground for leading firms in knowledge-intensive alliance networks to gain competitive advantages.	Capaldo, 2007
Orchestration Capability	The capability of a hub firm to "purposefully build and manage inter-firm innovation networks without the benefit of hierarchical authority".	Dhanaraj and Parkhe, 2006; Ritala et al., 2009

Network design is closely connected with network management. The objective of managerial activities is usually to create competitive advantages for firms involved in innovation networks. According to the resource-based view, a firm's sustained competitive advantage comes from valuable, rare, inimitable and nonsubstitutable

resources (Barney, 1991; Wernerfelt, 1984). Since a firm's critical resources may span firm boundaries and may be embedded in interfirm resources and routines (networks), sustained competitive advantage may be located in networks rather than single firms, which is regarded as "relational competitive advantages" (Dyer & Singh, 1998).

In order to achieve both firm and relational competitive advantages, scholars have conceptualized some capabilities that a firm needs. Through the construction of a network or a network organization, a firm may need to alter their resource base to generate new resources of competitive advantage, which requires dynamic capabilities (Eisenhardt & Martin, 2003; Teece & Pisano, 1994). Besides dynamic capabilities, there are also other capabilities related to network organization and management of networks. Of the six capabilities summarized in Table 3.6, combinative capability (Cohen & Levinthal, 1990; Kogut & Zander, 1992), absorptive capacity (Cohen & Levinthal, 1990), and multiplicative capacity (Gassmann & Keupp, 2008) are more related to a single firm's competitive advantages, while network capability (Hagedoorn, 2006), relational capability (Capaldo, 2007), and orchestration capability (Dhanaraj & Parkhe, 2006), are more related to network management and generating relational competitive advantages.

4.3 Formation, change and evolution of network organizations

Regarding network formation, whether potential network partners' resource endowments will create value when combined with the focal firm's resource base is a prerequisite for establishing a network. Some scholars argue that only when network members have complementary resource endowments is a network viable and feasible (Dyer & Singh, 1998; Frenken, 2000; Park & Ungson, 1997). Yet others have found that similar resources that are supplementary to each other can also stimulate the formation of networks (Ireland, Hitt, & Vaidyanath, 2002). In particular, Cowan and Jonard (2009) suggest that firms must have an intermediate degree of similarity in their knowledge, and only then can a network be formed.

Besides resource endowments, a firm's innovation strategy will also influence its decision of establishing innovation networks. For example, Bercovitz and Feldman (2007) investigate when firms tend to establish R&D partnerships with universities and find that firms with an internal explorative innovation strategy and a more centralized R&D organization will allocate more R&D resources to collaborate with university partners. Moreover, the firm's accumulated information from prior network collaborations is influential in that firm's decisions to enter into new alliances (Gulati, 1999).

Network change and evolution is the result of both environmental context and a firm's strategic actions, and network change is part of the process of network evolution. Koka et al. (2006) analyze the network evolution through its two evolutionary primitives, i.e. the creation and dissolution of ties, and propose four patterns of network change: network expansion, network churning, network strengthening and network shrink.

Regarding the impact factors of network change and evolution, Kim et al. (2006) propose that an organization's attempts to change its network partner is influenced by four types of constraints: internal constraints of intraorganizational networks, tie-specific constraints of dyadic ties within interorganizational networks, network position-specific constraints, and external constraints. Regarding external constraints, scholars have noticed that the innovation network change and evolution is influenced by the business or technological environment change. Some research shows that network change and evolution is the reaction or adaptation of external changes (See Cantner and Graf, 2006). Some scholars show how innovation networks co-evolve with the external environment (Koka et al., 2006).

4.4 TNC and Network Organization

This research stream focuses particularly on TNCs' network organization for innovation, and 11 articles are categorized into this stream. This stream partly overlaps with the other streams. For example, the discussion in this subsection is in line with the review in Section 4.2, i.e. network organization design, structure and management. However, the reasons for separating these papers from the others are: firstly, the internationalization of R&D and knowledge searching on a global level is an emerging phenomenon (Johanson & Wiedersheim-Paul, 1975; Johanson & Vahlne, 1977; Johanson & Vahlne, 1990; Zander, 1999); secondly, a global network model is becoming the common choice of TNCs as suggested by scholars such as Bartlett and Ghoshal (2002).

Typologies of TNCs' R&D organizations

Some scholars investigate the role of R&D subsidiaries within TNCs' R&D organization. Chiesa (1996) divided firm's R&D structure into exploitation and experimentation R&D structures. Kuemmerle (1997) identifies two types of R&D sites: home-base-augmenting laboratory site and home-base-exploiting laboratory site. Birkinshaw and Morrison (1995) propose that the role of TNCs' subsidiaries has turned from local implementer, to specialized contributor and world mandate. Medcof (1997) proposes eight types of overseas technology according to three dimensions: type of technical work (research, development, or support); functional works (marketing, manufacturing, marketing and manufacturing combined); and geographic area of collaboration (local, international). The eight types are: local research, local development, local marketing support, local manufacturing support, international research, international development, international marketing support, and international manufacturing support.

In particular, some scholars point out that a network model does not merely mean decentralization. For example, Malnight (2001) proposes that TNC's decentralized structure is not a network structure, but is a transition from decentralized to network-based TNC structure, which is similar to the transition from polycentric decentralized R&D to integrated R&D network (Gassmann and von Zedtwitz, 1999).

Role of R&D subsidiaries

Some scholars investigate the role of R&D subsidiaries within TNCs' R&D organization. Chiesa (1996) divided firm's R&D structure into exploitation and experimentation R&D structures. Kuemmerle (1997) identifies two types of R&D sites: home-base-augmenting laboratory site and home-base-exploiting laboratory site. Birkinshaw and Morrison (1995) propose that the role of TNCs' subsidiaries has turned from local implementer, to specialized contributor and world mandate. Medcof (1997) proposes eight types of overseas technology according to three dimensions: type of technical work (research, development, or support); functional works (marketing, manufacturing, marketing and manufacturing combined); and geographic area of collaboration (local, international). The eight types are: local research, local development, local marketing support, local manufacturing support, international research, international development, international marketing support, and international manufacturing support.

Power

The different roles of global R&D subsidiaries and different types of TNCs' R&D organizations show the power status between R&D subsidiaries and headquarters. Power is derived from critical resources that an organization holds, and organizations' attempts to reduce other's power over them in order to reduce environmental interdependence and uncertainty (Hillman, Withers, & Collins, 2009; Pfeffer & Salancik, 1978). It is also applicable when regarding TNC's control or coordination over those R&D subsidiaries. Within a network organization, TNCs' global R&D subsidiaries may have strong power due to their own competences, so it is common to see an R&D subsidiary within a network organization being responsible for the entire value chain (Gassmann & von Zedtwitz, 1999).

Based on the resource dependence theory, the resource-based view and Vroom-Yetton model, Medcof (2001) proposes that there are three core modes regarding TNCs' globally distributed technology units, i.e. autocratic, consultative and inclusive. He asserts that resource-based power goes with R&D subsidiaries when they hold critical knowledge / R&D resources, and these international R&D units should be managed with inclusive mode with more autonomy due to the power configuration.

Andersson et al. (2007) find that there is a dilemma with R&D subsidiaries: they can access a variety of competencies and may not be veryinterested in contributing to the overall performance of the TNC. Thus, they argue that it is better for headquarters to balance or moderate the influence of strong subsidiaries. Besides, a subsidiary's local business network will influence the resource allocation and management of headquarters. For example, Dellestrand and Kappen (2012) investigate how spatial and contextual distances (geographic distance, cultural distance, linguistic distance, institutional distance

and network embeddedness) within a multinational corporation affect headquarters' innovation-related resource allocation among subsidiaries and find that host countries' factors such as structures of subsidiaries' local networks and distance factors strongly influence headquarters' resource allocation.

R&D subsidiaries' competences

TNC's R&D subsidiaries have the possibility of accessing resources from two distinctive knowledge contexts: firstly, they enjoy knowledge transferred from the TNC's internal networks; and secondly, they can utilize knowledge resources from local host countries (Almeida & Phene, 2004; Pearce & Papanastassiou, 1996; Papanastassiou & Pearce, 2009; Phene & Almeida, 2008). Therefore, subsidiaries' competencies will be influenced by both the TNC itself and the supply, market and technical environment of the host country (Asmussen, Pedersen, & Dhanaraj, 2009).

Almeida and Phene (2004) find the technological richness of the TNC itself, the subsidiary's knowledge linkage to host country firms, and the technological diversity within the host country, to have positive impacts on the subsidiary's innovation performance. Collinson and Wang (2012) examine how innovation-related capabilities for production, design and marketing develop at subsidiaries. They do so through multiple case studies of five Taiwan-based multinational corporation subsidiaries' evolution of specialization in the semiconductor industry. The results show that subsidiaries' capability accumulation can be discontinuous and subsidiaries in the same host region may have different specializations due to different degrees of network embeddedness of the subsidiaries. Liu and Chen (2012) examine multinational corporations' R&D networks in the host country's innovation system and find out that the subsidiaries' strategies, i.e. home-based technology exploitation and home-base technology augmenting, and the regional innovation system, mutually influence each other. For example, an R&D subsidiary with a home-based technology exploitation strategy will tend to be located in a region with a strong knowledge application and exploitation system, while a regional innovation system with strong knowledge generation and diffusion will induce multinational corporations' R&D subsidiaries to pursue a home-based technology augmenting strategy.

5. The Theoretical Underpinning of the Network Organization

After reviewing the selected articles, I found that network organization is a concept that has its roots in several of the classical scientific disciplines and thus is derived from economic, sociological, organizational, international business or marketing, and innovation theories. The purpose of this section is to briefly review these theories and their contributions to the network organization theory.

5.1 Transactions cost theory and coordination cost

Firstly let us consider the concept of network organization as derived from the economic views, i.e. *transaction cost theory* (Coase, 1937; Williamson, 1991) and *coordination cost* concept (Jones & Hill, 1988; Rawley, 2010). Initially, transaction cost theory successfully explained that organizations emerged to reduce transaction costs, and this in turn supported the trend of vertical integration from the 1930s to 1970s. From the 1980s, a "turbulent time" has come, and many U.S. companies have been forced to rethink their competitiveness and their existing inflexible organization structures. As a result, Williamson (1991) advances transaction cost theory by proposing "hybrid forms" as a middle form between market and hierarchy, which requires medium level transnational costs. As a result, transaction cost theory is still powerful to explain short-term network organization, but when it comes to long-term, the basic assumptions, i.e. bounded rationality and opportunism, is challenged. As complementary to transaction cost, "coordination cost" is used to cope with the interdependencies of organizations, i.e. pooled, sequential, reciprocal and team interdependencies (Van de Ven, Delbecq, & Koenig, 1976). The more uncertainty and complexity in an innovation project, and the richer the information links between value activities, the more powerful coordination mechanisms are needed, and thus, the higher the coordination cost.

5.2 Social capital

From the sociological view, one essential theory to understand network organization is *social capital*. People may discover that some do better than others and the explanation according to human capital is that those who do better are more intelligent, more attractive, more articulate and more skilled. Yet, another explanation is that they are better connected than others. This is the basic proposition of social capital. This capital is embedded within networks of mutual acquaintance and recognition and can be defined as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit" (Nahapiet & Ghoshal, 1998). Structural, relational, and cognitive are three dimensions of social capital. Firstly, the location of an actor in a social structure of interactions provides advantages for the actor. Structural holes are the source of value added, and actors across structural holes will generate predominate advantages (Burt, 2000). Secondly, the relational dimension indicates that trust and trustworthiness are rooted in relationships. Thus, actors that are regarded as trustworthy are more likely to gain others' support. The third aspect is a cognitive dimension which refers to the shared paradigm that facilitates collective goals and legitimate behaviors. In conclusion, the emergence of network organizations facilitate the generation of social capital, and social capital requires a network organization to embed itself in.

5.3 Organizational theories

Organizational theories such as the resource-based view (RBV), knowledge-based view (KBV), resource dependency theory (RDT), institutional theory and theories on capabilities such as dynamic capabilities and orchestration capabilities are related to network organization.

The institutional theory focuses on the deeper aspects of social structure and provides a powerful explanation for both individual and organizational action (Dacin, Goodstein, & Scott, 2002; Scott & Davis, 2007). The basic idea of institutional theory is that organizations are shaped by political and legal frameworks, the rules governing market behavior and general belief systems. Here, institutions are "composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life" (Scott and Davis, 2007, pp: 258). Institutions can be seen as regulative systems that are comprised ofrules, laws and sanctions. Institutions can be normative systems providing a moral framework for the conduct of social life, and institutions can be seen as culture-cognitive systems that emphasize shared beliefs and logics of action. Moreover, many culture theories, such as Hofstede's (2001) and Trompenaar's national culture theories, as well as Louis' and Schein's corporate culture theories, can be considered as supporting theories of the culture-cognitive dimension of institutional theory. In terms of global R&D, a subsidiary of a TNC may construct a local innovation network with the host country's partners, not only due to low cost, but perhaps also due to the host country's policy requirements, business systems, peer pressure, as well as culture and beliefs. Furthermore, the features of an innovation network, such as content, size, density, and hierarchy of a network, is influenced by the institutional environment. More importantly, national innovation systems (Lundvall, 2010) and Triple Helix (Etzkowitz and Leydesdorff, 2002) of host countries can be seen as part of the institutional environment, or even as we mentioned in previous sections, as the context of innovation networks.

5.4 International business and marketing

Since the 1970s, the IMP (industrial marketing and purchasing) scholars have been trying to search for a new approach of business research, i.e. the interaction approach which takes the relationship as its unit of analysis rather than the individual transaction. Within an interaction approach, it is not what happens within companies but what happens between them that constitutes the nature of business (Håkansson et al., 2009). Furthermore, it is through interaction that the benefits of these resources and activities flow between and into the companies in the network. More recently, they have begun to move from dyadic relationships to business networks, and propose an Activity-Resource-Actor (ARA) model, which indicates that the outcomes of the interaction process can be described in terms of three layers of networks between counterparts: activity links, resource ties and actor bonds. Managing international business then, is a matter of

establishing, developing and maintaining a firm's positions in international business networks (Johanson & Vahlne, 2003).

5.5 Innovation theories

In the national systems of innovation theory (NIS), interactive learning is a key assumption (Lundvall, 2010, pp: 1). Inter-firm interaction is presented as network relationships by further constituting industrial networks as a description of sub-systems of national innovation systems (Gelsing, 2010). Etzkowitz (2002) uses concepts such as "network of innovation" and "networked incubators" to discuss the relationship between university, industry and government, which is well-known as the Triple Helix (TH) model. Open innovation (OI) scholars propose that the focus of innovation should not only remain on the firm level but also consider network level, since systematic innovation requires dynamic interplay between innovators, which means that inter-organizational context, knowledge networks, and value networks are regarded as forms to generate open innovation (Chesbrough, et al., 2006). In the user innovation theory, user communities are actually horizontal innovation networks that generate innovation development, production, distribution and consumption (von Hippel, 2005, 2007). The Innovation diffusion theory regards the diffusion as a process by which an innovation is communicated through social networks (Rogers, 1995).

In summary, this section has shown that the network organization theory draws on many different theories, and thus different authors with different theoretical backgrounds have put different perspectives into the concept of network organization. Thus, to some extent, the theory of network organization is an interdisciplinary theory.

6 Network Organization: Proposing a Three Level Framework

Section 5 has shown that the interdisciplinarity of network organization, thus scholars may have different understandings on this concept due to their own theoretical background, which made it almost impossible to give a universal definition. In this section, a three-level framework will be summarized based on the literature review to facilitate the understandings on network organizations.

Based on coding the data in the column called "definition of network organization or innovation networks" in Appendix 3.1, Table 3.7 shows different understandings or definitions on network organization for innovation. Most of the articles refer network organization or innovation networks as interorganizational networks between firms or between firms and other institutions. There are also some other definitions such as defining networks as intraorganizational design of a company, construct of clusters or regional innovation systems, virtual knowledge or information networks, and interpersonal social networks. In particular, we found that some scholars regard network as a context full of innovation resources that innovation actors are embedded in.

Table 3.7. Different understandings of network organization for innovation.

Node	Articles
Interorganizational networks	46
Intraorganizational networks	7
Interpersonal, social networks	6
Interregional networks, clusters, cliques	11
Knowledge networks or virtual networks	2
Networks as context	2
Total	74

6.1 A framework

Based on my review of the different definitions of network organization, I have formed the following framework consisting of different levels of understanding of network organization for innovation (See Figure 3.2).

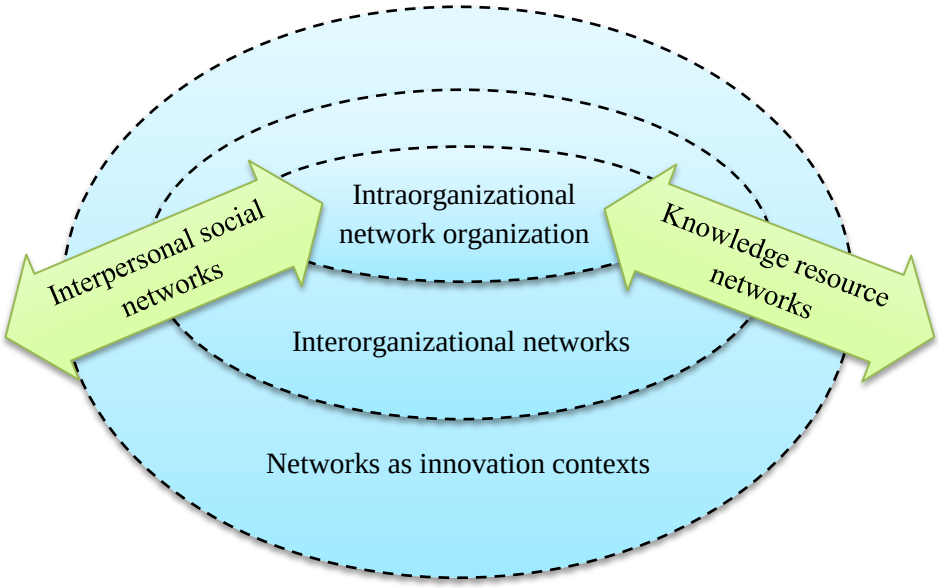


Figure 3.2. A framework showing different levels of network organizations.

The "three-layer onion" classifies different levels of network organizations according to the boundary of the organization and their scope. *Intraorganizational network organization* refers mainly to a firm or an organization's internal organizational design and networks between business units. Meanwhile, *interorganizational networks* refers to alliance or partnerships between different firms sharing the same innovation objective. However, it may not be true to say that interorganizational networks are "bigger" than intraorganizational network organizations in terms of number of actors, ties, or depth of collaboration, as shown in the figure. For example, in the case of a TNC that has hundreds of business units scattered across different countries, its intraorganizational

network is obviously "bigger" than a technological partnership between one of its business units and an external partner.

As a result, Figure 3.2 is an analytical abstract rather than a replication of the real business world. A network of actors as the context for innovation is a macro network perspective moving us towards a wider understanding of network organizations. Moreover, as we can see from the dotted lines, the boundaries between different layers are open rather than closed, indicating the intensive interactions between individuals, knowledge and informational flows, activities, and organizations.

Knowledge/information and human resources are basic constructs of innovation networks, so interpersonal social networks and networks of knowledge resources penetrate different layers of networks. Björk and Magnusson (2009) explore where good innovation ideas come from within a company and find out that the connectivity of virtual networks of ideas among employees is positively related to the quality of the innovation ideas created. Moreover, Hage and Hollingsworth (2000) find that idea networks exist in both the development and marketing stages of an innovation, and the strength and connectedness of idea networks influence the radical innovation process, i.e. from research to commercially successful radical products.

Many research studies have examined how social networks influence idea generation and innovation performances and how they evolve over time (Obstfeld, 2005). In particular, within a TNC, employees' social networks exist both within and outside of the firm's boundary and will influence the knowledge generation as well as innovation performance. After a 14-month field study and over 200 interviews, Kijkuit and van den Ende (2010) find that communications with acquaintances or friends in other units should be promoted at the front end of idea generation. Rodan and Galunic (2004) use a sample of 106 middle managers in a European telecommunications company and find that their interpersonal social networks as well as access to heterogeneous knowledge are critical for their individual managerial and innovation performance. Fichter (2009) defines an innovation community as an informal network of individuals, often from more than one organization and team, participating in a project aimed at promoting a specific innovation on one level or across several levels of an innovation system. Fichter also discovers that close and informal cooperation across organizational and functional boundaries between innovation promoters plays a key role in open innovation. This research also confirms that interpersonal networks link different levels of networks together.

6.2 Intraorganizational networks

In my review, I found 7 articles defining a network organization as existing within a firm's boundary. Here, boundary mainly refers to legal boundary. Generally speaking, there are two different perspectives as to what constitutes the internal network organization.

First of all, regarding TNCs as an organization with networks of business units, assets, and knowledge resources has become the mainstream perspective with regard to multinationals or transnationals (Cantwell & Piscitello, 1999). This can actually be regarded as a "network perspective" that tends to conceptualize organizations as networks of actors, resources and activities (Borgatti & Foster, 2003; Ghoshal & Bartlett, 1990; Håkansson, et al. 2009). Thus, a traditional organization with hierarchical layers can also be conceptualized as hierarchical networks of business units and knowledge flows.

From such a network perspective, a TNC aiming to implement innovation strategy can be seen as a network of specialized interdependent business units with the capacity to assimilate, generate and integrate knowledge on a global scale (Collinson & Wang, 2012; Frost & Zhou, 2005). Within such a network of knowledge flows, globally distributed subsidiaries can be knowledge receiver, disseminator, contributor and creator, thus making their roles more complex than ever (Asmussen, Pedersen, & Dhanaraj, 2007; Asmussen et al., 2009). This actually requires a flattening of the traditional structure of layers and an increase in autonomy and networking activities of the subsidiaries, which is in line with the second view of intraorganizational network organization that will be discussed below.

Secondly, as opposed to a network perspective, some authors regard network organizations as a specific and new organizational design that evolves from a "centrally coordinated, multi-level hierarchy and matrix" (Miles & Snow, 1992), and incorporates itself into the transnational strategy (Bartlett & Ghoshal, 2002) and prospector's strategy (Miles & Snow, 1986). Such a network organization is less hierarchical and more loosely coupled, and power is distributed to different business units since no single unit can have all the knowledge, especially regarding innovation (Andersson et al., 2007). Due to specialization of resources and different competences, business units are interdependent with each other and empowered to have a higher degree of autonomy. Besides, many scholars point out that a network organization should adopt market mechanism to facilitate resource allocation and decision making among business units or subsidiaries (Boutellier et al., 2008; Foss, 2003; Miles & Snow, 1986). Foss (2003) shows how a firm radically changes its internal organization into a spaghetti organization, i.e. "an internal hybrid", by infusing market mechanism into hierarchies, and then changes back into a matrix organization due to problems such as a lack of incentives, which also shows that it is very difficult to put such an organization into practice and sustain it unless potential problems can be solved.

The main features of a network organization show the change from in-house to outsourcing, from administrative to market mechanism-based, from passive to proactive, and from static to evolutionary. Thus, some of the discussions in Section 4.4 can be included in this category. For example, there are some typologies on TNCs' internal

R&D organizations (Zander, 1999) and the conceptualization of how TNC's internal R&D organization evolves from centralized R&D headquarters, to a polycentric organization with multiple hubs, and then to an integrated network model (Gassmann & von Zedtwitz, 1999; Medcof, 2004).

Miles and Snow (1992) suggest that there are three types of network organizations: stable network, internal network and dynamic network. A stable network organization has a core firm that links upstream and downstream to a limited number of selected partners; an internal network form adopts market mechanism (buying and selling) between its business units; and a dynamic network form consists of multiple actors such as designers, suppliers, producers and distributors instead of one firm holding all functions and assets internally. Moreover, they propose that stable, internal and dynamic network organizations evolve respectively from functional organization, divisional organization and matrix organization. As a result, though network organization can be regarded as a specific organizational form, it may also include external partners and not be restricted within a firms' boundary. Thus, we can move the discussion outside of the boundary and to the interorganizational network level.

6.3 Interorganizational network organization

When we move out of a firm's legal boundary, network organization can be understood on a second level, i.e. interorganizational networks. The search result indicates that most of the articles (46 out of 74) regard network organization as innovation networks between different firms and institutions. Similar to intraorganizational network organization, there are also two types of perspective on interorganizational network organizational for innovation.

The first view focuses on a firm's ego network organization, meaning that a network is a mode of organization that is purposefully designed and used by managers or entrepreneurs to implement their strategies and position their firms in a stronger competitive position within the industry (Jarillo, 1988). From this perspective a network organization is a set of selected preferable innovators, the relationships between different partners are trustful, interdependent and nonhierarchical (Freeman, 1991; Hatch & Cunliffe, 2006), and the networks can be either stable or dynamic (Miles and Snow, 1992). Therefore, purposefully designed strategic alliances or strategic networks, outsourcing, joint ventures, virtual corporation, and value chain are different forms of network organizations (Child et al., 2005; Gereffi, Hatch & Cunliffe, 2006; Humphrey, & Sturgeon, 2005; Tidd & Bessant, 2009). Hagedoorn (1990) gives a classification of six modes of inter-firm cooperation based on organizational interdependence, i.e. joint ventures, joint R&D agreements, technology exchange agreements such as cross-licensing, direct investment and cross-holding, customer-supplier relations, and one-directional agreement such as licensing. Also, value chains can be seen as networks; there can be hierarchy, captive, relational and modular networks based on different levels of

authority and specialization (Dicken, 2011; Gereffi et al., 2005). Snow et al. (2011) show how firms have moved from a single organization to a community-based organizational design consisting of multiple firms to implement the strategy of innovation through a single case study on "Blade.org". Such a multifirm network organization provides a clear institutional mechanism to support knowledge sharing and creation between member firms. Any member firm within this community can find willing partners to form temporary collaborative innovation networks. Thus, a firm can maintain its independent businesses while collaborating with other firms on R&D simultaneously.

Secondly, when we move out of a firm's ego network organization, we may find that interorganizational network organizations also take the form of agglomerations of SMEs, regional clusters, incubators or science parks, and even inter-regional clusters. . Through networking, SMEs can form agglomerations to integrate their capabilities and act efficiently to compete with competitors such as vertically integrated firms (Bianchi & Bellini, 1991). Sá and Lee (2012) define a technology-based incubator as "an organization that provides services for new start-up and early-stage companies with a technological focus, and assists their survival and growth", and they show how an incubator encourages the formation of interorganizational networks and interplay between firms to facilitate their technological needs through a single case study on a Canadian technology-based incubator.

Besides incubators, regional clusters often consist of reciprocal ties between geographically co-located organization such as firms, research institutes, intermediaries and governmental institutions, and the intensive knowledge interaction between organizations located in the cluster and the formation of collaborative research projects has significant impact on the innovation performance of the cluster and regional innovation systems (Liyanage, 1995; Whittington et al., 2009). Baptista and Swann (1998) ask whether firms located in strong industrial clusters or regions are more likely to innovate than firms outside these regions, and their empirical research yielded a positive answer. Moreover, since interorganizational ties serve as channels of knowledge dissemination and interaction, geographically dispersed firms and clusters from different regions are actually connected, and such an interregional network structure will facilitate innovation generation and diffusion at the system level (Gibbons, 2004), which leads us to the third level that will be discussed below.

6.4 Overlapping networks as innovation contexts

Until now, we have shown intra-and interorganizational network organizations, and one may question what there is outside of an interorganizational network organization. One answer could be "market", and from this perspective, outside of a network organization, there is a dangerous jungle full of competitors and all relationships are based on transaction. However, on the one hand, the role of network actors inside a network organization may change, i.e. one partner could have previously been a

competitor; while on the other hand, different network organizations, though there may be boundaries and geographical disparities, are not unreachable to each other according to Milgram's "six degrees of separation" proposition.

Due to the existence of social networks and information networks, we are always able to reach another network by establishing some form of relationship. For example, an R&D unit can act as an intermediate between TNC's internal global R&D network and the local R&D network in host country, so the intra- and inter-organizational networks are overlapping, which is also in line with the thinking of a TNC as "a network within networks" (Dicken, 2011, pp: 121). Therefore, different network organizations, whether they be intra- or interorganizational, are linked to each other and overlapping. That is to say, compared to a neoclassical market consisting of independent suppliers and customers, these overlapping networks constructed by a web of relationships is the essence of the international business environment (Johanson & Mattsson, 1988; Johanson & Vahlne, 2003; Johanson & Vahlne, 2009). No wonder Achrol (1997) proposes that the market can be divided into four types of networks: internal market network, vertical market network, inter-market network and opportunity network.

Based on the above discussions, we have moved to a new level of regarding overlapping networks as innovation contexts that firms embed themselves in, rather than a neoclassical market (Johanson and Vahlne, 2003, 2009). Thus, a regional cluster is connected with other clusters, and the interregional networks of clusters act as the context of an innovation system. These overlapping networks serve as an innovation environment or context that provides valuable innovation resources to be explored and utilized (Gulati, 1999), and in such a scenario, external firms are no longer enemies but potential partners. Managing a business then, is a matter of establishing, developing and maintaining the firm's position in international business networks (Forsgren & Johanson, 1992; Håkansson & Ford, 2002).

6.5 Network organization definition in broad and narrow senses

Regarding the examples shown above, some of them are "networks", and some are "network organizations", so when can we call a network an organization? Borgatti and Foster (2003) regard this as linguistic chaos, i.e. some scholars think all firms should transform from separated organizations to network organizations, while others think organizations are already combinations of network relationships. Within the literature on network organizations, there are also different perspectives: some think that all actors are interactively connected by cooperative and interdependent relationships and with a joint decision-making process can be seen as a network organization (Gassmann and von Zedtwitz, 1999; Jarillo, 1988; Malnight, 1996; Medcof, 2004); some regard network organization as an organization with an internal market (e.g. Miles and Snow, 1986; Baker, 1993), while others may consider strategic alliances, virtual organizations, value

chains, etc. as a network organization (Child, 2005; Gereffi, 2005; Hatch & Cunliffe, 2006).

A network can be simply defined as a combination of nodes and ties (Scott and Davis, 2007, pp: 278). Nodes can be actors such as people, groups, organizations, or other entities such as ideas or resources. Ties can be physical linkages to contractual or personal relationships. An organization is a social structure created by individuals to support the collaborative pursuit of specified goals (Scott and Davis, 2007, pp: 11). It requires defining objectives, control and coordination by rules or incentives, resource allocation, selection of participants, etc. Thus, network organization is one type of "network" with the characteristics of an "organization", i.e. a social combination of actors and relationships with the aim of achieving certain goals and guided by certain rules. Podolny and Page (1998) define a network form of organization as "any collection of actors ($N \geqslant 2$) that pursue repeated enduring exchange relations with one another and, at the same time, lack a legitimate organizational authority to arbitrate and resolve disputes that may arise during the exchange." Network organization is an integration of strategy, structure and managerial process (Miles and Snow, 1992). It is incorporated into a prospector's strategy, adopts a loose and decentralized structure and discards hierarchical control by involving orchestration and coordination. Thus we can hardly call a social network between friends or a virtual knowledge network a network organization, though they can be integrated into different levels of networks (See Figure 3.2).

As a result, we can summarize here that, in a broad sense, value chain, virtual organization, hollow network, and strategic alliances are all network organizations pursing the goal of innovation. While in a narrow sense, a network organization is one type of firm's organizational design with characteristics such as flexibility, decentralized inclusive decision making, and cooperative ties. However, what about clusters, incubators and even interregional clusters that consists of interorganizational innovation networks? Are these networks network organizations? A few scholars classify market or clusters as organizations (Reddy & Rao, 1990). These networks aiming at promoting systematic innovation are parts of an innovation system and are coordinated by both the invisible hand of the market and the visible hand of governmental directions. Thus, they can be regarded as quasi-network organizations integrating both cooperation and competition between firms, relying much on self-organizing due to a lack of hub organizations and being much more complex than ever.

7 Conclusion

In the face of extensive amounts of research literature and different perspectives on network organization for innovation, this paper made an attempt to clarify what a network organization is based on a systematic literature review of 74 top journal articles.

Generally speaking, network organization is an interdisciplinary concept and a popular research topic especially when regarding innovation.

This paper proposes that network organization for innovation can be understood on three levels, i.e. intraorganizational, interorganizational network organizations and networks as innovation contexts. In the narrow sense, network organization refers to a new internal organizational design to promote innovation strategy through the following: encouraging more interaction between business units and knowledge sharing, introducing market mechanism to optimize internal resource allocation, and reducing hierarchies. In the broad sense, interorganizational innovation networks such as strategic technological partnerships, joint ventures, value networks and technological outsourcing and licensing can be seen as network organization as well. These interorganizational network organizations are coordinated or jointly coordinated by hub organizations, rely on trustful relationships between partnering firms, encourage the pooling of knowledge resources, and ensure mutual benefits. Moreover, when we adopt a network perspective which is both a way of thinking and a research method that enables us to analyze organizations and business contexts by identifying nodes and ties, the market and the business environment can be conceptualized into networks that provide contexts for innovation. Thus, a national or regional innovation system and even the market itself can be seen as a quasi-network organization that relies heavily on self-organizing, culture, governmental policies, market mechanism, etc.

In conclusion, network organization is an interdisciplinary concept and a popular research topic especially when regarding innovation. Hopefully, this paper has clarified some chaos and ambiguities in this research area.

References

Achrol, R. S. (1997). Changes in the theory of interorganizational relations in marketing: Toward a network paradigm. *Academy of Marketing Science Journal, 25*(1), 56-71.

Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: A longitudinal study. *Administrative Science Quarterly, 45*(3), 425-455.

Almeida, P., & Phene, A. (2004). Subsidiaries and knowledge creation: The influence of the MNC and host country on innovation. *Strategic Management Journal, 25*(8-9), 847-864.

Andersson, U., Forsgren, M., & Holm, U. (2002). The strategic impact of external networks: Subsidiary performance and competence development in the multinational corporation. *Strategic Management Journal, 23*(11), 979-996.

Andersson, U., Forsgren, M., & Holm, U. (2007). Balancing subsidiary influence in the federative MNC: A business network view. *Journal of International Business Studies, 38*(5), 802-818.

Asmussen, C. G., Pedersen, T., & Dhanaraj, C. (2007). Evolution of subsidiary competences: Extending the diamond network model. *Journal of International Business Studies*,

Asmussen, C. G., Pedersen, T., & Dhanaraj, C. (2009). Host-country environment and subsidiary competence: Extending the diamond network model. *Journal of International Business Studies, 40*(1), 42-57.

Baker, W. E. (1993). *The network organization in theory and practice*. Boston: Harvard Business School Press.

Baptista, R., & Swann, P. (1998). Do firms in clusters innovate more? *Research Policy, 27*(5), 525-540.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99.

Bartlett, C. A. (1986). Building and managing the transnational: The new organizational challenge. *Competition in Global Industries* (pp. 367-401). Boston: Harvard Business School Press.

Bartlett, C. A., & Ghoshal, S. (2002). *Managing across borders: The transnational solution*. Boston, Massachusetts: Harvard Business Press.

Betts, S. C., & Stouder, M. D. (2004). The network perspective in organization studies: network organizations or network analysis? *Academy of Strategic Management Journal*, *4*, 1-21.

Bercovitz, J. E., & Feldman, M. P. (2007). Fishing upstream: Firm innovation strategy and university research alliances. *Research Policy, 36*(7), 930-948.

Bianchi, P., & Bellini, N. (1991). Public policies for local networks of innovators. *Research Policy, 20*(5), 487-497.

Birkinshaw, J. M., & Morrison, A. J. (1995). Configurations of strategy and structure in subsidiaries of multinational corporations. *Journal of International Business Studies, 26*(4), 729-753.

Borgatti, S. P., & Foster, P. C. (2003). The network paradigm in organizational research: A review and typology. *Journal of Management, 29*(6), 991-1013.

Bouncken, R. B. (2011). Innovation by operating practices in project alliances–when size matters. *British Journal of Management, 22*(4), 586-608.

Boutellier, R., Gassmann, O., & Von Zedtwitz, M. (2008). *Managing global innovation: Uncovering the secrets of future competitiveness* Springer Verlag.

Burt, R. S. (2000). The network structure of social capital. *Research in Organizational Behavior, 22*, 345-423.

Calia, R. C., Guerrini, F. M., & Moura, G. L. (2007). Innovation networks: From technological development to business model reconfiguration. *Technovation, 27*(8), 426-432.

Cantner, U., & Graf, H. (2006). The network of innovators in Jena: An application of social network analysis. *Research Policy, 35*(4), 463-480.

Cantwell, J., & Piscitello, L. (1999). The emergence of corporate international networks for the accumulation of dispersed technological competences. *MIR: Management International Review, ,* 123-147.

Capaldo, A. (2007). Network structure and innovation: The leveraging of a dual network as a distinctive relational capability. *Strategic Management Journal, 28*(6), 585-608.

Chen, S. (2004). Taiwanese IT firms' offshore R&D in china and the connection with the global innovation network. *Research Policy, 33*(2), 337-349.

Chiesa, V. (1996). Managing the internationalization of R&D activities. *Engineering Management, IEEE Transactions On, 43*(1), 7-23.

Child, J. (2005). *Organization: Contemporary principles and practice*. Oxford: Blackwell.

Child, J., Faulkner, D., & Tallman, S. (2005). *Cooperative strategy: Managing alliances, networks, and joint ventures*. New York: Oxford University Press.

Child, J., & McGrath, R. G. (2001). Organizations unfettered: Organizational form in an information-intensive economy. *The Academy of Management Journal, 44*(6), 1135-1148.

Coase, R. H. (1937). The nature of the firm. *Economica, 4*(16), 386-405.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128-152.

Collinson, S. C., & Wang, R. (2012). The evolution of innovation capability in multinational enterprise subsidiaries: Dual network embeddedness and the divergence of subsidiary specialisation in Taiwan. *Research Policy, 41*, 1501-1518.

Cowan, R., & Jonard, N. (2009). Knowledge portfolios and the organization of innovation networks. *Academy of Management Review, 34*(2), 320-342.

Dacin, M. T., Goodstein, J., & Scott, W. R. (2002). Institutional theory and institutional change: Introduction to the special research forum. *The Academy of Management Journal, 45*(1), 43-56.

Das, T. K., & Teng, B. S. (2000). A resource-based theory of strategic alliances. *Journal of Management, 26*(1), 31-61.

DeBresson, C., & Amesse, F. (1991). Networks of innovators: A review and introduction to the issue. *Research Policy, 20*(5), 363-379.

Dellestrand, H., & Kappen, P. (2012). The effects of spatial and contextual factors on headquarters resource allocation to MNE subsidiaries. *Journal of International Business Studies, 43*(3), 219-243.

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *The Academy of Management Review ARCHIVE, 31*(3), 659-669.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *The Academy of Management Review, 23*(4), 660-679.

Eisenhardt, K. M., & Martin, J. A. (2003). *Dynamic capabilities: What are they?* Blackwell, Malden, MA.

Eisenhardt, K. M., Santos, F. M., Pettigrew, I. A., Thomas, H., & Whittington, R. (2000). Knowledge based view: A new theory of strategy? *Handbook of Strategy and Management,* 139-164. London: Sage.

Fagerberg, J., Mowery, D. C., & Nelson, R. R. (Eds.). (2006). *The Oxford Handbook of Innovation*. Oxford: Oxford university press.

Fichter, K. (2009). Innovation communities: The role of networks of promotors in open innovation. *R&D Management, 39*(4), 357-371.

Forsgren, M., & Johanson, J. (1992). *Managing Networks in International Business*. Amsterdam: Gordon and Breach.

Foss, N. J. (2003). Selective intervention and internal hybrids: Interpreting and learning from the rise and decline of the oticon spaghetti organization. *Organization Science, 14*(3), 331-349.

Freeman, C. (1991). Networks of innovators: A synthesis of research issues. *Research Policy, 20*(5), 499-514.

Frenken, K. (2000). A complexity approach to innovation networks: the case of the aircraft industry (1909–1997). *Research Policy, 29*(2), 257-272.

Frost, T. S., & Zhou, C. (2005). R&D co-practice and 'reverse'knowledge integration in multinational firms. *Journal of International Business Studies, 36*(6), 676-687.

Gassmann, O., & Keupp, M. M. (2008). The internationalisation of western firms' R&D in China. *International Journal of Entrepreneurship and Small Business, 6*(4), 536-561.

Gassmann, O., & Von Zedtwitz, M. (1999). New concepts and trends in international R&D organization. *Research Policy, 28*(2), 231-250.

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy, 12*(1), 78-104.

Ghoshal, S., & Bartlett, C. A. (1990). The multinational corporation as an interorganizational network. *Academy of Management Review, 15*(4), 603-625.

Gibbons, D. E. (2004). Network structure and innovation ambiguity effects on diffusion in dynamic organizational fields. *Academy of Management Journal, 47*(6), 938-951.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal, 17*, 109-122.

Gulati, R., & Gargiulo, M. (1999). Where do interorganizational networks come from? *The American Journal of Sociology, 104*(5), 1398-1438.

Gulati, R. (1999). Network location and learning: The influence of network resources and firm capabilities on alliance formation. *Strategic Management Journal, 20*(5), 397-420.

Hage, J., & Hollingsworth, J. R. (2000). A strategy for the analysis of idea innovation networks and institutions. *Organization Studies, 21*(5), 971-1004.

Hagedoorn, J. (2002). Inter-firm R&D partnerships: An overview of major trends and patterns since 1960. *Research Policy, 31*(4), 477-492.

Hagedoorn, J. (1990). Organizational modes of inter-firm co-operation and technology transfer. *Technovation, 10*(1), 17-30.

Hagedoorn, J. (2006). Understanding the rationale of strategic technology partnering: Interorganizational modes of cooperation and sectoral differences. *Strategic Management Journal, 14*(5), 371-385.

Håkansson, H., & Ford, D. (2002). How should companies interact in business networks? *Journal of Business Research, 55*(2), 133-139.

Håkansson, H., Ford, D., Gadde, L. E., Snehota, I., & Waluszewski, A. (2009). *Business in networks*. West Sussex: Wiley.

Hales, C. (2002). 'Bureaucracy-lite'and continuities in managerial work. *British Journal of Management, 13*(1), 51-66.

Hämäläinen, T. J., & Schienstock, G. (2000). *Innovation networks and network policies*

Hillman, A. J., Withers, M. C., & Collins, B. J. (2009). Resource dependence theory: A review. *Journal of Management, 35*(6), 1404-1427.

Imai, K., & Baba, Y. (1989). Systemic innovation and cross-border networks. *International Seminar on the Contributions of Science and Technology to Economic Growth at OECD, Paris,*

Ireland, R. D., Hitt, M. A., & Vaidyanath, D. (2002). Alliance management as a source of competitive advantage. *Journal of Management, 28*(3), 413-446.

Jarillo, J. C. (1988). On strategic networks. *Strategic Management Journal, 9*(1), 31-41.

Jesson, J., Matheson, L., & Lacey, F. M. (2011). *Doing your literature review: Traditional and systematic techniques*. London: Sage.

Johanson, J., & Mattsson, L. G. (1988). Internationalization in industrial systems: A network approach. *Strategies in Global Competition*, 198-314.

Johanson, J., & Vahlne, J. E. (2003). Business relationship learning and commitment in the internationalization process. *Journal of International Entrepreneurship, 1*(1), 83-101.

Johanson, J., & Vahlne, J. E. (2009). The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership. *Journal of International Business Studies, 40*(9), 1411-1431.

Johanson, J., & Vahlne, J. (1977). The internationalization process of the firm-a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies, 8*(1), 23-32.

Johanson, J., & Vahlne, J. (1990). The mechanism of internationalisation. *International Marketing Review, 7*(4)

Johanson, J., & Wiedersheim-Paul, F. (1975). The internationalization of the firm - four Swedish cases 1. *Journal of Management Studies, 12*(3), 305-323.

Jones, G. R., & Hill, C. W. L. (1988). Transaction cost analysis of strategy-structure choice. *Strategic Management Journal, 9*(2), 159-172.

Joshi, A. M., & Nerkar, A. (2011). When do strategic alliances inhibit innovation by firms? Evidence from patent pools in the global optical disc industry. *Strategic Management Journal, 32*(11), 1139-1160.

Josserand, E. (2004). *The network organization: The experience of leading french multinationals* Cheltenham: Edward Elgar Publishing.

Karamanos, A. G. (2012). Leveraging micro-and macro-structures of embeddedness in alliance networks for exploratory innovation in biotechnology. *R&D Management, 42*(1), 71-89.

Kastelle, T., & Steen, J. (2010). Are small world networks always best for innovation? *Innovation: Management, Policy & Practice, 12*(1), 75-87.

Kijkuit, B., & van den Ende, J. (2010). With a little help from our colleagues: A longitudinal study of social networks for innovation. *Organization Studies, 31*(4), 451-479.

Kim, T., Oh, H., & Swaminathan, A. (2006). Framing interorganizational network change: A network inertia perspective. *Academy of Management Review, 31*(3), 704-720.

Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science, 3*(3), 383-397.

Koka, B. R., Madhavan, R., & Prescott, J. E. (2006). The evolution of interfirm networks: Environmental effects on patterns of network change. *Academy of Management Review, 31*(3), 721-737.

Lee, S., Park, G., Yoon, B., & Park, J. (2010). Open innovation in SMEs—an intermediated network model. *Research Policy, 39*(2), 290-300.

Liu, M., & Chen, S. (2012). MNCs' offshore R&D networks in host country's regional innovation system: The case of taiwan-based firms in china. *Research Policy, 41*, 1107-1120.

Liyanage, S. (1995). Breeding innovation clusters through collaborative research networks. *Technovation, 15*(9), 553-567.

Löfsten, H., & Lindelöf, P. (2005). R&D networks and product innovation patterns—academic and non-academic new technology-based firms on science parks. *Technovation, 25*(9), 1025-1037.

Love, J. H., & Roper, S. (2001). Location and network effects on innovation success: Evidence for UK, german and irish manufacturing plants. *Research Policy, 30*(4), 643-661.

Lundvall, B. (2010). *National systems of innovation: Toward a theory of innovation and interactive learning*. London: Anthem Press.

Malnight, T. W. (2001). Emerging structural patterns within multinational corporations: Toward process-based structures. *Academy of Management Journal, 44*(6), 1187-1210.

Medcof, J. W. (2001). Resource-based strategy and managerial power in networks of internationally dispersed technology units. *Strategic Management Journal, 22*(11), 999-1012.

Medcof, J. W. (1997). A taxonomy of internationally dispersed technology units and its application to management issues. *R&D Management, 27*(4), 301-318.

Medcof, J. W. (2003). Network centrality and power among internationally dispersed technology units. In M. G. Serapio, & T. Hayashi (Eds.), *Internationalization of research and development and the emergence of global R&D networks (research in international business* (pp. 179-203). Oxford: Elsevier.

Miles, R. E., & Snow, C. C. (1986). Organizations: New concepts for new forms. *California,*

Miles, R. E., & Snow, C. C. (1992). Causes of failure in network organizations. *California Management Review, 34*(4), 53-57.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *The Academy of Management Review, 23*(2), 242-266.

Narula, R., & Hagedoorn, J. (1999). Innovating through strategic alliances: Moving towards international partnerships and contractual agreements. *Technovation, 19*(5), 283-294.

Nieto, M. J., & Rodr ǵuez, A. (2011). Offshoring of R&D: Looking abroad to improve innovation performance. *Journal of International Business Studies, 42*(3), 345-361.

Nieto, M. J., & Santamaria, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. *Technovation, 27*(6), 367-377.

Obstfeld, D. (2005). Social networks, the tertius iungens orientation, and involvement in innovation. *Administrative Science Quarterly, 50*(1), 100-130.

Osborn, R. N., & Hagedoorn, J. (1997). The institutionalization and evolutionary dynamics of interorganizational alliances and networks. *Academy of Management Journal, 40*(2), 261-278.

Papanastassiou, M., & Pearce, R. (2009). *The Strategic Development of Multinationals: Subsidiaries and Innovation*. Hampshire: Palgrave Macmillan.

Park, S. H., & Ungson, G. R. (1997). The effect of national culture, organizational complementarity, and economic motivation on joint venture dissolution. *Academy of Management Journal, 40*(2), 279-307.

Pearce, R., & Papanastassiou, M. (1996). R&D networks and innovation: Decentralised product development in multinational enterprises. *R&D Management, 26*(4), 315-333.

Perks, H., & Jeffery, R. (2006). Global network configuration for innovation: A study of international fibre innovation. *R&D Management, 36*(1), 67-83.

Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York: Harper & Row.

Phelps, C. C. (2010). A longitudinal study of the influence of alliance network structure and composition on firm exploratory innovation. *Academy of Management Journal, 53*(4), 890-913.

Phene, A., & Almeida, P. (2008). Innovation in multinational subsidiaries: The role of knowledge assimilation and subsidiary capabilities. *Journal of International Business Studies, 39*(5), 901-919.

Podolny, J. M. (2001). Networks as the pipes and prisms of the market. *American Journal of Sociology, ,* 33-60.

Podolny, J. M., & Page, K. L. (1998). Network forms of organization. *Annual Review of Sociology, 24*, 57-76.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly, 41*(1), 116-145.

Powell, W. W. (1990). Neither market nor hierarchy: Network forms of organization. *Research in Organizational Behavior, 12*, 295-336.

Provan, K. G., Fish, A., & Sydow, J. (2007). Interorganizational networks at the network level: A review of the empirical literature on whole networks. *Journal of Management, 33*(3), 479-516.

Rawley, E. (2010). Diversification, coordination costs, and organizational rigidity: Evidence from microdata. *Strategic Management Journal, 31*(8), 873-891.

Reddy, N. M., & Rao, M. (1990). The industrial market as an interfirm organization. *Journal of Management Studies, 27*(1), 43-59.

Robertson, P. L., & Langlois, R. N. (1995). Innovation, networks, and vertical integration. *Research Policy, 24*(4), 543-562.

Rodan, S., & Galunic, C. (2004). More than network structure: How knowledge heterogeneity influences managerial performance and innovativeness. *Strategic Management Journal, 25*(6), 541-562.

Sá, C., & Lee, H. (2012). Science, business, and innovation: Understanding networks in technology-based incubators. *R&D Management, 42*(3), 243-253.

Salman, N., & Saives, A. (2005). Indirect networks: An intangible resource for biotechnology innovation. *R&D Management, 35*(2), 203-215.

Schilling, M. A., & Phelps, C. C. (2007). Interfirm collaboration networks: The impact of large-scale network structure on firm innovation. *Management Science, 53*(7), 1113-1126.

Scott, W. R., & Davis, G. F. (2007). *Organizations and organizing: Rational, natural, and open systems perspectives*. New Jersey: Pearson Prentice Hall.

Serapio, M. G., & Hayashi, T. (Eds.). (2004). *Internationalization of research and development and the emergence of global R&D networks* Elsevier Oxford.

Snow, C. C., Fjeldstad, Ø D., Lettl, C., & Miles, R. E. (2011). Organizing continuous product development and commercialization: The collaborative community of firms model. *Journal of Product Innovation Management, 28*(1), 3-16.

Stuart, T. E. (2000). Interorganizational alliances and the performance of firms: A study of growth and innovation rates in a high-technology industry. *Strategic Management Journal, 21*(8), 791-811.

Sydow, J., & Windeler, A. (1998). Organizing and evaluating interfirm networks: A structurationist perspective on network processes and effectiveness. *Organization Science, 9*(3), 265-284.

Teece, D., & Pisano, G. (1994). The dynamic capabilities of firms: An introduction. *Industrial and Corporate Change, 3*(3), 537.

Teubal, M., Yinnon, T., & Zuscovitch, E. (1991). Networks and market creation. *Research Policy, 20*(5), 381-392.

Thorelli, H. B. (1986). Networks: Between markets and hierarchies. *Strategic Management Journal, 7*(1), 37-51.

Tidd, J., & Bessant, J. (2009). *Managing innovation: Integrating technological, market and organizational change.
* John Wiley &Sons Ltd.

Van de Ven, A. H., Delbecq, A. L., & Koenig, R. (1976). Determinants of coordination modes within organizations. *American Sociological Review, 41*(2), 322-338.

Von Hippel, E. (2007). Horizontal innovation networks—by and for users. *Industrial and Corporate Change, 16*(2), 293.

Von Hippel, E. (2005). *Democratizing Innovation*. Cambridge, Massachussats: MIT Press.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5*, 171-180.

Whittington, K. B., Owen-Smith, J., & Powell, W. W. (2009). Networks, propinquity, and innovation in knowledge-intensive industries. *Administrative Science Quarterly, 54*(1), 90-122.

Williamson, O. E. (1991). Comparative economic organization: The analysis of discrete structural alternatives. *Administrative Science Quarterly, 36*(2), 269-296.

Zander, I. (1999). How do you mean by 'global'? An empirical investigation of innovation networks in the multinational corporation. *Research Policy, 28*(2-3), 195-213.

Appendix 3.1. Summary of Selected Literature.

Author	Year	Journal	Research Method & Data Type	Research Question	Definition of Network Organization or Innovation Networks	Key findings
Phelps, C. C.	2010	AMJ	Quantitative, longitudinal study of 77 equipment manufactures	Network structure and composition's influence on its exploratory innovation.	Strategic alliances among firms, alliance networks	Reinforce the relational view of firm resource creation (Dyer and Singh, 1998). The benefits of network closure (a firm's partners are partners) and access to diverse information can coexist in an alliance network and increase exploratory innovation.
Tsai, W.	2001	AMJ	Quantitative, 24 business units from Company A and 36 business units in Company B	How can an organizational unit gain useful knowledge from other units to enhance its innovation and performance? Intraorganizational business units' innovation performances.	Intraorganizational networks among different business units	organizational units can produce more innovations and enjoy better performance if they occupy central network positions that provide access to new knowledge
Ibarra, H.	1993	AMJ	Quantitative, one business unit's all employees	Investigate the impacts of individual attributes, formal position and network centrality on the individual involvement in technical and administrative innovations. Interpersonal networks within a business organization.	The innovation roles of individuals within the interpersonal information networks.	An organization's informal structure may be more critical than its formal structure when the exercise of power requires extensive boundary spanning and that sources of power have both general and innovation-specific effects.

Gibbons, D. E.	2004	AMJ	Quantitative, Computational modeling simulated innovation diffusion.	Explore structural effects on innovation transfer at the system level, focusing on influential factors before the innovation diffusion starts.	Interregional network structures: unconstrained network, decentralized interregional structure, regionals connected in a chain, hierarchy among regions, central region connecting cliques via one region per clique, central region connecting cliques via scant ties to all regions.	Overall, local and interregional network structures interacted with the observability of an innovation's benefits to determine diffusion.
Osborn, R. N. and Hagedoorn, J.	1997	AMJ	Conceptual	Showing the multifaceted character of the researches on interorganizational networks and alliances.	Alliances and networks are evolutionary, multifaceted institutions for cooperation.	Alliances and networks are complex. Dualities are inherent in analyzing these emergent institutions: temporary mechanism and long-lasting relationship; cooperative and competitive.
Kim, Tai-young, Oh, H., Swaminathan, A.	2006	AMR	Conceptual	Conceptualize the constraints on network change as network inertia. Interorganizational dyadic ties	Between market and hierarchy. An organization is a structure in which intraorganizational interactions form a centralized network in which the vast majority of ties flow to or from on particular node.	An organization's attempts to change its network partner is influenced by four types of constraints: internal constraints (intraorganizational networks), network tie-specific constraints (interorganizational dyadic ties), network position-specific constraints (interorganizational network position), and external constraints (the interorganizational field.)

Cowan, R., Jonard, N.	2009	AMR	Modeling	Try to model the innovation network formation, and only that. Alliance or network structures, small world networks	Innovation is the discovery of a piece of knowledge not known by either of the partners, partnerships can facilitate innovation.	Firms must have a certain degree of commonality in their knowledge to have a successful alliance. It would be desirable to control for knowledge similarity/complementarity in alliance formation.
Dhanaraj, C. and Parkhe, A.	2006	AMR	Conceptual	conceptualize innovation network orchestration capability	Loosely coupled systems of autonomous firms. Hub firms orchestrate network activities.	The orchestration in innovation networks can be divided into three stages: network design, orchestration process and outcome. Three key issues: managing knowledge mobility, managing innovation appropriability, and managing network stability.
Koka, B. R., Madhavan, R., Prescott, J. E.	2006	AMR	Conceptual	Try to develop a framework examine the relationship between environmental change and patterns of network change; seek to contribute to network evolution.	Interorganizational networks.	This paper propose four patterns of network change (network expansion, network churning, network strengthening, and network shrinking) across four environmental context and strategic action.
Ghoshal, S. and Bartlett, C. A.	1990	AMR	Conceptual	Draw on interorganizational theory to develop a model of the MNS as an internally differentiated interorganizational network.	MNCs' intraorganizational networks, also network as business environment	A MNC consists of a group of geographically dispersed and goal-disparate organizations that include its head-quarters and the different national subsidiaries, which can be conceptualized as an interorganizational network that is embedded in an external network consisting of all other organizations.

Ahuja, G.	2000	ASQ	Quantitative	Examine the relationship between a firm's position in the industry network of interfirm collaborative linkages and its innovation output.	Network relationships can be described as network resources (Gulati, 1999). Interfirm networks, Joint ventures and interfirm agreements	Direct and indirect ties both have a positive impact on innovation but that the impact of indirect ties is moderated by the number of direct ties. Structural holes have both positive and negative influences on subsequent innovation.
Powell, W. W., Koput, K. W., Smith-Doerr, L.	1996	ASQ	Quantitative, cooperative ventures to organizational learning.	To examine the organizational arrangements that has arisen in response to the technological ferment generated by biotechnology.	Interorganizational collaborations are not simply a means to compensate for the lack of internal skills, nor should they be viewed as a series of discrete transactions.	When the knowledge base of an industry is both complex and expanding and the sources of expertise are widely dispersed, the locus of innovation will be found in networks of learning, rather than in individual firms.
Whittington, K. B., Powell, W. W.	2009	ASQ	Quantitative, social network analysis. Patenting data, 12 years' time period	Examine the contingent effects that network centrality and geographic propinquity exert on innovation by human therapeutic and diagnostic biotechnology firms.	Regional clusters arise from reciprocal linkages among co-located organizations, while physical proximity can alter the nature of information and resource flows through networks	Regional agglomeration and network centrality exert complementary, but contingent, influences on organizational innovation.
Obstfeld, D.	2005	ASQ	quantitative, networks and innovation in an engineering division of an automotive manufacturer	Examine the micro processes in the social networks of employees in an organization.	Mainly referring to social networks	Tertius iungens orientation is a strategic behavioral orientation toward connecting people in one's social network by either introducing disconnected in individuals or facilitating new coordination between connected individuals.

McGuire, J. B.	1988	JM	Qualitative, interviews 36 agencies, over 50 interviews.	Examine the broad research implications of dialectical analyses to the study of interorganizational networks to: assess the extent to which these implications are supported, and suggest theoretical refinements.	Interorganizational networks	This paper presents a dialectical view of inter-organizational networks. Viewing them as the outcome of the juxtaposition of the social paradigms of participants.
Provan, K. G., Fish, A., and Sydow, J.	2007	JM	Literature review	Review empirical literature on whole networks.	Whole networks are consisting of multiple organizations and multilateral ties. Network level.	Distinctions between egocentric and network-level research is introduced.
Bouncken, R. B.	2011	BJM	Quantitative, 166 project alliances on innovation	To explore how stable and repetitive activity patterns of project alliance management, defined as operating practices, affect project alliances' innovation performance.	Firms, multi-firm consortiums or inter-firm networks an establish project organizations. Project alliances are temporary coordinated and project-based activities between legally autonomous firms.	Project alliances offer firms an opportunity to increase innovation performance through the flexible combination of specialized competencies across firms. There are two metrics of project alliances: formal and emergent operating practices.
Stuart, T. E.	2000	SMJ	Quantitative	Try to show that the advantage of alliances is determined not so much by the portfolio's size, but by the characteristics of the firms that a focal organization is connected to.	Interfirm alliances and partnerships, interfirm technological alliances	The advantages which a focal firm derives from a portfolio of strategic coalitions depend upon the resource profiles of its alliance partners. The paper also argues that alliances are both pathways for the exchange of resources and signals that convey social status and recognition.

Capaldo, A.	2007	SMJ	Multiple longitudinal case studies, three case companies, 30 years of data. Both quantitative and qualitative data	Try to make sense of the relational capability of lead firm. Three levels' of analysis: lead firm level, dyad level and network level.	Alliances are interfirm collaborative relationships directed to the generation of relational rents. They consist of joint value-creation processes and are embedded in their surrounding social context.	The ability to leverage a dual network architecture: integrating a large periphery of heterogeneous weak ties and a core of strong ties, is a distinctive lead firm's relational capability, which provides fertile ground for leading firms to gain competitive advantages.
Gulati, R.	1999	SMJ	Both qualitative and quantitative: 153 interviews with 11 firms, and 9-year panel data	What determines which firms enter into alliances and which do not? Not focusing on dyads, focus on the firm level and consider social factors that influence the extent to which firms participate in alliances over time.	Networks are the contexts that most firms are embedded in.	Accumulated network resources arising from firm participation in the network of accumulated prior alliances are influential in firms' decisions to enter into new alliances.
Almeida, P. and Phene, A.	2004	SMJ	Quantitative, semiconductor patents.	Investigate the influence of external knowledge on innovation in subsidiaries of multinational firms.	MNC's intraorganizational networks, subsidiaries are embedded in the host countries local knowledge networks	The technological richness of the MNC, the subsidiary's knowledge linkages to host country firms, and the technological diversity within the host country have a positive impact on innovation.
Medcof, J. W.	2001	SMJ	conceptual	How strategically important extra-national units should be managed, and why they should be managed differently from units with little strategic importance.	MNC's intraorganizational networks. The relationships between resources, power and leadership	The extra-national technology units that embody those strategically important resources should be managed with inclusive methods that respect that power shift.

Joshi, A. M., and Nerkar, A.	2011	SMJ	Quantitative, 30 years of patenting activity by participants in three patent pools within the global optical disc industry.	Does the formation of patent pools enhance or inhibit firm-level innovation? Are the effects on innovation the same for licensor and licensee firms? Firm level analysis	Patent pools, strategic alliances. Contract relationships between licensors and licensees	Patent pools actually inhibit rather than enhance systemic innovation at the firm level. Not all R&D consortia are helpful in terms of increasing the quantity and quality of innovation for the firms participating in the consortia.
Jarillo, J. C.	1988	SMJ	Conceptual	This paper develops the concept of strategic network, as a tool to understand those cooperative relationships and their role in the strategy of the firm.	Networks are a mode of organization to position firms in a stronger competitive stance. Strategic networks are long-term, purposeful arrangements among organizations that allow those firms in them to gain or sustain competitive advantage.	A conceptual framework of four modes of organizing economic activity. There are classic market, strategic network, bureaucracy and clan. Within a strategic network, a hub firm has especial relationships with the other members of the network. Those relationships have most of the characteristics of a hierarchical relationship.
Gulati, R., Nohria, N., and Zaheer, A.	2000	SMJ	Conceptual	To highlight how the conduct and performance of firms is influenced in important ways by the strategic networks in which they are embedded. Industry level of analysis from a network perspective.	Industry participants can be seen as embedded in networks of resources, information, and other flows. Network linkages bind firms in complex relationships that are simultaneously competitive and cooperative.	Relational characteristics: network structure, network membership and tie modality, are all inimitable resources. A network perspective can add an important new dimension to explore differences in profitability across industries, and provide new insights for strategy scholars who are proponents of a resource-based view of the firm.

Snow, C. C., Fjeldstad, Ø. D., Lettl, C. and Miles, R. E.	2011	JPIM	Case study, descriptive/illustrative case study	Discuss innovation-related organizational design, showing how firms have moved from stand-alone organizations to multifirm network organizations to community-based organizational designs.	Multifirm network. Network organizations are different from traditional hierarchical organizations in several respects.	Multifirm organizational design combines a community "commons" for the collective development and sharing of knowledge among member firms with explicit institutional mechanisms for the support of direct inter-member collaboration.
Björk J., and Magnusson M.	2009	JPIM	Add to existing theory. Social network analysis within a company. UCINET. Using the company's data. Some qualitative interviews	Aims to add to existing theory and practice by exploring the innovation idea network of an organization to find out how this affects the generation of innovation ideas. Structural analysis of networks	Virtual networks of ideas.	There is a clear interrelationship between network connectivity and the quality of the innovation ideas created. The more connected category performed better than the least connected category.
Tijssen, R. J. W., and Korevaar, J. C.	1997	RP	Case study, quantitative and qualitative data	Industrial level analysis. Collaborative research publications, informal network ties and formal R&D linkages. Network level.	Interorganizational networks among universities, public research labs and private enterprises. Private/public network	The interorganizational relationships reveal a strong and integrated network comprising many universities, public research labs and private enterprises.

Smith, H. L., Dickson, K., Smith, S. L.	1991	RP	Case study, qualitative	Showing the research collaboration between small and large firms, particularly in the electronics section. Both inter personal level and interfirm level.	Interfirm collaboration for innovation is in line with the global shift in production amounting to an internationalization of production and trade and the globalization of research and development networks.	Interfirm collaborative networks serve to externalize the innovation function through the transfer of technology between firms. The existence of informal, personal networks among the scientific and engineering elite was the key factor in the establishment of collaborative links. Formalization can also be a barrier to successful collaboration, with small firms particularly vulnerable to adverse decisions made by people in authority above the level of technical collaboration.
Cantner, U., Graf, H.	2006	RP	Social network analysis, case study	To describe the evolution of the innovator network, specifically focus on aspects of technological and social proximity.	Supplier-user networks, networks of pioneers and adopters, regional inter-industrial networks, international strategic technological alliances, and professional interorganizational networks.	The dynamics of the system is directed towards an increasing focus on core competencies of the local innovation system; i.e. innovators on the periphery of the network exist and new entrants position themselves closer to the core of the network.
Dodgson, M., Mathews, J., Kastelle, T., Hu, M.	2008	RP	“Collective case study” approach (Stake, 2003) focusing on multiple evolving elements and relationships to understand the complexities and dynamics of the case.	What do differences in these institutions and behaviors compared to existing models tell us about the evolution of the NIS in Taiwan?	National systems of innovation, and focus on the innovation networks between biotechnology firms, governments, universities	By examine the process and mechanisms by which new biotechnology innovation networks are being created, and contrasting their development with existing networks, the paper shows the dynamics of Taiwan's NIS and the new phase in Taiwan's transition from "imitation" to innovation.

Collinson, S.C., Wang, R.	2012	RP	Multiple case studies, interviews. Five Taiwan-based MNE subsidiaries in the semiconductor industry	Examine how innovation-related capabilities for production, design and marketing develop at the subsidiary level within multinational enterprises (MNEs).	International business studies has focused on the MNE as a network with potential for integrating assets, resources, capabilities and knowledge from multiple locations for competitive advantage (Cantwell, 2009).	Capability accumulation can be discontinuous and that subsidiaries in the same host location specialize in different ways. Highlight the importance of MNE networks and the network embeddedness of subsidiaries.
Chen, S.	2004	RP	Qualitative and quantitative, IT industry in Taiwan, survey and interviews	Examine the R&D internationalization of a newly-industrializing country, Taiwan being a prime example and its connection with the global production network.	Production networks, interfirm networks	Propose a conceptual framework adapted from Dunning's eclectic paradigm. Put forward a 'holistic' view of the cross-border innovation network.
Bianchi, P., Bellini, N.	1991	RP	Conceptual	To offer a comprehensive view of innovation experiences based on local networks of innovators.	Agglomerations of SMEs. A network is an interactive set of firms, based on an external division of labor, which is not directed by hierarchical command.	Local networks may be positively stimulated by policy actions of governments, but these actions are successful only to the extent that the community of innovators is well rooted in a socially stable, economically developed local society.
Lee, S., Park, G., Yoon, B., and Park, J.	2010	RP	Case study on an association, both quantitative and qualitative data	This paper focusses on open innovation in the context of SME, and encourages innovation by suggesting a network model that emphasizes the role of intermediaries in linking SMEs.	Association of networks of SMEs. A collaborative business model based on a horizontal structure of specialized	Network is an effective way to facilitate open innovation among SMEs. Intermediation is one way of facilitating open innovation strategy, and an intermediated network is an effective model to enable their collaboration and specialization.

Freeman, C.	1991	RP	Conceptual	What is new about networks of innovators? Are there new forms of organization or new technologies or new policies which justify renewed research efforts since they go beyond those developments already analyzed in earlier empirical and theoretical work?	Networks of innovators. Network organizations are a basic institutional arrangement to cope with systemic innovation.	This paper demonstrated unambiguously the vital importance of external information networks and of collaboration with users during the development of new products and processes. Moreover, the dilemmas of cooperative research in competitive industries were recognized.
DeBresson, C., Amesse, F.	1991	RP	Conceptual	Conceptualization of networks of innovators.	The metaphor of networks captures some of the essential characteristics of supplier-user relationships, regional agglomerations, and international strategic technical alliances.	The concept of network has been used to examine many configurations: of individuals in research projects, of technical artifacts, or of innovating business firms working together. Network arrangements can deal with technological uncertainty but with higher appropriation uncertainty.
Soh, P., Roberts, E. B.	2003	RP	Quantitative, social network analysis, longitudinal, 1985-1996	This paper investigates how evolutions of complex technologies and networks of innovators affect the development of emerging innovations.	Multifirm alliances, structure of networks and position of firms	This research has extended the field of technological evolution by focusing on the inter-organizational dynamics leading to the change and stability of industry networks during eras of incremental change. A central-periphery structure best describe the patterns of industry networks

Liu, Meng-chun, Chen, Shin-Horng	2012	RP	First theory building then quantitative, hypothesis testing,	What locational advantages (Dunning, 1993) of an RIS within a host country affect the network linkages and networking strategy of MNCs offshore R&D units; in what way R&D subsidiaries of Taiwan-based firms in different Chinese regions interact with their local innovative milieu?	MNCs' R&D networks refer to the offshore R&D units' relationships with external parties locally in the host countries, including research institutes, other firms and other organizations. Regional innovation systems.	MNCs' offshore R&D units' strategy tends to be located in a host region with a strong knowledge application and exploitation subsystem. While an RIS with a strong knowledge generation and diffusion subsystem, may induce MNCs' local R&D units to pursue home-based technology augmenting strategy.
Love, J. H., Roper, S.	2001	RP	Modeling	1. How important are firm-specific, regional and national industry factors in determine the intensity of firms R&D, networking and technology transfer activities. 2.Are local networking, technology transfer and R&D substitutes or complementary inputs to the innovation process? 3. How important are firms' R&D, networking and technology transfer activities in determine the level and success of firms' innovative activity? 4. Do regional and industry factors influence the efficiency with which R&D, networking and technology transfers are translated into innovation outputs?	Regional innovation systems, intra-regional learning and knowledge transfer. Networking is defined as collaborative or sub-contract relationship between plants unrelated by ownership. Three levels of analysis: firm-regional networking and national industrial levels.	Intragroup links are important in terms of achieving commercial success, though have no effect on the commercial success of plants' innovation activity. R&D, technology transfer and networking inputs are substitutes rather than complements in the innovation process, and that there are systematic sectoral and regional influences in the efficiency with which such inputs are translated into innovation outputs.

Robertson, P. L., and Langlois, R. N.	1995	RP	conceptual	Examine the relationship between innovation and industry and firm structure to determine whether flexibility and the scope for change vary across environments.	Vertically integrated firms and loose webs of small producers are only two of types of networks operating in modern economies.	Neither vertical integration nor networks of small specialized producers are the panacea. Government's role ought to be facilitating rather than narrow and prescriptive, allowing scope for firms to develop organizational forms that are best adapted to their particular environments.
Zander, I.	1999	RP	Quantitative modeling and qualitative data. Sample of 24 major Swedish multinational corporations.	A first attempt to differentiate between various types of international innovation networks and to examine how the pre-conditions for gaining leverage from internationally dispersed research efforts might vary across firms.	Four types of international innovation networks: internationally duplicated, dispersed, home-centered, and internationally diversified.	The results suggest significant variation in the structure of international networks of multinational corporations, and hence unequal opportunities to exploit the potential competitive advantages from geographically dispersed technological capabilities.
Bercovitz, J. E. L., Feldman, M. P.	2007	RP	Quantitative, statistical testing	Examines how innovation strategy influences firms' level of involvement with university-based research.	Cross boundary alliances	Firms with internal R&D strategies more heavily weighted toward exploratory activities develop deeper multifaceted relationships with their university research partners. Universities are preferred when the firm perceives potential conflicts over intellectual property.
Santangelo, G. D.	2000	RP	Econometric and hypothesis testing 91 possible alliances among the 14 firms modeling.	Investigates the role of corporate technological specialization factors in the conclusion of STPs in the European ICT industry.	Firm-university R&D alliance	More similar partners' technological portfolios are with one another; the easier it is to absorb each other's capabilities.

Frenken, K.	2000	RP	Modeling, 863 aircraft models.	Try to model the complex, nonlinear and evolutionary natures of innovation networks.	Networks of producers, users and governmental bodies, are innovation networks of technology, market and regulatory bodies.	Only when individual actors have complementary competencies, the network is expected to be viable.
Perks, H., Jeffery, R.	2006	R&D Mgmt.	Multiple case studies on three global innovation networks.	How do innovation networks operate in practice? How do organizations configure industry networks in the innovation process? How do they influence the direction of the innovation? How and why does the shape and configuration of the network change over time? What are the underlying mechanisms which explain and drive such approaches?	Innovation network configuration is conceptualized as the shaping and management of the firm's position in a network in order to access and mobilize critical knowledge for innovation which resides within the network.	Three types of network configuration type in the fabrics industry: outsources network configuration (Dyadic relationship with networked organization); centralized network configuration (development of central control over extended network); specified network configuration (specification of restricted network membership and knowledge flows). Firms must enlarge the scope of their capabilities. Managers need to find appropriate levels of investment and mechanisms to help evolve the innovativeness of network members.
Salman, N, Saives, A.	2005	R&D Mgmt.	Interviews, social network analysis, centrality measures, and hierarchical regressions. Using interviews to get data.	Research on ties and position	Social network theory. Line network is also regarded as a "network"	Indirect ties and direct ties. Direct ties are tangible, strong ties, transfer of knowledge and resources. Indirect ties are less tangible, weak ties, flow of information, monitoring for resources.

Fichter, K.	2009	R&D Mgmt.	Multiple case studies, three cases.	Explore the role of promoters and networks of promoters in open innovation. Why do promoters become involved in across boundary networking and develop innovation communities? Do community members collaborate closely and informally, and perceive themselves as a team, as proposed by the innovation community construct? Why and when are innovation communities relevant for open innovation and success of innovation projects?	An innovation community is an informal network of likeminded individuals, acting as universal or specialized promoters, often from more than one company and different organizations that team up in a project related fashion, and commonly promote a specific innovation, either on one or across different levels of an innovation system. Three levels of innovation systems: firm level, value chain level, framing and linking level.	Transformational leaders as promoters, and especially their close and informal co-operation across functional and organizational boundaries, play a key role in open innovation.
Karamanos, A. G.	2012	R&D Mgmt.	Quantitative, statistical testing, patents of 455 biotechnology firms. 2933 technological alliances	How alliance networks facilitate the creation of new knowledge for exploratory innovation	Alliance networks: micro level-direct and indirect ties (networks as local neighborhood); macro level- density, clustering (macrostructure)	In the case of biotechnology, firms with high exploratory innovation output have short path indirect access to many other firms (micro-level), and operate in dense industry alliance networks centralized round a few key firms (macro-level), and that these effects are curvilinear.
Wincent, J., Anokhin, S., Boter, H.	2009	R&D Mgmt.	Quantitative, five year longitudinal data on 53 Swedish strategic small-firm networks	How the boards should be organized to help improve the innovative status of network participants.	Networks of SMEs	Under certain circumstances renewal rates among network board officers may be important determinants of improvements in innovative performance of network member firms.

Pearce, R., and Papanastassiou, M.	1996	R&D Mgmt.	Survey, two datasets, one sent to overseas R&D laboratories, one for foreign labs in UK	What's the role of overseas R&D labs in MNEs now play roles in innovation?	MNEs are being played by networks of geographically-dispersed R&D facilities (labs).	Overall overseas R&D units in MNEs may be seen as seeking effectiveness through an involvement in two intermeshing technology networks.
Sá, C., Lee, H.	2012	R&D Mgmt.	Single case study	How do the efforts of technology-based incubators to facilitate interorganizational networks relate to firms' needs? How do incubated organizations conceive of the networks they partake of? What enables or inhibits the formation of beneficial networks?	A technology-based incubator can be defined as an organization that provides services for new start-up and early-stage companies with a technological focus, to assist their survival and growth.	Different kinds of networks are created in a high-tech incubator environment. Factors that enable and constrain such networks are identified. Greater attention is needed to the conceptualization of interorganizational interactions in technology-based incubators.
Hanna, V., Walsh, K.	2002	R&D Mgmt.	Multiple case study, 3 cases, semi-structured interviews	Explores wither collaborations between small firms on marketing, purchasing, R&D, training or manufacturing lead to innovation.	Small firms' cooperation networks. Network brokers identify opportunities, bring small firms together and facilitate co-operation.	Small firms may have to rethink their approach to co-operation, and their motives for initiating inter-working if they are to benefit fully from co-operation.
Rese, A., and Baier, D.	2011	R&D Mgmt.	Survey, hypothesis testing, 271 questionnaires.	Explore the underlying factors that affect the performance of new product development by networks of firms and research institutes.	Networks of manufacturers, suppliers, marketing intermediaries, service providers and research institutes.	The results confirm the traditional success factors, especially the product advantage and proficiency factors. But they also show that network-related success factors (especially network cohesion and organization) are of similar major importance.

Hage, J., Hollingsworth, J. R.	2000	OS	Conceptual	To suggest a strategy for understanding how research leads to commercially successful radical product and radical process innovations in research intensive industries.	Idea innovation networks exist at the level of an industrial sector and market sector, and each network has six different functional arenas in which various types of innovative processes occur.	Radical process innovations as significant improvements in the throughput. Two crucial concepts related to idea innovation networks are: shape of idea innovation networks, and strength of the connectedness.
Park, S. H.	1996	OS	Conceptual, propose a framework, then empirical testing.	Explore the selection of a control mode in managing interorganizational network, considering the risk and cost involved in working with others.	The interorganizational network is viewed as a strategic mechanism to improve a firm's competitive advantage through cost minimization while maintaining flexibility.	The paper proposes a framework of institutional mechanism for network control: nature of network governance (bilateral, trilateral), type of interdependence (vertical, horizontal).
Kijkuit, B., van den Ende, J.	2010	OS	Longitudinal, 14 months on-site field study, over 200 interviews to map the networks around 17 ideas for new products as they moved from rough ideas to detailed project proposals.	Focus on the effects of social network interaction on the quality of ideas and on the review decisions for converting ideas into projects. Investigating network structure (size, density, intensity), network content.	Social networks of people involved in the idea generation and development process on the success of ideas.	Particularly strong ties between different units advance the adoption chances of ideas. Communication with good acquaintances or friends in other units should be promoted in the front end of idea generation.
Rothaermel, F. T., Hess, A. M.	2007	ORSC	Quantitative, hypothesis testing, 22 years' data of 22 firms.	Investigate whether a firm's antecedents to innovation lie across different levels.	Individual (intellectual human capital, star scientists), firm (R&D capability) and network level (strategic alliances, acquisitions). Also interactions between the three	The antecedents to innovation lie across different levels of analysis and can have compensating or reinforcing effects on firm-level innovative output.

					levels	
Paruchuri, S.	2010	ORSC	Quantitative, eight sample companies patent data from 1985-1992, including their subsidiaries patents	Examine the effects of a firm's structural position in the interfirm collaborative network on its internal innovation dynamics. Structural position.	Both interorganizational networks such as strategic alliances and intraorganizational networks such as information flow.	a firm's internal innovation activities are carried out by inventors connected in an intrafirm co-inventing network
Sydow, J., Windeler, A.	1998	ORSC	Conceptual	Use the structural perspective to build theories on how structures of signification, domination, and legitimation shape network processes and how they are reproduced under the auspices of network effectiveness.	SMEs engage in networking in order to gain the advantages of bigness while keeping the flexibility of smallness. The nature of interfirm networks is an organizational form.	Network effectiveness is depended on domination, signification, and legitimization.
Liyanage, S.	1995	Technovation	Qualitative analysis. Co-occurrence of words is used as a method of mapping distributions and interrelations in exchanges of knowledge in networks.	Examines the process by which innovation clusters are formed in research collaborations by analyzing the work programs of 51 Australian cooperative research centers. Network level.	Collaborative research networks involve both technology and market stakeholders and are extend to include industry, research and technology producers.	The iterative process of innovation cluster formation is an effective form of organizing a national system of innovation. These clusters enable public policy makers to identify complementarities between generation, acquisition and diffusion of knowledge across a range of innovations rather than a single innovation.

Staropoli, C.	1998	Technovation	Comparative case studies, descriptive case studies. Two cases	Aim at understanding the choice of the interfirm network as a contractual arrangement governing cooperation in pharmaceutical R&D.	New institutional economics, with its recent recognition of hybrid organizational forms, gives an analytical framework for analyzing the various arrangements governing cooperation.	Tight networks refers to a hard cooperative relationship, with an explicit purpose agreed upon by all parties who intentionally join the network and implement multilateral contractual relationships. Authority plays a fundamental role in the coordination of the network since the parties keep their legal autonomy and property rights are properly allocated.
Calia, R. C., Guerrini, F. M., Moura, G. L.	2007	Technovation	Single case study, qualitative	Analyze how a mid-sized company in a developing country succeeded to grow and internationalize its business (dependent variables) as a function of innovations in the organizational business model shaped by resources provided from a technological innovation network.	Three independent variables for innovation network: the relationship structures, the innovation typology, and the innovation network dynamic. Mainly means network of organizations.	This case study presents an example of how a technological innovation network provides the necessary resources to change the business model, in order to achieve global competitive ness.
Löfsten, H., Lindelöf, P.	2005	Technovation	Survey	Explore the R&D networks and product innovation patterns made by the university spin offs, and corporate spin-offs located on Science parks.	Science parks and incubators.	The proportion of university spin-offs and Company spin-offs on Science Parks with links with universities is comparatively high. University spin-offs are not able to channel investments into greater R&D outputs (Patents) than comparable firms.

Zeng, S.X., Xie, X.M., Tam, C.M.	2009	Technovation	Survey, 137 Chinese manufacturing SMEs, structural equation modelling (SEM)	Explores the relationships between different cooperation networks and innovation performance.	Inter-firm cooperation, cooperation with intermediary institutions, cooperation with research organizations	Inter-firm cooperation has the most significant positive impact on the innovation performance of SMEs. However cooperation with government agencies do not demonstrate any significant impact on the innovation performance of SMEs. Vertical and horizontal cooperation with customers, suppliers and other firms plays a more distinct role in the innovation process of SMEs than horizontal cooperation with research institutions, universities or colleges, and government agencies.
Rycroft, R.W., Kash, D. E.	2004	Technovation	Multiple case studies of three industries	Explore the co-evolution between self-organizing innovation networks and globalization	Networks are linked organizations that create, acquire, and integrate the diverse knowledge. Innovation networks are organized around constant learning.	Globalization and self-organizing innovation networks maybe co-evolving.

Lin, C., Wu, Y., Chang, C., Wang, W., Lee, C.	2012	Technovation	Quantitative hypothesis testing, 1996-2000, 220 firms	Explore the role of interfirm R&D alliances as a vital mechanism for creating new technological knowledge	An R&D alliance acts as a mechanism of knowledge acquisition to achieve innovation is greatly influenced in practice by the firm's absorptive capacity.	Firms with a high level of absorptive capacity seem to benefit more from their alliances. R&D alliances should be regarded as a complement to rather than a substitute for a firm's internal R&D.
Nieto, M. J., Santamaria, L.	2007	Technovation	longitudinal data, 1998-2002, cross-sectional data	Explores how technological collaboration affect the degree of novelty of product innovation, in particular how experience and continuity of the collaboration affect the degree of novelty. Is it possible to observe different trends according to type and diversity of partners?	Networks with suppliers, clients, research organizations and even competitors.	Collaboration with suppliers, clients and research organizations - in this order - has a positive impact on the novelty of innovation, while collaboration with competitors has a negative impact. The greatest positive impact on the degree of innovation novelty comes from collaborative networks comprising different types of partners.
Salavisa, I., Sousa, C., Fontes, M.	2012	Technovation	Qualitative, interviews with entrepreneurs of 46 young firms of the young firms of biotechnology and software sectors. Social Network analysis.	Empirically investigate the impact of differences in the nature of resources on the architecture of innovation networks	Networks are critical to the innovation process in knowledge-intensive sectors; this is particularly so in young small firms operating in these sectors.	The result shows differences in the topology of networks within and across sectors. The differences become particularly evident regarding: 1. the formal access to complementary assets, reflecting distinct dynamics of the environment where firms pursue their activities; 2. the informal access to knowledge, associated with differences in knowledge bases.

Dellestrand, H., Kappen, P.	2012	JIBS	Survey, 63 subsidiaries located in 14 countries, 23 MNEs. Data from 72 innovations developed at the subsidiaries., these 72 innovations have been transferred within the MNEs to 169 receiving subsidiaries located in 31 countries	Investigate how spatial and contextual distance within multinational enterprises affects headquarters resource allocation to specific innovation transfer projects between subsidiaries.	MNE's globally distributed subsidiaries are regarded as internal networks.	Subnational factors, such as the structure of the subsidiary network, offer a strong explanation for headquarters resource allocation. Positive and negative effects of national factors were also found, which implies that distance matters for headquarters resource allocation activities.
Frost, T. S., Zhou, C.	2005	JIBS	Quantitative modeling, hypothesis testing, US patent data	Investment the knowledge integration and R&D co-practice (joint technical activities between units) inside an MNC.	Multinational as a geographically distributed innovation network, with the capacity to assimilate, generate and integrate knowledge on a worldwide basis.	R&D co-practice increases levels of absorptive capacity and social capital among participating units, thus increasing the likelihood of knowledge sharing in the future.
Phene, A., Almeida, P.	2008	JIBS	Tracking 24 subsidiaries from six US semiconductor firms' patent data from 1981-1992	Seeks to understand which sources of knowledge are most useful to MNC subsidiary innovation.	Multiple inter-unit linkages within an MNC lead to increased knowledge sharing and transfer.	Knowledge absorbed from the host country is useful to subsidiary innovation. We also find support for the role of subsidiary capabilities: both sourcing capability and combinative capability have a significant influence on the scale and quality of innovation.

Asmussen, C. G., Pedersen, T., Dhanaraj, C.	2009	JIBS	Survey, hypothesis testing	Little knowledge about the mechanisms by which and dimensions along which these cluster characteristics work. This paper attempts to fill in the gap by moving away from the concepts of environment and subsidiary strength and toward the concept of configuration.	MNE as a network of specialized, interdependent units.	Extended Porter's diamond model.
Andersson, U., Forsgren, M., Holm, U.	2007	JIBS	97 subsidiaries located in 13 European countries and North America	Explore subsidiary's influence within the federative MNC.	MNCs are less hierarchical and more loosely coupled organizations than had traditionally been assumed. MNC federation. Power 'is redistributed. Independence between subsidiaries and headquarter.	The strength and influence of a subsidiary's local business network are determined by the extent to which the subsidiary provides technology within the MNC. When the headquarters has a sound knowledge of the subsidiaries' business networks, it is better able to balance or moderate the influence of strong subsidiaries.

3.3 Reflections on Paper 1 and Additional Discussions

As an additional section to Paper 1, the main findings of Paper 1 will be briefly reflected upon and some further research topics will be discussed.

3.3.1 Reflections on the findings-Paper 1

The title of the PhD dissertation is "*In search of a network organization for global Innovation: a multilevel analysis on transnational corporations' global innovation"*. It would seem, therefore, that I only need to review literature related to TNCs' global innovation. However, I think understanding network organization is the foundation for looking into its application to TNC's global innovation, so it is crucial to include more literature from organization, strategic management, and innovation management journals rather than simply focusing on limited journals on international business.

This systematic literature review partly answers the first research question of this dissertation from the theoretical point of view by identifying three levels of network organization for innovation. In the next three chapters (Chapter 4, 5 and 6), networks as innovation contexts, interorganizational networks, and intraorganizational network organization for global innovation will be elaborated on from a practical perspective showing how TNCs understand network organization and how they put it into practice in different ways. When dividing intra-and interorganizational network organizations, the criterion is the legal boundary of a firm. How then, is the meaning of the boundary between interorganizational network organizations and the context to be defined? When we typically think of the context, it is always regarded as some given settings which are "outside" of what I am focusing on now which could be intra- or interorganizational network organizations. Thus, networks as innovation contexts represent the mega innovation environment that on the one hand, consists of overlapping intra- and interorganizational network organizations, and on the other hand, influences the formation and coordination of network organizations.

In addition, Paper 1 summarizes the meaning of network organization in the narrow and broad senses. In a narrow sense, network organization refers to a new internal organizational design to promote innovation strategy; meanwhile in a broad sense, interorganizational innovation networks such as strategic technological partnerships, joint ventures, value networks and technological outsourcing and licensing can also be seen as network organizations. Besides exploring the meaning of network organizations for innovation, Paper 1 also shows the current research status of this area. The literature review shows that existing literature on network organization for innovation adopts various multiple research methods (both quantitative and qualitative), and it has different levels of analysis (focal, dyadic and network level) in order to fulfill different research aims. However, with regards to the research topics, most of the research still focuses on

the interorganizational network organizations. Therefore, there is a research gap in the internal network organizational design and management. This could be partly due to the fact that designing a network organization for a firm's internal organization is still an emerging phenomenon. This dissertation tries to partly fill in the research gap through exploring the design and management of TNCs' internal network organizations, which also provides possibilities of theory building and expanding.

In the following three sections, I will further reflect on three research topics that are related to network organization for innovation, which are related to the following papers.

3.3.2 Market, hierarchy and network

A network is not only a structure, but also a coordination mode based on mutual benefits, interdependence, trust, long-term oriented collaborations, etc. Therefore, its relationship with two traditional coordination modes (market and hierarchy) has always been an interesting and highly debatable research topic.

One stream believes that network lies in-between market and hierarchy, which can be viewed as an inter-penetrated form of market and hierarchical or functional organizations (Imai & Baba, 1989; Teubal, Yinnon, & Zuscovitch, 1991; Thorelli, 1986). According to different levels of integration, between fully integrated hierarchy and independent market forms, there are strategic alliance, virtual corporation, dominated network, unilateral agreements and equal-partner networks (Child et al., 2005, pp: 153). These ideas are based on the definition of "hybrids" from Williamson (Williamson, 1991). Here, hybrids mean various forms of long-term contracting, reciprocal trading, regulation, franchising, and the like, or in other words, it is what we now call network organization. .

Apparently, an organization is not only a combination of costs and benefits, but a social entity constructed by people with different personalities and abilities. Besides, human beings have cooperative inclinations and the need for and ability to trust. As a result, it is no wonder that some scholars see networks as a distinctive form of coordinating economic activity which is different from market and hierarchy (Hämäläinen and Schienstock, 2000; Powell, 1990). In the influential paper "*Neither market nor hierarchy: Network forms of organization*", Powell (1990) criticizes the transaction cost theory and its proposition that networks are an intermediate of market and hierarchy, and he developed a set of factors to prove that network organization is unique. In a market, transactions are guided by the invisible hand (price mechanism), while a hierarchical organization is regulated by a visible hand (routines and authorities). In a network organization, transactions occur through "networks of individuals engaged in reciprocal, preferential, mutually supportive actions" (Powell, 1990, pp: 303). One important point is that trust will be generated through long-term network transactions based on mutual and reciprocal benefits. Trust will then in turn reduce transaction cost, the uncertainty of reality and the complexity of coordination.

Podolny and Page (1998) argue that it is wrong to make a trichotomy of market, hierarchy and network because each market actor is a node whose ties to other actors are either loose or non-existent,, and a hierarchical organization can be seen as a centralized network in which most or even all ties flow to one central node. Reddy and Rao (1990) make a proposition that we can treat the market as an interfirm organization since interdependencies between organizations "engender formal arrangements that replace the price system as a coordinating mechanism of exchange." Moreover, since the 1970s, the IMP (industrial marketing and purchasing) and Uppsala scholars have been trying to search for a new approach of business research, i.e. the interaction approach which takes the relationship as its unit of analysis rather than the individual transaction. Within an interaction approach, it is not what happens within companies but what happens between them that constitutes the nature of business (Håkansson et al., 2009, pp: 27). Thus, market structure can be seen as being business networks rather than an outside environment with many independent suppliers and customers. Currently, these scholars hold a *network perspective*, i.e. conceptualize all organizations including market as networks of nodes and ties and consider relationships as an analytical unit rather than a single organization (Baker, 1993; Betts & Stouder, 2004; Borgattie & Foster, 2003). Under the network perspective, a network characterized by a hierarchical division of roles and tasks, vertical layers, and a central administration of resource allocation and decision making is called bureaucracy (Baker, 1993; Burt, 2000). Thus, here we have a third understanding on the relationship between market, hierarchy and network, i.e. market and hierarchy are two extreme cases of network (Burt, 2000).

Based on the above discussions, Figure 3.3 provides an overview showing different ways to position a "network". Williamson's continuum shows that a network lies in between market and hierarchy; Powell's trichotomy argues that a network is a unique form that has its own principles; while Scholars holds a network perspective, regarding market and hierarchy as extreme cases of networks. However, I think that the above three are all analytical constructs, and it is not possible to find pure networks, market or hierarchy. Regarding network organization, we may have noticed that, in business, it is hard to find a pure case of network organization since you can always find hierarchy or market transaction in a network organization. For example, Kastelle and Steen (2010) discover that although networks are good for innovation, the problem solving within networks always reflects the formal management hierarchy of the firm.

As a result, there will be a fourth situation in reality in which the three coordination modes are overlapping each other. Reflecting on the three-level framework proposed in Paper 1, regarding the business market and innovation environment as overlapping networks in nature admits the overlapping of two coordination modes, i.e. market and network. The overlapping and triplicity of market, hierarchy and network will be further elaborated upon in Chapter 6: Intraorganizational network organization.

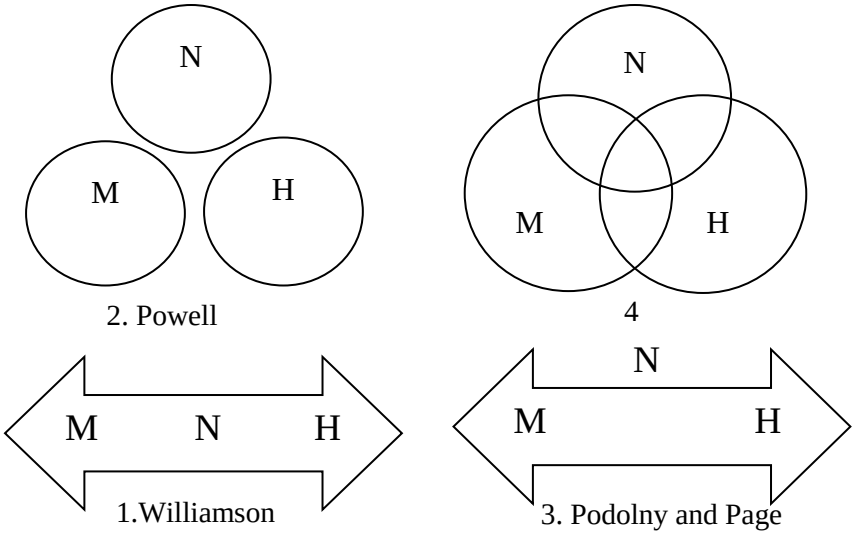


Figure 3.3. Relationship between market (M), hierarchy (H) and network (N).

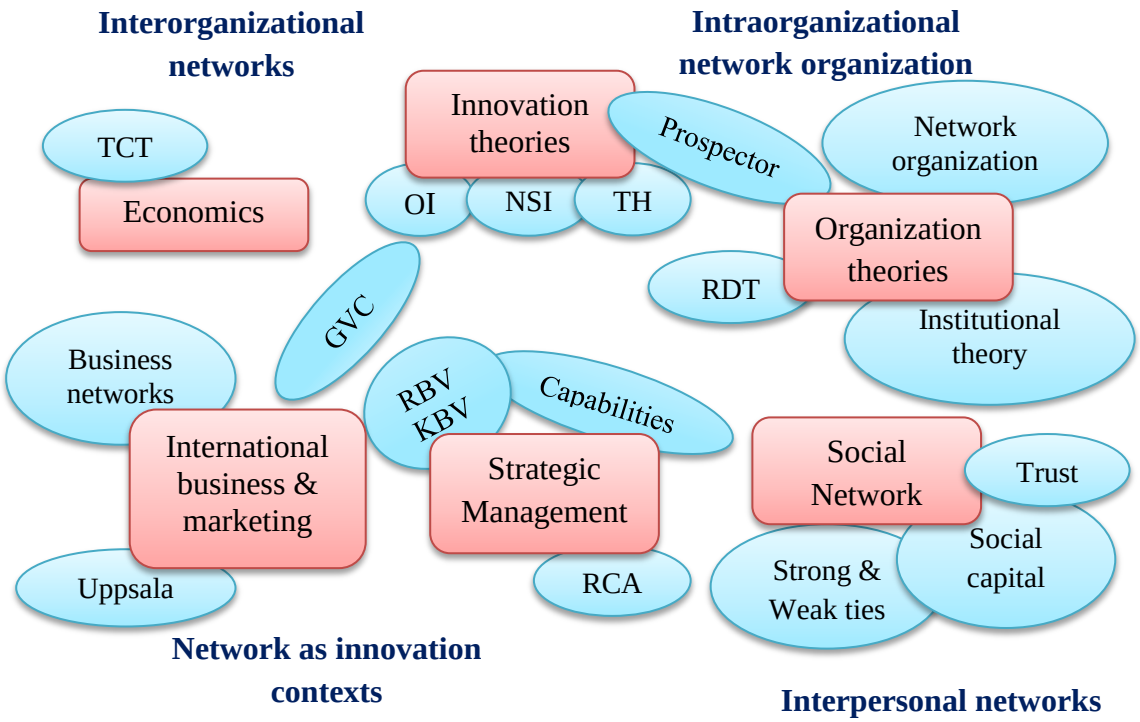
3.3.3 Theoretical background of network organization for innovation

Regarding the theoretical foundation of network organization for innovation, one thing that is interesting is that the emergence of network organization links different theories together. Traditionally, economics focuses on market and single firm's optimal choices; organization theories focus only within an organization's boundary; strategic management researchers study and make strategies for single firms; innovation scholars focus on single firm's performance or innovative heroes; and business researchers tend to take business environment as exogenous.

However, the emergence of network organizations has already moved economists from market and hierarchy, to hybrid forms which blur firms' boundaries. Organization researchers now move beyond traditional boundaries and try to understand network as a quasi-organization. For example, according to Hatch and Cunliffe (2006),

> The prototypical post-industrial organizational form is the network, but other forms associated with post-industrialism include joint ventures, strategic alliances, and virtual organizations as well as the democratically inspired labor-managed firm and the post-bureaucratic organization. One important distinguishing feature shared by post-industrial organizations is boundarylessness – for them boundaries are either transparent or permeable.

Moreover, a firm is inevitably embedded in different networks even though it is unaware of it, and a business environment itself is constructed by massive overlapping networks.



TCT: transaction cost theory; OI: open innovation; NSI: national systems of innovation; TH: triple helix; RDT: resource dependence theory; GVC: global value chain; RBV: resource-based view; KBV: knowledge-based view; RCA: relational competitive advantage

Figure 3.4. Theoretical foundation of network organization for innovation.

Figure 3.4 provides us with a systematic view of the theoretical foundation. Network, as an intermediate point, makes inter-disciplinary conversation viable and feasible, and provides a lot of potential for theory building. In terms of management of network organization, new concepts and approaches are needed to complement traditional managerial principles toward hierarchical or matrix organizational form, which will be discussed below.

3.3.4 Management: Administration, orchestration, coordination, facilitation, and adaptation

In organizational and managerial articles, "control" and "administration" are always in line with managing hierarchical organizations. However, as a distinctive coordination mode, the management of network organization requires new concepts and styles. As discussed in Paper 1, within a network organization, different organizations have their own competences and hold critical resources that are needed by others, so they are interdependent from each other. The fundamental factor that determines the role and managerial ability of an organization within a network is its power that come from critical resources it holds (Pfeffer & Salancik, 1978; Scott and Davis, 2007). In addition,

the power of a firm is also influenced by the complexity of a task and uncertainty of the environment, i.e. the more complex the innovation task is and the more uncertain the environment is, the less power one focal firm may possess, and less possible for the focal firm to manage the whole network organization (Hillman et al., 2009).

Therefore, due to limited power, it is no longer possible for a single organization to directly administrate its partners within a network organization, especially within an interorganizational network organization. According to existing literature, we see the following concepts that describe the managerial role of an organization, i.e. administrator, orchestrator, coordinator, facilitator and adaptor. These managerial roles can be defined as follows:

- Administrator: planning, decision making, directing, and controlling of the R&D process.
- Orchestrator: focal organization has a central position and power to perform a leadership role to arrange different partners to achieve a desired overall effect; all actors share the same goal.
- Coordinator: making different people or entities with different goals work together for a compromised goal.
- Facilitator: helping a group of people understand their common objectives and assisting them to plan to achieve them without taking a particular position in the discussion.
- Adaptor: adjusts itself in order to survive in environmental change.

The above managerial concepts show a continuum that indicates the decreasing degrees of power and possibilities of control over other organizations. In terms of TNC's global R&D, it is still possible to "administrate" it as long as the R&D subsidiaries' powers are relatively limited. Orchestration and Coordination can be applied in both an internal network organization and interorganizational networks. When a firm has some specialty but is not able to influence the whole network organization, it can "facilitate". Finally, when it is difficult for a single firm or organization to influence the network contexts, we see researchers discussing how firms should adapt to institutional change. Thus, in any organization, we may see a dominant management formula within the above continuum, but we will also expect the organization in different situations to use a variety of mechanisms. In Chapter 5 and Chapter 7, I will discuss the managerial issues related to both intra- and inter-organizational network organizations. Chapter 5 of this dissertation explores how partnering firms successfully coordinate a strategic technological partnership in order to generate relational competitive advantages. Chapter 7 explores how an SME orchestrates both intra-and interorganizational network organizations.

References

Betts, S. C., & Stouder, M. D. (2004). The network perspective in organization studies: network organizations or network analysis? *Academy of Strategic Management Journal, 4*, 1-21.

Burt, R. S. (2000). The network structure of social capital. *Research in Organizational Behavior, 22*, 345-423.

Child, J., Faulkner, D., & Tallman, S. (2005). *Cooperative strategy: Managing alliances, networks, and joint ventures*. New York: Oxford University Press.

Hatch, M., & Cunliffe, A. (2006). *Organization theory: Modern, symbolic & postmodern Perspective*. New York: Oxford University Press.

Hillman, A. J., Withers, M. C., & Collins, B. J. (2009). Resource dependence theory: A review. *Journal of Management, 35*(6), 1404-1427.

Håkansson, H., Ford, D., Gadde, L. E., Snehota, I., & Waluszewski, A. (2009). *Business in networks*. West Sussex: Wiley.

Hämäläinen, T. J., & Schienstock, G. (2000). Innovation networks and network policies, *OECD Working Paper*, February.

Imai, K., & Baba, Y. (1989). Systemic innovation and cross-border networks. *International Seminar on the Contributions of Science and Technology to Economic Growth at OECD,* Paris.

Kastelle, T., & Steen, J. (2010). Are small world networks always best for innovation? *Innovation: Management, Policy & Practice, 12*(1), 75-87.

Reddy, N. M., & Rao, M. (1990). The industrial market as an interfirm organization. *Journal of Management Studies, 27*(1), 43-59.

Scott, W. R., & Davis, G. F. (2007). *Organizations and organizing: Rational, natural, and open systems perspectives*. New Jersey: Pearson Prentice Hall.

Teubal, M., Yinnon, T., & Zuscovitch, E. (1991). Networks and market creation. *Research Policy, 20*(5), 381-392.

Thorelli, H. B. (1986). Networks: Between markets and hierarchies. *Strategic Management Journal, 7*(1), 37-51.

Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York: Harper & Row.

Podolny, J. M., & Page, K. L. (1998). Network forms of organization. *Annual Review of Sociology, 24*, 57-76.

Powell, W. W. (1990). Neither market nor hierarchy: Network forms of organization. *Research in Organizational Behavior, 12*, 295-336.

4. Network Organization as the Global Innovation Context

4.1 Introduction to Paper 2

Paper 1 answers what a network organization for innovation is from a theoretical point of view, and develops a three-level framework to facilitate the understanding of this concept.

In the second paper, the authors will show that the global innovation context is constructed by networks of actors by focusing on an interesting phenomenon: the internationalization of the triple helix. We use the Danish triple helix actors' (government, university and industry) experiences in China to illustrate such an emerging trend. This paper firstly shows the possibility of applying the triple helix model in another nation, and secondly expands the existing triple helix model by adding an internationalization dimension.

This paper mainly contributes to the first main research question of this dissertation:

How do transnational corporations perceive/design a network organization to facilitate their global innovation?

4.2 Paper 2

Triple Helix Going Abroad? The Case of Danish Experiences in China[7]

Yimei Hu, Olav Jull Sørensen

Department of Business and Management, Aalborg University

Abstract

The aim of this paper is to conceptualize and illustrate the potential of the internationalization of the triple helix. Unlike the existing literature, which focuses on the triple helix model within a national context, we observed a tendency to internationalize the triple helix. We conceptualize the internationalization of the triple helix into three stages: pioneering stage, exploration stage, and integration stage. In the pioneering stage, we see the establishment of each of the three helix spheres abroad, i.e. internationalization of companies, universities and governments; in the exploration stage, the three spheres start to interact abroad and collaborate with counterparts in the host country; in the integration stage, helix to helix collaboration is emerging. The paper is exploratory in nature using evidences from the collaboration between Denmark and China in various aspects. This model indicates some implications on a country's policy on enhancing innovation overseas.

Keywords

Triple helix, internationalization, innovation

1. Introduction

Transnational companies (TNCs) are on a continuous global search for exploitative and explorative activities to improve their competitiveness. Related to China, this search took at first the form of outsourcing labor intensive activities in order to lower production costs. Outsourcing on a large scale started in the 1990s and peaked in the first five years of the new millennium. It is still popular but is running out of steam as there is less to outsource. However, the outsourcing wave has made China the world's manufacturing power house. The second form of the global search was that of exploiting the Chinese market, taking advantage of the increase in income as well as the bold policies on industrialization, infrastructure building etc. This is going on right now and will continue to be on the search agenda as long as the high growth rates remain. The third form of global search is relatively new, which is the internationalization of R&D.

[7] Paper submitted to journal. Draft version presented at CICALICS Workshop 2010, August, Hangzhou, China.

While conducting a study of the internationalization of R&D activities of Danish companies in China, it became clear that the companies use an incremental approach in the building of their Chinese R&D capabilities. They start by establishing their own R&D activities as part of sales and production activities, focusing more on the D (development) than the R (research), and the R&D group at headquarters is in full control of the activities. Thus, initially, the R&D activities in China have the purpose to support local production/sales. From this platform, they were to develop and the interviews indicated that they used Danish institutions as well as Chinese institutions in the enhancing of their capabilities. This was what triggered the interest in using the triple helix (TH) framework to understand the internationalization of R&D of Danish companies.

On the Chinese side, the policy makers are aware of the dangers of being the manufacturing power house of the world without more to offer than cheap labor forces. Therefore, much is being invested in enhancing the research capabilities of both universities/academies and industry. At the same time, the Chinese Government invites TNCs to invest in China, expecting this way to tap into "modern" management and technology and have spillover effects into the value chain as well as companies at the same level of the value chain as the foreign invested company. For example, since 2000, China has issued a regulation aiming at encouraging the establishment of foreign R&D, by providing preferential treatment for transnational corporations' R&D in China. In general, we expect in the coming years to experience interesting developments in the relations between China and the developed market economies (Sørensen, 2009).

In the light of this, we will argue that one of these developments would be an internationalization of the triple helix and collaboration between, for example the Danish internationalized triple helix and the Chinese domestic one. Since our empirical findings suggest that Danish TNCs' R&D activities in China also involve governments and universities from both countries, the triple helix theory could be a preferred model to support our analysis.

The main objective of this paper is to make sense of the internationalization of the triple helix by proposing a theoretical model for it. We use the actual interaction between Danish and Chinese triple helix actors as explorative cases. Our model suggests that it is possible for triple helix to go beyond national boundaries and interact with another triple helix in a foreign country to facilitate innovation activities. The internationalization process of the triple helix can be conceptualized into three stages: pioneering stage, explorative stage and integration stage. This will contribute to the theoretical development of the triple helix by adding an international perspective, as well as providing implications for government policies on promoting innovation under different national contexts.

The paper is structured as follows. After the introduction part, Section 2 briefly introduces the triple helix theory that will be used in the paper; then, Sections 3 discusses the internationalization of the triple helix model; Section 4 discusses the methodology of this paper. Section 5 uses Section 3 as a basis for discussing the empirical findings. Section 6 discusses the context sensitivity of the model. At the final section, the findings will be summarized and some policy implications will be outlined.

2. The Triple Helix Framework

To enhance innovation and to unfold and conceptualize the relatively broad concepts of the knowledge society and knowledge based economy, several concepts and theories have been launched and discussed, including the national innovation system (Lundvall, 2010; Nelson, 1993); the cluster theory (Porter, 1990); The Mode 2 theory of knowledge production (Gibbons et al. 1994); the global value chain theory focusing on upgrading (Gereffy 1994; Gereffi, Humphrey and Surgeon, 2005), and the triple helix concept (Etzkowitz and Leydesdorff, 2000; Etizkowitz, 2002; Leydesdorff, 2000). Although analytically different and also different in terms of public policy and firm strategy implications, they also have much in common such as the focus on interaction, networking and learning and in general an institutional approach to understand reality.

The triple helix framework reflects the increasing importance of innovation for socio-economic progress and the increase in the demand on universities to produce research results that both contribute to our knowledge and at the same time to industry and society. Innovation is here broadly understood as new knowledge, new technology, new products and services and new business platforms and organizational designs. The idea behind the triple helix model is that the innovation process can be improved by moving from a linear process to conducting innovation in reflexive networks with a high degree of diversity and endless transformations that result in reconfigurations of the core actors and their relations (Etzkowitz, 2002; Etzkowtiz and De Mello, 2004; Leydesdorff, 2000). Through the transformations and circulations, new opportunities are discovered.

The model consists of three spheres: the industry/business, the universities/academia, and the governmental bodies. Each of the three spheres has an aim and a life in their own right at the same time as synergy emerges through their interaction and collaboration. The synergy expectedly arises from the interplay between three rationales embedded in three different institutions: the market, the production of knowledge, and public governance. Each triple helix sphere has a different role: for government, it is the social mission of the collaboration; for industry, it is the prospects of a commercial outcome; and for universities, it is the possibilities to get access to data and especially experiences and tacit knowledge and thus contribute both to science and society and business.

Industry and environment in general expect to be able to increase the “smartness” of their market offers through knowledge intensive research. Companies expect their

innovation process to be faster, less expensive, and that the outcome will be better market offers that with more value for customers can assure the competitiveness of the company (Leydesdorff and Etzkowitz, 1998).

The government should be proactive to make necessary adjustments that will make the triple helix network possible but not have a totalizing role (Leydesdorff and Etzkowitz, 1998). Thus the government should stimulate collaboration through incentive systems, and should also provide some funding as a mechanism to assure social benefits.

Unlike national systems of innovation theory (Lundvall, 2010; Nelson, 1993), open innovation theory (Chesbrough, 2003; Chesbrough et al., 2006), and "networks of innovators" approach (Freeman 1991), the triple helix model emphasizes that the university plays a key role in innovation in knowledge-based societies, and the network of the triple helix is the heart of the national systems of innovation (Etzkowitz and Leydesdorff, 2000; Etzkowitz, 2002). Often being the largest "knowledge-based" institutions in the regions, universities are increasingly challenged with the generation of technological innovations and expected to play an enhanced role in the social-economic development of the region through dissemination of knowledge and industry linked partnerships, which can be referred to as the "third mission" of the university besides education and academic research (Dzisha and Etzkowitz, 2008; Etzkowitz and Leydesdorff, 2000, Etzkowitz et al. 2000; Hagen, 2002; Razak and Saad, 2007). Some universities saw the mission completed through creating what has been termed the entrepreneurial university (Etzkowitz et al. 2000; Yusof and Jain, 2010; Wong, Ho and Singh, 2007). This entails going beyond simple collaboration and take out patents and establish companies through the use of incubators. Other universities have seen the third mission more in terms of enhancing the platform for research as collaboration with industry could provide finance and access to new types of data, i.e. experiences and the tacit knowledge embedded in people and systems of the companies. Take Chinese universities as an example, there is a trend showing a transition from vertical collaboration such as university-run enterprises or formal contract-based research collaboration towards horizontal and informal university-industry linkage (Eun, 2009). This again would require new research methodologies notably subjective in nature.

However, the triple helix is not a simple linkage of the three institutions described above. Each of them would have to develop their mindset, organization and create mechanisms for the triple helix collaboration. Companies, for example, would have to reorient themselves from innovations in "concealed labs" to open innovation collaborations and networks (Chesbrough, 2003); universities had to reorient themselves from the "ivory tower" way of conducting research to collaborate with external stakeholders in solving actual problems and adopt a wider range of research methodologies suitable for the interaction; governments would also have to develop new policies and funding mechanism that would relate to the interface between industry and

academia. In western countries, government is seen as the strategic partner within the collaborative innovation networks, while the direction and implementation of science and technology innovation in China is almost decided by the government, which acts as a leader over other partners rather than a partner with in the network of the triple helix (Lu 2008).

These reorientations and reorganizations of each of the partners are needed in order for collaboration to unfold and thereby take advantage of the envisioned synergy. At the same time, we also see the overlaps in capability and competence profile. Universities for example, turn entrepreneurial and thus "compete" with industry; industry establishes research units and corporate universities, and governments establish their own "strategic research programs" and may create companies/institutions of their own as well. (Leydesdorff and Etzkowitz, 1998).The triple helix model is thus basically a collaborative model but it has also competitive features and potential.

Etzkowitz and Leydesdorff (2000) outline three generic triple helix models to illustrate the evolution of it. In what they call Triple Helix 1, the nation state encompasses academia and industry and directs the relations between them. In Triple Helix 2, the three institutions are related but are also autonomous with borders dividing them and each thus with their own strategic space and resources. In the Triple Helix 3 the three core actors are still related but autonomous. At the same time they have established mechanisms for collaboration and the collaboration may have been institutionalized depending on how advanced they are. In addition, the overlap may also entail that they compete.

In summary, the triple helix framework shows the nonlinear and networking relationships among three key innovators: industry, university and government. Effective and efficient triple helix interaction will facilitate national innovation. However, on the other side, we are experiencing a trend of global distribution of key knowledge resources, which requires triple helix spheres to go beyond national borders searching for innovation resources.

3. The Internationalization of the Triple Helix

Some studies have mentioned that the triple helix of university-industry-government networks is emerging as a common phenomenon that goes beyond national boundaries (Etzkowitz and Leydesdorff, 2000; Etzkowitz and De Mello, 2004; Leydesdorff and Sun, 2008). However, the international trend of triple helix mentioned in the literature is usually limited to each sphere's international collaboration, i.e. cross-border partnerships between companies; governments act at international levels; cross border co-authorship and international co-research projects undertaken by universities, etc. Thus, while the triple helix theory is relatively well established on a national platform, its

internationalization is an emerging issue and there are few discussions on it. As a result, there is gap in the literature to be closed.

The internationalization of the triple helix came on the agenda when companies started internationalizing their R&D. With the internationalization of R&D, there is a common interest among the core partners of the triple helix. Firstly, there is a direct activity overlap between universities and companies as they both have a research agenda. Secondly, governments that pursue the knowledge-based society, has an interest both to promote R&D at home and to establish "listening posts" abroad to be sure that the companies have access to the front end knowledge globally.

Inspired by the existing triple helix theory, internationalization theories, and the empirical findings from the internationalization of R&D, we propose a model for the internationalization of the triple helix. This process-based stage model can be divided into three stages: pioneering stage, exploration stage, and integration stage.

In the pioneering stage, we see the establishment of each of the three spheres abroad. Companies establish R&D units; universities establish more long-term and institution based research projects and education arrangements such as student exchange with cross border partners, and governments establish various institutions with a political status and a business mandate (see Figure 4.1). In the exploration stage, each helix sphere is strengthened and starts to collaborate with its counterpart abroad even though the relationships are still weak, i.e. collaboration between Danish and Chinese companies, universities and governments. Moreover, the triple helix synergy is established in another country, i.e. Danish triple helix actors are interacting with each other in China (see Figure 4.2). The collaborations are initiated, promoted and facilitated by various organizations. In the integration stage, direct TH to TH interaction emerges (see Figure 4.3). As a result of the close collaboration, we may see new institutions emerge and the potential synergy arising from the TH to TH collaboration may result in new opportunities for both countries' innovation.

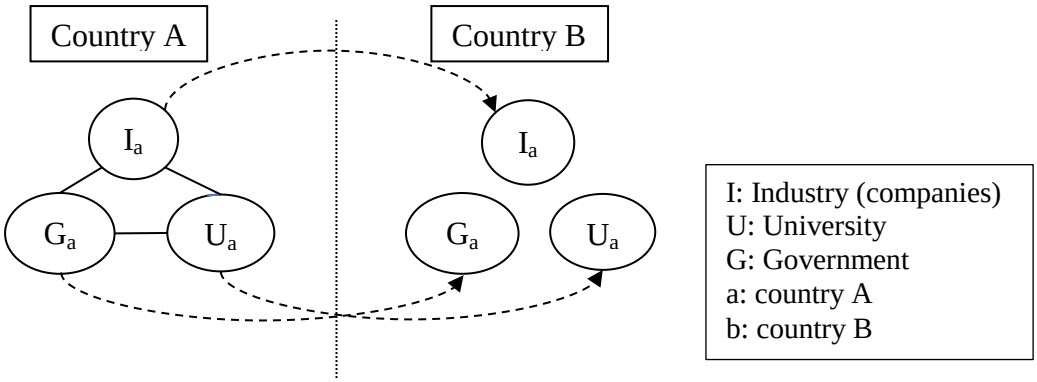


Figure 4.1. Pioneering stage.

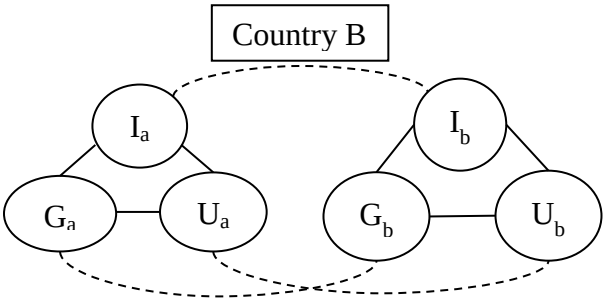


Figure 4.2. Exploration stage.

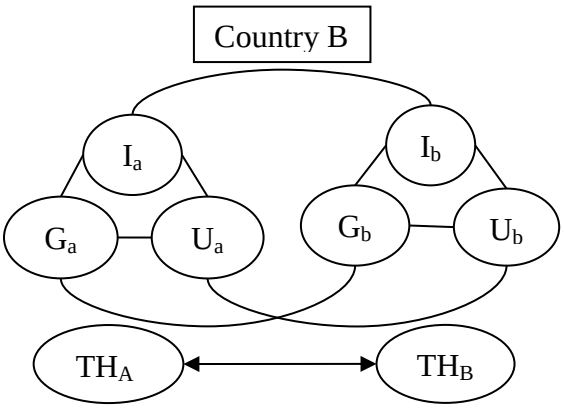


Figure 4.3. Integration stage.

4. Research Method

We are always surprised by the serendipitous findings. In the words of Johanson (2001), "if you search the known, you will discover the unknown". As mentioned, the idea of exploring the internationalization of the triple helix was triggered by conducting a study on Danish TNCs' R&D activities in China. At first, we had not envisioned this idea. However, when analyzing our empirical data on R&D-internationalization, we found

indication of an internationalization of a Danish triple helix. We used the inductive approach involving the search for pattern from observations and the development of explanations or theories (Bernard and Ryan, 2010). Thus, we redefine our research objective into making sense of the internationalization of the triple helix, and reorganize our data.

Both primary and secondary data were collected. The primary data are: 1. in-depth interviews with R&D directors and managers from a set of Danish transnational corporations' R&D subsidiaries in China, and with officials and staffs working in the Danish Innovation Centre in Shanghai; 2. personal experiences on collaborating with Chinese universities on research and education; 3. field participative observation of the establishment of the "Sino-Danish Centre for Education and Research" (SDC) in Beijing and the Nordic Center at Fudan University. Secondary data are collected through desk research on various government documents and companies' reports. Minutes of interviews have been prepared, and personal experiences and observations are summarized. The main limitation of this paper is that very little was done to collect data from the Chinese triple helix actors and thus limited discussions on it.

5. Findings

5.1 Pioneering Stage

The pioneering stage is defined as the stage where each of the triple helix spheres is internationalized. In our case, Danish companies are becoming transnational and establishing R&D related business units in China. Danish universities are recruiting more Chinese students, establishing affiliates in China to search potential opportunities for research and education, enhancing their own impacts in China, and doing more research on China. Danish governmental institutions are aware of the increasing interdependent relationship between Denmark and China, and are paying attention to China related international strategies in order to enhance innovation.

Internationalization of Transnational Corporations' R&D Activities

Theories of why and how companies internationalize their activities have been on the research agenda for the last 50 years. Today we have a situation with thousands of TNCs that have or are in the process of globalizing all their functions (sales, production, finance, organization and personnel, and R&D) taking advantage of the globally liberal trade and investment regimes adopted by most governments and promoted by global institutions such as WTO. The internationalization of R&D is the most recent function added to the internationalization agenda and as this is the company function most directly related to the Triple Helix concept, focus will be on the internationalization of R&D.

Coming from the era of concealed labs, companies today face five challenges related to R&D:

- Open innovation systems
- Improving the customer driven interaction for innovation
- Internationalization of R&D
- Decentralization of R&D
- Location of R&D, including cultural diversity

The first challenge asks the companies to bring down the walls of the concealed labs and engage in innovations within networks, strategic alliances, etc. (Chesbrough, 2003; Chesbrough et al., 2006; Chesbrough and Appleyard, 2007; Chesbrough and Crowther, 2006). Underpinning this idea is that you get better ideas and more innovation through weak links (Granovetter, 1983), flat organizations (Hatch, 2006), and diversity than through concealed labs manned by engineers with a similar mindset. It also reflects that innovation today is a companywide phenomenon and not restricted to technology and related to product and process.

The second challenge is that of moving from solely technology driven innovation to a balance between technology driven (push) and customer driven (pull) innovations. It is a question of collecting information from customers but more so a question of interaction and even co-creation of innovations. The online game industry (Hu & Sørensen, 2011) is an excellent example of how users get involved in the innovation process and form more or less institutionalized partnerships with producers.

The move from concentration of R&D activities in one place, normally at the home country, to globally distributed R&D activities, i.e. internationalization of R&D is motivated by several factors, four of which seem to dominate (Gassmann and von Zedtwitz, 1998; Kuemmerle, 1997). The first factor is access to human resources/scientists, i.e. access to capacity especially engineers. The second factor is access to knowledge resources since relevant knowledge may emerge globally; the third factor relates to nearness to production and market since companies are required to adapt their production to new markets in an ever more rapid pace, and the fourth factor relates to diversity, trying to capture new ideas arising from cultural and other types of diversity. The costs side is much less pronounced as a motive compared to outsourcing of production. In one case, a Danish TNC argued that it partly internationalized its R&D-activities due to diseconomies of a large R&D unit (with 1500 employees in one place) with the risks of bureaucracy and inflexibility.

The fourth challenge is that of organizing and coordinating the globally distributed activities. The traditional hierarchies used when the R&D activities were concentrated at R&D headquarters seem less appropriate in a situation with globally distributed R&D

activities. The matrix organization may be one solution, but many companies with highly distributed activities experiment with various forms of the network organization.

The fifth challenge is the actual location of the R&D-activity. Many factors influence the actual location, including market factors, nearness to production, access to resources and competences, Government policies, etc. Given the special nature of R&D and as R&D is crucial to the competitiveness, the solutions to these challenges are vital to transnational corporations. The companies will therefore be very interested in frameworks and initiatives that can overcome the challenges. The triple helix may be one such framework. TNCs gradually have engaged themselves more and more in China (outsourcing/procurement, sales/production and R&D) and China has become one of the most desired locations for many TNCs to carry out R&D (von Zedtwitz, 2004; von Zedtwitz et al., 2007). In fact, two of the Danish global leading companies in their respective industries, call China their "second home market".

According to von Zedtwitz (2004), there are three ways to enter China with R&D: 1. wholly owned independent R&D labs; 2. R&D departments or R&D activities conducted under a branch of a Chinese operation or within a joint venture with the Chinese partner; and 3. cooperative R&D with Chinese research universities and R&D institutes. According to figures from the Statistics Denmark, there were 320 affiliates in China by 2010 owned by Danish transnational corporations and the number is on the increase[8]. Relatively few have established genuine R&D units, but using a broad definition of R&D many have especially established development activities or technical support to sales/after-sales and production.

Internationalization of Universities

Similar to companies, universities use three principal modes of internationalization, i.e. international recruitment through market; establish affiliates around the world, and through strategic alliances. The market mode is primarily used to recruit students globally. Universities compete on the global market and try to attract students to come to study at their university abroad. The market mode is also used to attract globally the best scholarly brains. The incentives used in both cases are scholarships and attractive salaries and facilities.

Some universities also internationalize through foreign direct investments by establishing their own university units abroad. It is a relatively costly way to internationalize and only universities which can establish a synergy between studies in an affiliate at for example the bachelor level and graduate studies at the home university will use this internationalization mode. The use of affiliates is also constrained by the fact that

[8] See: http://www.statbank.dk/statbank5a/default.asp?w=1366

in many countries, university education enjoys public support, which makes it difficult to compete on commercial grounds.

The most popular internationalization mode is the strategic alliance, which appear in many versions ranging from alliances that are driven by a single person via project driven to institutional/university driven alliances. Furthermore, the alliances may be bilateral; multilateral such a loose network based alliances (bottom-up), or embedded in a more structured consortium with a top-down approach to internationalization.

The general picture is that most universities have formulated an internationalization strategy, but often it is not a very stringent one due to the way academic work is structured and operated. This is especially the case of research while educational internationalization is more streamlined.

To illustrate these internationalization paths, we will use the internationalization of Aalborg University into China as an example (See Table 4.1).

Table 4.1. Internationalization of universities: examples from Aalborg University

Modes of Internationalization	Illustrative examples
International recruitment through markets and fairs	• Active web-recruitments • participation in students fairs in China
Establishing foreign affiliates	N/A
Strategic alliances	• Multiple formal agreements for exchange of students and staff • long-term research collaboration with Chinese local universities

Internationalization of Government and Public Agencies

We normally do not speak of internationalization of governments, but it makes sense in this relation to launch that concept and look at the international activities of government under our research agenda. Globalization triggers resource distribution and interdependence between countries. In order to adapt to the international environment, governments need to improve coordination capabilities and reform existing strategies through different means (Metcalfe, 1994).

Take the Danish government as an example, the primary mode of internationalization of governments is a diplomatic mission, an embassy or the like, which enjoy special treatment by the host country. The primary roles of the mission are political and economic, but social, military, and other issues are also part of the international agenda. Governments are reforming themselves by decentralization and creation of agencies overseas to carry out specific tasks (Metcalfe, 1994). For example, embassies are often used as platform for a number of activities in order to give them an official flavor. An embassy may thus have a trade mission as part of the embassy and they may also have

other units such as development program office in countries where development aid plays an important role. Another way of internationalization is organizing missions and delegations of, for example, business people.

5.2 Exploration Stage

The concept of exploration indicates that the second stage in the internationalization of triple helix is somewhat unpredictable, as the three helixes explore and go on a search mission in China. The exploration has two main directions, one being the formation of a Danish triple helix in China and the other being the exploration of the possible collaboration with their Chinese counterparts.

A Danish Triple Helix in China

In the explorative stage, we observe tendencies to bi-lateral and tri-lateral collaboration among Danish triple helix spheres in China, for example collaboration between I-G, U-I, U-G and collaboration among all three spheres. This collaboration may be done by the actors themselves or through mediators.

One example is the Innovation Center Denmark (ICD) in Shanghai, in itself a business-government (I-G) collaboration between the Danish government and the business community (Danish Federation of Industries). The aim of ICD is to support Danish companies to tap into the Chinese national innovation system (or parts thereof). It has both a business arm and a science arm and it is thus also a complete example of a Danish triple helix network in China.

Government-owned fund also plays an important role on promoting performance of TNCs (I-G). The investment fund for developing countries (IFU) is such an example. IFU offers advisory services and co-investing with Danish companies in developing countries such as China.

Another example is the Sino-Danish Center for research and education (SDC), which is collaboration between the Danish government and a consortium of the eight Danish universities (U-G). In addition, the Danish private foundation is involved through the financing of construction and buildings. As a Danish government sponsored project, the SDC has three tasks, coordinating a graduate education that is attended by both Danish and Chinese students; formulating a research program in collaboration with Chinese colleagues; and thirdly establishing collaborative links to business in line with the new role of universities, which is often referred to as the "third mission" (Etzkowitz and Leydesdorff, 2000) or the development role of the university (U-I).

Collaborating with Chinese triple helix counterparts

In case of the establishment of a Danish triple helix in China, Figure 4.4 provides an overview of the most important triple helix actors that have been established in China, and some examples showing the collaboration between Danish and Chinese triple helix counterparts. Although not in any way a uniform pattern, it is safe to say that the formation of a Danish triple helix in China is a forerunner of collaboration between the Chinese and the Danish triple helix counterparties. The reasons can be for this sequence of events are many, including that the Danish helix needs to be firmly established before it has the capacity to collaborate with the Chinese helix. The reason could also be that the Chinese helix has a different configuration and governance mode compared to the Danish one. The Government, for example, plays a more decisive role in the Chinese triple helix compared to the Danish one (Lu, 2008; Zhou, 2008). Thus it is easier to start with establishing a triple helix synergy with other Danish triple helix spheres in China.

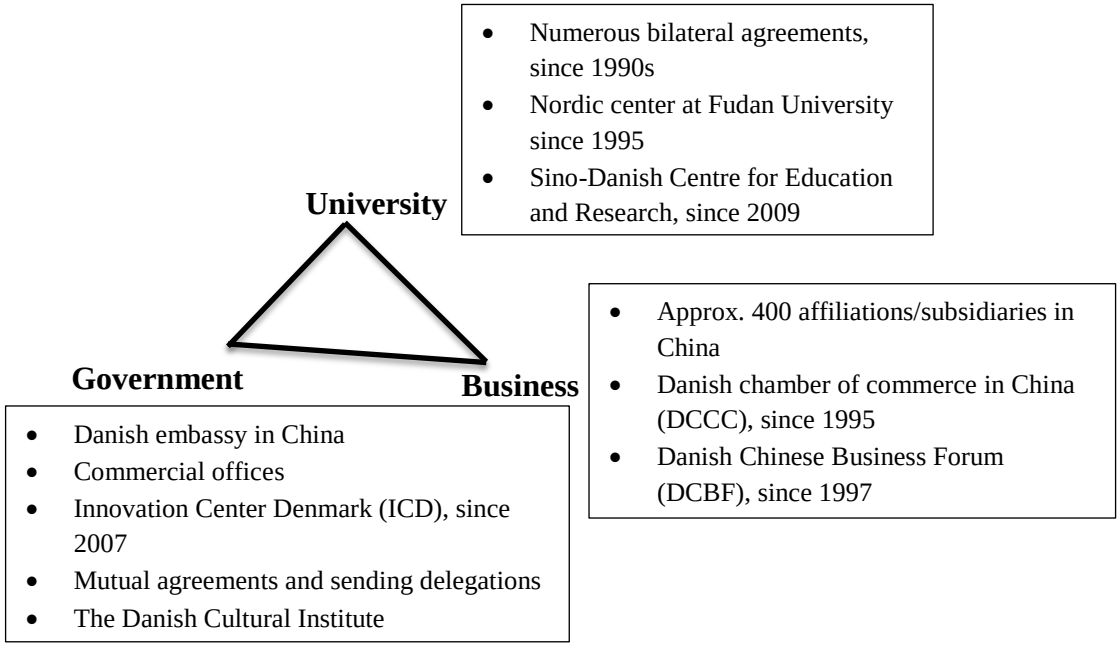


Figure 4.4. The exploration stage of the Danish triple helix in China.

What we see the most is that single sphere approaches their counterparts in China, i.e. the Danish government through its embassy may create links to the Chinese government; Danish TNCs may establish alliances with Chinese companies, and Danish universities will create deeper alliances with Chinese universities.

Governments collaborate based on multilateral and bilateral agreements, i.e. they participate in multilateral arrangements such as the UN (global) and they enter bilateral agreements with specific countries on trade, development, exchange of resources, etc. The Danish government and Chinese government have signed many agreements regarding enhancing collaboration on economic growth, environment protection,

scientific innovation, environmental development, etc. For example, in 2008, Denmark and China published a project aiming at establishing a "mutual beneficial" relationship between the two countries in the long run. Another example will be that the former Chinese president Hu Jintao visited Denmark with a delegation of senior Chinese business men in 2012 and sighed several major agreements. Under these agreements, Danish and Chinese companies will establish a set of in-depth collaborations, which means that strategic collaboration between Danish and Chinese governments also triggered collaborations between Danish and Chinese companies. The Danish pump manufacturer, Grundfos, is an example of establishing a strategic technological partnership with the Chinese solar corporation Himin in an attempt to co-developing a solar-heating system.

Having been deeply involved in the internationalization of Aalborg University (AAU), an example related to China may serve the purpose of both illustrating internationalization and especially building a bridge to the TH to TH collaboration discussed in the integration stage.

AAU uses four approaches to its establishing of links to Chinese universities (see Table 4.2). The first approach is that of bilateral agreement between AAU and a Chinese university with the aim of collaborative research or students' exchange. Often, bilateral collaboration is based on personal contacts between scholars, from which the collaboration agenda can be specified or broadened. This approach has been very popular as it is often based on contacts at the individual level, for example, based on meeting a colleague with similar research interests at a conference. It is a pure bottom up approach to internationalization and important as a dynamic way of enhancing the research capacity of universities.

The second approach is that of a collective approach with a consortium of universities linking up to one or a consortium of universities in China. An example is the Nordic Centre at Fudan University located in Shanghai with 25 Nordic Universities involved. The Nordic Centre coordinates the operations and creates links not just to Fudan University but to more of the important universities in the Shanghai area. This collective approach is a long term strategic alliance, which is stronger than the bilateral as it has the possibility to leverage larger and more diverse resources plus it has "an office on the ground" to take initiatives.

The third approach is investment oriented, i.e. we invest in establishing a unit abroad to facilitate education, research and innovation. The investment is capitalized through funds and tuition fees from participants. The Center for Tele-infrastructure (CFTI) is an organization founded by Aalborg University aiming at facilitating global research and education activities, as well as regional business development. The CFTI has four global

branches, and some Chinese researchers and companies are involved in partnerships with Danish companies and academia.

The fourth approach is again a collective approach but this time through a joint venture or partnership, and a physical institution will be established. One example is the SDC located in China mentioned above, which is a research and education institution and jointly-run by both Danish and Chinese universities.

Although, at face value, it seems obvious that each of the Danish triple helix spheres explores links to their direct counterparts in the Chinese triple helix, the exploration may also cut across the three helixes so that Danish TNCs collaborate with the Chinese government; Danish universities collaborate with Chinese companies etc. For example, Danish companies establish many links to universities and research institutions rather than links to suppliers and customers beyond mere selling/buying. Pharmaceutical companies such as Novozymes and Novo Nordisk are examples of research collaboration with universities. Thus, as indicated by (Li and Zhong, 2003), we see a tendency to a gradual opening up with the establishing of collaboration between TNCs' Chinese affiliations and Chinese actors such as local customers, suppliers, universities and other partners on R&D.

Table 4.2. Collaborating with Chinese partners: evidence from Aalborg University

Modes of Internationalization	**Bilateral University to University**	**Nordic Centre at Fudan University**	**Center for Tele-Infrastructure**	**Sino Danish Centre (SDC)**
Purpose (primary)	Research and students exchange program	Teaching, research, student visits, company collaboration	Building a global research and education network, also support regional business position	Research; Phd-program; educational programs; collaboration with stakeholders
Form	Strategic alliance	Strategic alliance with some institutional investment	Foreign direct investment (affiliate or JV)	Strategic alliance with some investment
Partners involved	Universities and often sections of universities	25 Nordic Universities	AAU as a founder, plus global academic and industrial partners	Governmental ministries and universities
Activities	Research, education, and capacity building	Research, education and collaboration with industry	Research projects, joint PhD programs, and collaboration with industry	Master programs, research, PhD projects

It is purposeful to distinguish between genuine helix partners and helix institutions aiming at promoting helix collaboration. The Innovation Center Denmark in Shanghai mentioned above can be defined as an institution that aims to promote helix collaboration while the SDC is not a promotional institution but a genuine helix institution. But promotional institutions may be needed in Stage 2 as they have to facilitate both the formation of a Danish triple helix in China and the links to the Chinese triple helix.

From the evidence we have. It seems reasonable to formulate the proposition that following the pioneering stage, there is a tendency to establish a Danish triple helix in China and partly use this as a platform for developing links to the Chinese helix partners. We may say that there is a Danish business oriented cluster for discussing mutual interests with Chinese partners and as a collaboration platform. For example, the business community has established both a business forum in Denmark (The Danish-Chinese Business Forum) and a chamber of commerce in China (Danish Chinese Chamber of Commerce) in order to enhance business collaborations[9].

5.3 Integration Stage

The third stage is the integration stage where the links between various triple helix spheres from both countries are deepened. Moreover, the mutual interests on innovation are achieved because of the significant synergy effects from the TH to TH collaboration. This stage is difficult to conceptualize beyond the trivial fact of intensive interaction among the triple partners. Each of the partners consists of numerous sub-partners with apex organizations. Basically, they form a network structure and it would be possible to map the basic actors within this structure. However, the integration or deepening stage is best understood from a process point of view. The triple helix actors interact around multiple projects some of which are short-term, some long-term.

Of course, it is possible to identify facilitators such as the ICD and the Danish embassy in general as well as drivers such as SDC with a mandate to create a research helix. Apart from facilitators and drivers, it is also possible to assess the gradual independence of the Danish helix in China, taking on a life of its own in conjunction with the Chinese helix partners. Denmark and China have not reached the integration stage. It takes time and the road to the integration stage is bumpy as we shall illustrate below. But the following examples may have the potential to lead the way to a higher integration degree.

Though TH to TH collaboration is currently more an analytical construct than an empirical reality, we are experiencing more and more direct collaborations between the Danish and Chinese triple helixes. For example, besides facilitating Danish triple helix spheres interacting with each other in China, the ICD has a mandate that goes beyond the

[9] More information: http://www.dccc.com.cn/about-dccc

forming of a Danish triple helix abroad. ICD is challenged with the task of organizing collaboration with the Chinese partners, and has formed a forum of R&D-intensive Danish companies by the Innovation Centre Denmark in Shanghai[10], which can be regarded as an institutional arrangement facilitating TH to TH collaboration.

In the exploration stage, we have discussed the SDC, which can be seen as one typical result of Stage 3 as well. SDC shows collaboration between Danish and Chinese universities in Stage 2; while intensified multi-lateral interactions evolve under the SDC platform showing TH to TH collaboration in Stage 3. The SDC is a strategic alliance around a joint project between eight Danish universities, the Danish Ministry of Science, Technology and Innovation, the University of the Chinese Academy of Science (UCAS) and the Chinese Academy of Sciences (CAS)11. This joint institution is initiated by the Danish Government and involves all eight Danish universities in a consortium. SDC aims to develop collaborative research, educational program and links to and collaboration with the business community, both the Danish one in China and the Chinese business community. Within the SDC framework Danish and Chinese scholars work closely together on common research projects and approach both the Danish and the Chinese business community for collaboration. Empirical evidences can be seen from the SDC case. Based on a ministerial level agreement between the Danish and Chinese government, the SDC was established as a cross-country strategic alliance where each partner contributes to the recurrent costs of the collaboration.

The SDC is more than just a research and education institute, but also serves as a platform for companies from both Denmark and China to communicate with each other. We are arranging innovation forums under the SDC platform, and both Danish and Chinese companies are invited to share experiences and knowledge with each other. Under the SDC platform, Danish and Chinese companies are going to communicate and collaborate with each other. From the SDC case, we can see that all these pieces of information show that the three Danish triple helix spheres not only transcend the national border separately, but also work as an innovation network and interact with their Chinese triple helix partners.

6. Discussion and Conclusion

The triple helix framework is overall based on the collaboration of three core spheres each with their strength, resources and competences. However, although the synergies to be obtained through collaboration are theoretically obvious, the road to achieve the synergies in practice is bumpy with a number of challenges.

[10] More information: http://icdk.um.dk/en/shanghai/
[11] More information: http://www.sinodanishcenter.com/about-sdc

Context is important as it influences the possibilities for the triple helix internationalization and TH to TH collaboration. The triple helix idea for the promotion of innovation has not taken equally root in all countries and their triple helix actors are not equally prepared even within the same country. It requires reorientation, a change in mindset, and reorganization to be open for helix collaboration and an attractive partner. Universities will, for example, have to become more entrepreneurial and thus integrate its scientific rigor with more pragmatism from business reality.

The strength of the triple helix is that each sphere (government, companies, and universities) brings unique resources and competences into the collaboration, resources and competences that are useful in combination with resources and competences owned by the other helix partners. The ideal situation is that all involved actors gain from the collaboration (win-win). When the triple helix is internationalized, the situation is a little different. Here, the weakness is that the partners may not have mutual or compatible goals. Clearly, the Chinese government through, for example, its state corporations hopes to get access to and tap into the technological knowledge of Danish companies and researchers while the Danish triple helix internationalizes in order to transfer good ideas and knowledge to Danish companies.

The partners in different countries may not be equally open-minded and ready to share information and knowledge. Danish companies, for example, are known to be ready to openly discuss company issues with researchers and students, while Chinese colleagues do not meet the same openness in Chinese companies. Surveys in China are, therefore, often distributed by a public institution with the authority to request the companies to complete the questionnaire. At a more general level, the internationalization of the triple helix is influenced by cultural differences. In Denmark, the Triple Helix collaboration will be characterized by a bottom-up process; while in China, the top-down process will dominate (Lu, 2008; Zhou, 2008). For example, under the Chinese context, the interactions between industry, university and research institutions are under the policy umbrella of both national and regional governments (Lu, 2008).

In conclusion, the above discussion indicates that the internationalization of the triple helix reflects the complexity of the knowledge economy and the R&D activity as partly belonging to the public partly to the business sphere. It is a natural consequence of globalization and may be seen as a step towards building common and more integrated institutions. The establishment of Danish triple helix in China creates synergies for the innovation activities of Danish TNCs and universities in China, which give us some policy implications. Firstly, companies and universities conducting R&D in a foreign country should not rely on do-it-alone, but cooperate with foreign partners and share experiences with other companies and universities from home country. Secondly, since triple helix is not restricted within the national border, government should proactively engage in the establishment of triple helix aiming at creating synergies among the three

spheres in a foreign country, for example, establishing certain governmental unit in a foreign country to promote communications and collaborations among the three triple helix spheres and with foreign triple helix partners. Thirdly, the complex TH to TH interaction, i.e. the integration stage of our model, will mobilize innovation resources from both countries, and will bring about significant synergy effects. However, in order to generate synergies rather than bringing in chaos, future researches on how to enhance the performance of a triple helix in another country, or topics related, are needed.

References

Bernard, H. R. and Ryan, G. W. (2010) *Analyzing Qualitative Data*, Sage: London.

Chesbrough, H. W. (2003) 'The era of open innovation', *MIT Sloan Management Review*, Spring: 34-41.

Chesbrough, H. W. and Appleyard, M. M. (2007) 'Open innovation and strategy', *California Management Review*, 50/1: 57-76.

Chesbrough, H. W. and Crowther, A. K. (2006) 'Beyond high tech: early adopters of open innovation in other industries', *R&D Management*, 36/3: 229-36.

Chesbrough H. W., Vanhaverbeke, W. and West, J. (2006) *Open Innovation Researching a New Paradigm*, Oxford University Press: USA.

Dzisah, J. and Etzkowitz, H. (2008) 'Triple Helix circulation: the heart of innovation and development', *International Journal of Technology Management and Sustainable Development*, 7/2: 101-15.

Etzkowitz, H. (2002) 'Networks of innovation: science, technology and development in the triple helix era', *International Journal of Technology Management & Sustainable Development*, 1/1: 7-20.

Etzkowitz, H. and Leydesdorff, L. (2000) 'The dynamics of innovation: from national systems and "Mode 2" to triple helix of university-industry – government relations'. *Research Policy*, 29: 109-23.

Etzkowitz, H., Webster, A., Gebhardt, C. and Terra, B. R. C. (2000) 'The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm'. *Research Policy*, 29: 313-30.

Etzkowitz, H. and de Mello, J. M. C. (2004) 'The rise of a triple helix culture: innovation in Brazilian economic and social development', *International Journal of Technology Management & Sustainable Development*, 2/3: 159-71.

Eun, Jong-Hak (2009) 'China's horizontal university-industry linkage: where from and where to'. *Seoul Journal of Economics*, 22/4: 445-65.

Gereffi, G. (1994) 'The Organization of buyer driven global Commodity chains: how US-Retailers Shape Overseas Production Networks'. In: Gereffi, G. and Korzeneiewicz, M. (ed.) *Commodity Chains and Global Capitalism,* Greenwood Press: USA

Gereffi, G., Humphrey, J. and Sturgeon, T. (2005) 'The governance of global value chains', *Review of International Political Economy,* 12/1: 78-104.

Gassmann, O. and von Zedtwitz, M. (1998) 'Organization of industrial R&D on a global scale', *R&D Management,* 28/3: 147-61.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P. and Trow M. (1994) *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies,* Sage: London.

Granovetter, M. (1983) 'The strength of weak ties', *Sociological Theory*, 1: 201-33.

Hatch, M. J. (2006) *Organization Theory* (2nd ed), Oxford University Press: Oxford.

Hagen, R. (2002) 'Globalization, university transformation and economic regeneration: a UK case study of public/private sector partnership', *The International Journal of Public Sector Management,* 15/3: 204-18.

Hofstede, G. (2001) *Culture's Consequences, Comparing Values, Behaviors, Institutions, and Organizations across Nations,* Sage: Thousand Oaks CA.

Hu, Y. and Sørensen, O. J. (2011) 'Innovation in virtual networks: evidence from the Chinese online game industry', *Journal of Knowledge-based Innovation in China,* 3/3 198-215.

Kuada, J. and Sorensen, O. J. (2010) 'Culture-in-action and creative learning in cross-border R&D-teams'. In: Kuada, J. and Sørensen, O. J. (ed.) *Culture and Creativity in Organisations and Societies,* pp. 25-49. Adonis and Abbey Publishers Ltd: London.

Kuemmerle, W. (1997) 'Building effective R&D capabilities abroad', *Havard Business Review,* March-April: 61-70.

Leydesdorff, L. (2000) 'The triple helix: an evolutionary model of innovations', *Research Policy,* 29: 243-55.

Leydesdorff, L. (2001) 'Knowledge based innovation systems and the model of the triple helix of university-industry-government relations', Paper presented at the conference on: *New Economic Windows: New Paradigms for the New Millennium. Salerno,* Italy.

Leydesdorff, L. and Etzkowitz, H (1998) 'The triple helix as a model for innovation studies', *Science and Public Policy,* 25/3: 195-203.

Leydesdorff, L. and Sun, Y. (2008) 'National and international dimensions of the triple helix in Japan: university-industry-government versus international coauthorship relations', *Journal of the American Society for Information Science and Technology*, 60/4, pp: 778-788.

Li, J. and Zhong, J. (2003) 'Explaining the growth of international R&D alliances in China', *Managerial and Decision Economics*, 24: 101-15.

Lundvall, B.-Å, (ed.) (2010) *National System of Innovation: Toward a Theory of Innovation and Interactive Learning*, Anthem Press: London.

Lu, L. (2008) 'Creating knowledge-based innovation in China', *Journal of Technology Management*, 3/3: 249-63.

Metcalfe, L. (1994) 'International policy co-ordination and public management reform', *International Review of Administrative Sciences*, 60/2: 271-90.

Nelson, R. R. (ed.) (1993) *National Innovation Systems: a Comparative Study*, Oxford University Press: New York.

Porter, M. (1990) *The Competitive Advantage of Nations*, MacMillan Press: London

Razak, A. A. and Saad, M. (2007) 'The role of universities in the evolution of the triple helix culture of innovation network: the case of Malaysia', *International Journal of Technology Management and Sustainable Development*, 6/3: 211-25.

Sørensen, O. J. (2009) 'Economic collaboration and regional integration in a TNC-strategic perspective'. In: *Proceedings from East Asian Economic and Cultural Forum*.

von Zedtwitz, M. (2004) 'Managing foreign laboratories in China', *R&D Management*, 34/4: 439-52.

von Zetwitiz, M., Ikeda, T., Gong, L., Carpenter, R. and Hämäläinen, S. (2007) 'Managing foreigh R&D in China', *Research Technology Management*, 50/3: 19-27.

Wong, O., Ho, Y-P. and Singh, A. (2007) 'Towards an "Entrepreneurial University" model to support knowledge-based economic development: the case of the National University of Singapore', *World Development*, 35/6: 941-58.

Yusof, M. and Jain, K. K. (2010) 'Categories of university-level entrepreneurship: a literature survey', *International Entrepreneurship Management Journal*, 6: 81-96.

Zhou, C. (2008) 'Emergence of the entrepreneurial university in evolution of the triple helix: the case of Northeastern University in China', *Journal of Technology Management in China*, 3/1: 109-26.

4.3 Reflections on Paper 2

We usually say that national or regional innovation performances may be facilitated by the synergy generated through the endless transition among government, industry and universities. However, we may question that what may happen if branches of one nation's government, industry or university go abroad. Are these globalized organizations/institutions still going to enjoy the benefit from national triple helix, or will they establish a triple helix abroad? What we see from the Danish triple helix actors' (governmental institutions, transnational corporations, universities) activities in China are that: they not only establish innovation networks among themselves, but also interact with the Chinese triple helix actors. As a result, the idea of the internationalization of triple helix is definitely bold, but not crazy.

However, we are quite aware of the limitations of this paper, especially the considerations on to what extent the stage-model of internationalization of triple helix is valid. The three stages, i.e. pioneering, exploration and integration, are sequential and evolutionary according to our findings. Yet, what will be the situation when regarding, for example, Chinese triple helix actors' innovation activities in Denmark or other European countries? Another concern is that, triple helix model is usually discussed under a national context and regarded as the heart of national systems of innovation, so the answer to whether it is "allowed" going international may fluctuate its basis. However, we believe at least this paper opens a door for new discussions.

In conclusion, the network of triple helix actors and networks among different national triple helixes are emerging as new phenomenon and contexts for global innovation. TNCs are not only pioneers that initiate this trend, but also embedded in such a context. How can TNCs use the opportunities provided by internationalization of triple helix to overcome challenges when carrying out R&D activities across borders may be future research dimensions.

5. Interorganizational Network Organization

5.1 Introduction to Paper 3

Following the three-level framework of understanding network organization for innovation, this chapter (Paper 3) will investigate the interorganizational network organization by focusing on one specific form: strategic technological partnership. The research objective of Paper 3 is to understand how generate relational competitive advantages are generated through rents generation and appropriation on a dyadic (relational) level.

Firms establish long-term oriented and efficient strategic technological partnerships to improve their competitive stances in markets, which also brings about sources of relational competitive advantages for partnering firms. Thus, the main purpose of this paper is to investigate how relational competitive advantages are gained through an explorative case study. The case is a strategic technological partnership between a Danish transnational corporation (Circular) and a Chinese local company (Sunshine), within which the Chinese firm has an equal stance on innovation compared to its counterparty. This paper mainly contributes to the second research question.

This paper mainly contributes to the second research question of this dissertation:

To what extent and how can we manage a network organization?

5.2 Paper 3

Gaining Relational Competitive Advantages: A Conceptual Framework on Rents Generation and Appropriation[12]

Yimei Hu[a], Si Zhang[b], Jizhen Li[b], Olav Jull Sørensen[a]

a. Department of Business and Management, Aalborg University, Aalborg, Denmark
b. School and Economics and Management, Tsinghua University, Beijing, China

Abstract

Establishing strategic technological partnerships (STPs) with foreign partners is an increasingly studied topic within the innovation management literature, and partnering firms can jointly create sources of relational competitive advantage. Chinese firms often lack research and development (R&D) capabilities and are increasingly becoming preferred technological partners for transnational corporations. We investigate an STP between a Scandinavian and a Chinese firm and try to explore how to gain relational competitive advantage by focusing on its two essential stages: relational rents generation and appropriation. Based on an explorative case study, we develop a conceptual framework which consists of a process, organizational alliance factors and coordination modes that we propose lead to relational competitive advantage.

Keywords

Relational competitive advantage, strategic alliances, relational rents, strategic technology partnerships

1. Introduction

A strategic technological partnership (STP) is a cooperative technological arrangement between two or more firms aiming to improve their performance and competitive market advantage through technology-based resource sharing and joint innovation activities (Das and Teng, 2000; Hagedoorn, 2002; Ireland et al., 2002; Jarillo, 1988; Santangelo, 2000). Over the years, STPs as well as international STPs have become increasingly popular (Hagedoorn, 1993; Narula and Hagedoorn, 1999; Yasuda, 2005). Most studies that are generally quantitative in nature have focused on testing factors that influence the performance of STPs, yet the formation, causality and the complete process of STPs has been left unresearched.

[12] Paper submitted to journal. Previous Draft version published in proceedings of 10th GLOBELICS International Conference.

A few researchers have also paid attention to the origins of new sources of competitive advantage from STPs, and how these sources actually originate. However, this research is moving beyond firms' own boundaries and suggests that firms can generate competitive advantage through relational rents jointly created with other firms (Dyer and Singh, 1998). Though some determinants on relational rents generation have been preliminarily conceptualized (Dyer and Singh, 1998; Lavie, 2006), existing theories on this topic are far from sufficient. In particular, we argue that the procedure in which relational competitive advantage is generated is scarcely investigated.

By means of an explorative case study, the aim of this study, i.e. the generation of relational competitive advantages, is explored by focusing on the two essential stages: relational rent generation and relational rent appropriation. The STP-case is between a multinational company from Denmark and a firm in China. Hence, the case represents the STP between a developed and an emerging economy. As over 90% of multinationals on the list of the Times Global 500 have R&D facilities established in China, the case will clearly be of interest to transnational corporations (TNCs) and their subsidiaries. Firms in the developed world have noticed China's potential, not only because of its impressive market size, but also because of its technological development at both the national and firm level (von Zedtwitz, 2004). It is therefore believed that this study can provide valuable implications for foreign investors seeking technological partnerships in China in the future.

The paper is organized as follows. Following the introduction, theories and concepts related to relational competitive advantage and STP are reviewed. This discussion is followed by an outline of the research methods used in this study and subsequently presents the case story. In the following section, we summarize findings from the case and propose a conceptual framework consisting of coordination modes and organizational alliance factors influencing the two key stages of relational competitive advantage generation, i.e. relational rent generation and appropriation. Finally, we will draw conclusions from our case study.

2. Theoretical background

Our research on relational competitive advantage is informed by three streams of researches: (1) literature on STPs and R&D strategic alliances; (2) the concept of competitive advantage; and (3) literature on the conceptualization of relational competitive advantage and relational rents.

2.1 Strategic technological partnerships

No business is an island (Håkansson and Snehota, 1989). Critical resources, especially knowledge for innovation may be located beyond a firm's boundary. One way to access the resources is to establish a technological partnership, requiring firms to adopt a cooperative R&D strategy. Many quantitative studies have shown that STPs, especially

international STPs which involve TNCs, are becoming a popular arrangement for firms' R&Ds, and are positively related to innovation performance and outputs (Cantwell and Janne, 1999; Hagedoorn and Narula, 1996; Yasuda, 2005; Zhang et al., 2007). Among all international STPs, firms from emerging economies such as China are becoming particularly important partners, and TNC investors are found in favor of STPs as an entry mode penetrating the less familiar market (Zhang et al., 2007). Yet many scholars have identified a high percentage of failure in strategic alliances due to opportunistic behaviors, task complexity, cultural and national differences, rivalry competition between partners, and the inability to adapt to high-velocity environments (Duysters et al. 1999; Hamel, 1991; McCutchen Jr. et al., 2008; Wu, 2012; Park and Ungson 1997).

Two key issues studied extensively by researches are partner selection and the competition within partnerships. Partner selection and the formation of STPs, are related to various factors such as each partner firms' resource bases, alliance objectives, alliance management experience, and the scope of international partners. One stream of researches on partner selection focuses on the "fit" between alliance firms, including the strategic and organizational compatibility, efficiency and effectiveness of alignment between members (Datta, 1991; Douma et al., 2000). Meanwhile, within an STP, competition sometimes coexists with collaboration. Once an STP is established, the collaboration provides a chance for one firm to not only access the others' resources, but also to internalize the skills of its partners. Due to asymmetries in learning, an STP may become a learning race between member firms which alters the bargaining power and the strategic position of partners (Hamel, 1991).

2.2 Competitive advantage

Seeking the sources of sustained competitive advantages is a major research topic within the strategic management domain. From an industrial point of view, a firm's competitive advantage and position are influenced by its external competitive environment. Therefore, the analysis will consider external factors based upon Porter's five forces (Porter, 1980). The resource-based viewpoint argues that a firm's competitive advantage comes from its resource base constructed by valuable, rare, inimitable, and non-substitutable resources (Barney, 1991; Peteraf, 1993).

From a resource-based viewpoint, the basic motivation for strategic partnerships is the value-creation potential of firm resources that are pooled together rather than transaction costs minimization (Yasuda, 2005). A firm must have unique resource endowments to attract partners (Eisenhardt and Schoonhoven, 1996). Thus, the more valuable, rare, inimitable, and non-substitutable resources a firm has, especially technological resources, the more likely the firm will be deemed as a worthy potential partner to be incorporated into an STP. Unlike arm's-length market transactions which are neither idiosyncratic nor rare, the long-term and trustful relationship between partnering firms is a unique and inimitable arrangement, which adds barriers for outsiders

to gain access to shared resources and facilitates the creation of competitive resources. Similarly, the ability to successfully construct, manage and maintain strategic alliances, which is a unique and inimitable skill, are seen as sources of a focal firm's competitive advantage (Ireland et al., 2002).

2.3 Relational competitive advantage and relational rents

Unlike the industrial viewpoint and resource-based viewpoint focusing on focal firm level, the relational viewpoint focuses on the dyadic or network level, and argues that competitive advantages may come from relational rents that alliance partners cannot generate independently. Relational rent is the profit jointly generated by alliance firms, which derives from specific resources and assets that firms have jointly dedicated to the alliance and from the integration and exchange among member firm's resources (Durant et al., 2008; Dyer and Singh, 1998; Lavie, 2006; Mursitama, 2006). Two essential aspects of relational rent are its generation and appropriation.

Regarding relational rent generation, Dyer and Singh (1998) proposed a set of primary sources and processes that determine the relational rents of a strategic alliance, i.e. relation-specific assets investment, knowledge-sharing routines, complementary resources endowment and effective governance. To yield a competitive advantage through interorganizational collaboration, relational rents must not only be generated, but also appropriated by alliance firms (Durant et al, 2008; Dyer et al., 2008). Lavie (2006) proposes that relational rent appropriation is influenced by relative absorptive capacity, relative scope of the firms and scope of resources, contracts and opportunistic behaviors, etc. Similarly, Dyer et al. (2008) propose that there are some key ways to improve relational rent appropriation such as investing more critical and scarce resources in the partnership, and occupying an information-rich position as well as acquiring key information from such position. There are a few empirical research studies aiming at testing hypothesis on relational rents appropriation. One of these studies, Capaldo and Petruzzelli (2011) found that the greater extent to which firms in an alliance search across different knowledge domains, the more relational rents are appropriated. Mursitama (2006) proves that relational rent appropriation is related to both technological and managerial resources investment.

Following an extensive study of the relevant literature, we discovered several gaps in the existing research on relational competitive advantages. Firstly, existing frameworks lack a process-based view to investigate relational competitive advantages and incorporate both rent generation and rent appropriation into one dynamic system. Secondly, research in this area is mostly conceptual. One rarely sees any in-depth case studies, or research done on STPs between companies from both developed and developing countries. Thirdly, concepts such as relational rent are still largely ambiguous. This research makes the best possible attempt to fill in the current gaps in research.

3. Research Design and Method

Our research objective is to understand how generate relational competitive advantages are generated through rents generation and appropriation on a dyadic (relational) level. We developed the following research questions: (1) Why is it important to ensure both relational rents generation and appropriation? (2) What are the key elements that impact the two essential stages of rents generation and appropriation? (3) What coordination modes are needed?

This paper employs the strategy of an explorative case study (Eisenhardt, 1989; Yin, 2008). We investigate the STP between Circular, a Danish TNC, and Sunshine, a Chinese private solar corporation13. On the one hand, this case clearly shows how partnering firms jointly create relational rents and then ensure appropriation. On the other hand, this case shows a unique situation in which the Chinese firm acts as an important R&D partner rather than solely being in charge of marketing or governmental relations, as is normally perceived.

An inductive view of the relationship between theory and research is adopted for qualitative data collection and analysis (Eisenhardt, 1989; Rindova and Kotha, 2001; Thomas, 2006). Both primary interview data and secondary data are collected. As our objective is to explore new insights from the case, we carried out semi-structured interviews and allowed the interviewees to express the facts and their own insights on the partnership. We identified three types of key informants, i.e. R&D and commercial directors, project managers (both technical and business managers), and project members (engineers) from both companies, and carried out four rounds of interviews over one and a half years.

At the initiation stage of this STP, we collected general information on partner selection and strategic considerations of the STP. At the development stage, we spent one week interviewing and observing in both companies, and we collected data on how they collaborate on R&D, coordinate the partnership, and generate rents from it. At the marketing stage, we collected data on how member firms do marketing together and distribute rents.

After composing the preliminary conceptual framework, we carried out additional interviews to reflect on the case and to check the framework. The conducting of interviews added up to 29 hours. All interviews were recorded and transcribed. Besides interviews, we also collected data based on our observations while present at both companies, especially observations of the joint laboratory. Reflective records were made during and after interviews and observations. Interview transcriptions and reflective records added up to around 180 pages.

[13] For confidentiality considerations, company names are pseudonyms.

Secondary data are mainly from the firm's annual reports, internal magazines and websites. We studied Circular' ten years of annual reports, and Sunshine's internal magazines as well as CEO's blogs. Evidence was found to support our framework. In addition, secondary data such as media interviews and reports were collected from reliable sources. Triangulating data from different sources allowed us to cross-check the validity of the information given by interviewees (Yin, 2008).

In terms of data analysis, we firstly wrote a case story to record this STP. Then we coded our primary and secondary data into themes, and selected those that are related to relational rents generation and appropriation. We also looked into the relationships among selected themes, reflected on existing theories, and constructed a conceptual framework showing how these variables are related to relational competitive advantages. We showed the primary framework to some interviewees to check the validity, and after several rounds of revision, we came up with a final framework.

4. Case Story

Table 5.1. Basic information of case companies.

	Circular	**Sunshine**
Size (employees)	Around 17,500 global, around 1,700 in China including around 200 R&D employees	Around 5,000
Industry	Pump	Solar energy
Age	Founded in 1945. Chinese subsidiary established in 1994.	Founded in 1996.
Market share	One of the world's largest pump manufacturers, covering 50% of the global market share for circulator pumps, with a turnover of 3,025 million euros in 2012.	No.1 in China, owning several brands aiming at different segments of the Chinese markets. World's largest manufacturer of solar panels and solar heating units.
Global footprint	Headquarters in Denmark. Represented by more than 80 companies in more than 55 countries.	Located in Shandong province, China. Targeting not only the Chinese market, but also the European and North American markets.
Technological capability	Leading technology on pumps and pump systems. The Chinese R&D center is the largest center, except for the R&D done at the Danish headquarters.	Owns the world's biggest solar energy test center. More than 600 national patents and around 132 national science and technology projects

Table 5.1 provides some basic information on the two companies. The solar heating industry is a rapidly-growing industry in China with fierce competition, and there are more than three thousand solar water heater producers in the country. However, core technology is in the hands of a few giants in the solar heating industry, and since many companies suffer from a lack of core technology, they have to compete in the price war of low-end markets. Circular is the world's largest manufacturer of pump circulators, and it established its Chinese subsidiary in 1994. Circular regards China as its second-home market. Now Circular has more than 1600 employees in China and has annual sales of more than 1.5 billion RMB, showing it has gained a strong foothold in the Chinese market.

4.1 Partnership formation

There is no clear definition on the objectives of the collaboration between the two companies, and they did not have a blueprint for what products they would jointly developed before they started. The partnership started with informal communication between a manager from Circular and an R&D director from Sunshine who Circular recognizes as a "key person". As explained by Circular's project manager:

> We need to find the key person. He can either be the decision maker or has the power to influence the decision maker.

They discussed and envisioned the possibilities and potentials of developing something "groundbreaking" by integrating both companies' R&D specialties. The interpersonal communication then attracted higher-level attention and became executive-level visits and formal firm-level communication/negotiation. Both firms could envision a significant market potential for new products, which also enhanced their confidence in the collaboration. Some trials were carried out together in order to ensure that the idea of joint R&D was viable. After three to four months' discussions, Sunshine and Circular clarified the concept of the new-generation solar heating system and subsequent products they sought to create. The means of collaboration, i.e. Circular as an OEM pump designer and supplier to Sunshine, was also determined.

Both firms' strategies are taken into consideration when forming the STP. Firstly, both firms pursue innovation, sustainability, and green strategies. Secondly, a technological partnership matches the current strategic agendas of both firms. Prior to the formation of the partnership, Circular had faced challenges from its competitors that had a better market position and brand influence in China, so it had sought to enhance its competitive position through developing its business in the solar industry and it had begun investigating potential partners.

As the largest global manufacturer of solar panels and solar units while facing fierce competition from competitors, Sunshine formed a strategy several years ago to target the high-end market in order to stabilize its market share and enhance its brand reputation.

The previous solar water thermo, the standard solar thermo selling in China, does not have pumps insides, so the water pressure and temperature are not stable. Sunshine was aware of the increasing comfort demands from users and believed there was market potential for developing a new generation system by introducing pump technologies.

Thus, the two companies are strategically important to each other, and this strengthened the mutual interdependence between them. Thirdly, unlike many firms pursuing a diversification strategy or cross-industry development, both companies in this STP tended to focus on their own specialization even though the joint R&D provides opportunities for both firms to learn about each other's technological know-hows. This partly reduced their worries of the possibility of becoming potential competitors in the future. Sunshine's project manager explained:

> Though we share knowledge, it doesn't mean that Circular will produce solar heaters and Sunshine will produce pumps. Plus, there is a large amount of tacit knowledge and know-hows in each industry, so it is hard to fully understand in a short time.

Similarly, one of Circular's directors says:

> Circular is a pump supplier, we are not a solar thermo producer. Some guys in our company think we can be, but we will never ever be that, because it's a complete different business, especially in China. It would make no sense to say, let's start competing with Sunshine.

In-depth knowledge in pump technology is crucial to develop new products, so Circular, the "pump king", is undoubtedly the best candidate due to its knowledge base that complements Sunshine's knowledge base. In addition, Sunshine and Circular are both highly-reputable brands in their corresponding industries that have world-leading technological resources as well as well-developed sales networks. One of Circular's managers commented:

> We draw help from each other's brand influences, and we believe it's a win-win situation.

This collaboration allows the two parties to share an equal status in the partnership and avoids situations where one partner may dominate the other. The project manager from Circular used the following metaphor:

> Collaboration is like marriage, we have to match. Though it is still possible to collaborate when the two parties have great differences in status and capability, the process will be very tough.

Moreover, they are quite aware of the organizational differences between them in terms of corporate culture, management styles, evaluation systems, employee's educational backgrounds and English skills, etc. Possible conflicts were also considered when designing the collaboration contract and agreement. After recognizing each other as the most suitable partner, the STP was finally commenced in September 2010.

4.2 Joint R&D

Circular and Sunshine invested numerous resources into this partnership. They jointly established a state-of-the-art research center to support their R&D activities. Sunshine was responsible for investing in solar heating-related experimental devices while Circular donated pump-related facilities. A project team was formed, consisting of around twenty engineers and experienced R&D managers from both companies. Additionally, one project manager from Sunshine and two managers (one technical manager and one commercial manager) from Circular were assigned to communicate and work together. As a TNC with more advanced R&D management experiences and know-how, Circular was also able to share this knowledge with Sunshine during the collaboration.

Circular and Sunshine co-created a transparent and cooperative knowledge-sharing routine which encouraged project members to work and communicate with each other on a regular basis. Executive-level meetings between the two firms were held on a monthly basis. Engineers were allowed to work on-site in each other's labs. Both firms spared no efforts and any knowledge that was related to the R&D of the new products was open to the partner. Whenever problems and task delays occurred, Circular and Sunshine proposed all possible solutions and tried to solve all problems together. This helped to solve problems more efficiently, minimize risks, and enhance mutual trust because of the positive attitudes of both companies.

In the joint R&D phase, differences between the two companies emerged. For example, in terms of flexibility, Sunshine reacts faster when changes are needed, while Circular has a longer response period due to its standardized management procedures. Another example of differences is that Circular tends to do more in-depth theoretical researches than Sunshine, which also resulted in a longer response period. A Circular manager stated:

> When a technical problem occurs, Sunshine goes and finds a solution. However, Circular goes further by doing some analyses and finding out whether the solution will cause any future side effects and whether or not the solution can be used in the future when similar problems occur"

Moreover, Sunshine and Circular are different in their management and evaluation systems. Therefore, they jointly designed an output-oriented mechanism to manage R&D activities, which avoided altering either firm's existing working styles and evaluation system. Both signed detailed contracts and agreements to clarify responsibilities and benefits. They scheduled regular meeting mechanisms, and reduced potential conflicts in order to ensure long-term collaboration. In this case, the trust between Circular and Sunshine played a significant role in encouraging transparent knowledge sharing and mutual learning, which complemented their contracts. As commented by Circular's project manager:

> A contract cannot cover everything…Based on the principle of mutual trust, we fully communicate with each other, and we keep the communication channels between us open and smooth.

In August 2012, their first jointly-produced product became available on the market: a compact solar heating system which supports plug-and-play, improves user experience, saves energy, and easier to install. The installation process of the previous product was complicated and the product itself lacked an aesthetically pleasing artistic shape. The birth of this new generation of solar systems provides solutions to both of these problems.

4.3 Post-product development

Circular and Sunshine discussed the rents distribution carefully in order to ensure a mutually beneficial arrangement. Generally speaking, firms get both visible and invisible fruitages from an STP.

This STP has resulted in technological advancements for both the solar heating and pump industries. The project covers a series of patent applications. The research results are owned by both firms. The newly developed system has already been launched onto the market, targeting both European and Chinese high-end markets. An annual growth rate of 30% is expected, corresponding to an approximate surge of 4 million euros during the first three years. However, though both firms are confident about the market potential, the sales for the first couple of months were not satisfactory, which was partly due to the downturn in global solar thermo industry and partly due to an erroneous estimation made by Sunshine. Circular assigned another business manager to facilitate the marketing with Sunshine. As a result of both firms' efforts, sales have improved. Circular's manager honestly expressed:

> It would be a lie to say that the relation was not influenced at all, but in order to increase both companies' benefits, we are now working on marketing together, and we have seen some improvements.

Besides the economic benefits, both firms have also gained from collaboration with each other. This STP opens a door for Circular to understand the solar industry better and to gain experience in doing business in China. A R&D director from Circular says:

> We went from a position where our main competitor had a stronger position than us in the solar thermo industry in China. That has been turned upside down now; everyone in the solar thermo industry wants to talk to us now, because they have seen what we have done and it is new.

As a local company, Sunshine is able to learn advanced managerial experiences and R&D standards from Circular. The jointly-developed research laboratory, the invested resources, the jointly-created working style, and the outcomes achieved thus far all provide a foundation for continuing the STP. Both firms regard each other as a competent strategic partner and have positive expectations for strengthening this STP in the future. As a Circular manager explained, this partnership and the level of depth at which the two

companies have collaborated have been perceived as unique and are likely never to be replicated:

> Circular may also collaborate with other solar companies in the future on some development projects, but in terms of collaborating at such an in-depth level with such transparency in knowledge sharing as in this partnership with Sunshine, I can hardly believe there will be another case. I believe that the story between Circular and Sunshine will continue.

5. Case Findings and Discussions

Firms co-create competitiveness through an inimitable and effective technological partnership that generates relational rents. In order to maintain an STP and sustain the competitive advantages together, it is also important to ensure that each member appropriates the relational rents, which is an important issue that has been highly neglected when studying STPs. In this section, we summarize some key issues and related tasks regarding relational rents generation and appropriation from the case and reflect on the existing literature (See Table 5.2). Then we propose a conceptual framework for understanding how sources of relational competitive advantage are created within an STP.

Existing literature usually define relational rents simply as the supernormal economic profit jointly created by member firms (Dyer and Singh, 1998; Lavie, 2006; Mursitama, 2006). In this case, we can see that economic revenue is just one part of the benefits that Circular and Sunshine enjoy from drawing help from each other's brand influence and the in-depth collaboration. Hereby, we define two types of relational rents: visible and invisible. Both rents are sources of relational competitive advantages since these are valuable resources that can hardly be imitated by another partnership. Visible rents include economic rents such as profit from new product sales and market share increase, and knowledge rent, such as codified knowledge and patents. Intangible rents include know-how knowledge, managerial capability, and improvements in brand awareness and market stance.

Table 5.2. Key issues and tasks of relational rent generation and appropriation.

Stage	Key Issues	Tasks and Explanations
Relational Rent Generation	Find the right partner	1. In search of a fit • Resource endowment fit: supplementary and complementary • Strategic fit • Business model fit • Identifying differences and reducing complexities 2. Trust building • Identifying key personnel • From informal communication to formal collaboration • Visioning
	Resource commitment	Allocating strategic resources: financial resources, technological & knowledge resources, and human resources
	Knowledge creation	1. Knowledge-sharing routines and dissemination capacity 2. Absorptive capacity 3. Avoidance of learning races
	Effective coordination	1. Eclectic mechanism 2. Contract and trust
Relational rent appropriation	Visible rent appropriation	Integration of legal, economic and social modes of coordination • Contract • Resource commitment • Trust
	Invisible rent appropriation	1. Absorptive capacity 2. Dissemination capability

5.1 Relational rent generation

From the case, we can identify four key issues that facilitate relational rents generation: finding the right partner, resource commitment, knowledge creation, and effective coordination.

Finding the right partner

The success of a partnership often depends upon the degree of their alignment, i.e. the fit between partners (Douma et al., 2000; Dyer et al., 2001; Kale and Singh, 2009). First, resource endowment fit influences the STP's formation and structure. From this case, we can see that both supplementary and complementary resources are needed. Supplementary resources provide both firms with positive expectations for their partnership and reduces the possibility of a situation in which one member is in a position of dominance. In this case, drawing help from each other's brand influences and the strong innovation capabilities of both firms are examples of supplementary resources. Complementary knowledge resources from both industrial partners are needed since neither firm can develop the new product alone. Second, strategic fit determines the potential for collaboration based upon how well-aligned each firm's vision and strategic focus is. Strategic fit in particular emphasizes the focus on innovation and on the firm's own specialties as criteria for partner selection in this case. Each firm focusing on its own specialized area will reduce the chances of one of them entering each other's businesses. Third, these two companies find their business model match each other, i.e. Circular as an OEM supplier to Sunshine, which reduces potential conflicts on rents distribution and worries of becoming future competitors. Moreover, firms need to identify organizational differences and possible conflicts when designing the collaboration contract and try to reduce complexities and uncertainties through in-depth discussion before forming the partnership.

During the process of searching for a fit and several rounds of in-depth discussion, the trust between these two companies was also created, which provided a positive foundation for reducing risks and generating rents from the STP. In this case, a set of social skills are adopted to facilitate trust building, i.e. identifying key persons, initiating informal communication, and visioning. A key person can either be the decision maker themselves or be a person who has the power to influence the decision maker. This case started with informal communication and then attracted executive-level attention and became a formal firm-level communication/negotiation. This also indicates one feature of doing business in the Chinese context: initiating informal communication ("*guanxi*") can build trust, which will create a foundation for a company -level partnership. Visioning is about cultivating confidence and positive anticipation in the partnership (Ritala et al., 2009). At the initiation stage, market and technological uncertainties are very high, and firms are not sure whether they need an STP. By visioning the future through in-depth communication with the potential partner, both firms get a clearer picture of how their collaboration would unfold.

Resource commitment

A commitment concerns a partner's intention and willingness to continue in a partnership (Cullen et al., 2000), which is always shown in allocating strategic resources to the partnership (Isobe, et al., 2000). There are three types of resources to be committed

to an STP: financial, knowledge, and human resources. The level of the partnering firms' commitment to investing strategic resources is positively related to the performance of an STP (Das and Teng, 2000; Isobe, et al., 2000). One reason is that both supplementary and complementary strategic resources pooled together can integrate firms' competences and facilitate innovation due to synergistic effects. In addition, the more a firm invests, the less likely it is that it will behave opportunistically since it is more afraid of the termination of the partnership, and thus it becomes more likely that each partner will support an open knowledge-sharing environment, and relational rents will be co-created and appropriated. As a result, we can regard resource commitment as an economic coordination mode that bonds member firms together.

Knowledge creation

Knowledge creation is a key part of innovation, which is also a major part of relational rents. An open knowledge-sharing routine will create an overlapping knowledge base for the STP, but it doesn't necessarily result in the generation of relational rents and relational competitive advantage unless member firms have both dissemination capabilities and absorptive capacities. Successful dissemination requires significant knowledge flows and sharing to ensure that the created knowledge reaches the relevant people (Liao et al, 2003). This process, therefore, requires mutual trust to enhance member firms' willingness to share each other's strategic resources. In addition, with absorptive capacity, members' critical knowledge resources related to the project can be identified, understood, transferred across organizational boundaries, and recombined, and thus new specialized knowledge is co-created and relational rents are generated (Cohen and Levinthal, 2000; Dyer and Singh, 1998; Dyer and Hatch, 2006; Lavie, 2006). In the knowledge-sharing and learning environment, the two firms enhance their absorptive capabilities and grow together. Meanwhile, an STP such as this provides opportunities for both firms to gain insights from each other, so knowledge-sharing goes hand in hand with learning. Sometimes, this could lead to a learning race between firms (Hamel, 1991) when member firms overly focus on capturing each other's critical knowledge resources, rather than jointly creating relational rents (Durant et al., 2008). Intra-alliance rivalry may erode the basis of an STP and deteriorate it.

Effective coordination

In order to create knowledge from the STP and avoid learning races, effective coordination is needed. Due to the existence of many organizational differences between Chinese and foreign firms, an eclectic solution was decided upon, in order to make the partnership feasible. The eclectic solution means the way in which coordination avoids harming either firm's existing working styles and evaluation system, and can better orient coordination around delivery of important, but not necessarily well-specified tasks.

A contract binds member firms to carry out actions needed to jointly achieve the mutual objectives, ensures collaboration rules are established, and clarifies responsibilities and benefits, which can be seen as a legal and hard coordination mechanism (Blomqvist et al., 2005). However, making a contract is usually more challenging between companies with different backgrounds (Blomqvist et al., 2005), e.g. an international STP, so managers rely more on relational ties and trust as uncertainty increases (Zhou et al, 2008). As an inimitable and idiosyncratic coordination mechanism, trust between alliance firms may significantly reduce costs of managing the alliance such as re-contracting cost and monitoring costs (Blomqvist et al., 2005; Cullen et al., 2000), which can be complementary to contracts. In this case, a trustful relationship has played a role in encouraging transparent knowledge sharing, mutual learning, and facilitating the relational rents generation. During the process of discussion/negotiation, both firms saw each other's competences and good faith in this STP, further enhancing mutual trust.

5.2 Relational rents appropriation

In this research, relational rent appropriation is divided into visible and invisible rents appropriation. Conflicts may occur when member firms all want to appropriate more of the relationship's benefits for themselves. Visible rents refer to newly developed products and revenue. Invisible rents are newly created knowledge and technological and managerial knowledge spillovers.

In order to ensure each firm receives proportional benefits from the STP, an integration of different coordination modes are needed. Carefully designed contracts can reduce conflicts and ensure the distribution of relational rents, especially visible economic benefits. In addition, in this particular case study, invested strategic resources such as a jointly developed research laboratory and knowledge resources show the firms' intention of future collaboration, and with this in mind, they are willing to ensure mutual benefits. This also partly explains why Circular also dedicated a sizeable effort to marketing. Based on trustful relationships, member firms tend to believe and understand that the final decision on rents distribution is the optimal choice for the partnership and future collaboration. Regarding invisible knowledge rents, firms' dissemination capacities determine how much spillover knowledge resources can be acquired. Firms with a higher level of absorptive capacity can benefit more from an STP (Lin, et al., 2012).

5.3 A Conceptual framework

From the above findings, we can see that many concepts come into play, each concept having an influence on the others, and the complex systematic relationships between all concepts affect the generation of relational competitive advantages. As a result, we propose a conceptual framework that consists of three categories of concepts: process, organizational alliance factors, and coordination modes (See Figure 5.1).

Opportunities to generate and appropriate rents exist because of competitive imperfections which are caused by technological advancement, new demand, or new combinations of knowledge (Alvarez and Barney, 2004). Thus, an STP aiming at innovation enhances the possibilities of rents generation and appropriation. We discovered a recursive, rather than linear relationship, between the generation and appropriation of relational rent within an STP. Once relational rents are generated, partnering firms are able to appropriate them, especially for invisible rents. On the other hand, appropriated relational rents, especially newly co-created knowledge may lay foundations for future rent generation and deepen the cooperative relationship in the long run. We make the following propositions:

Proposition 1a. The generation of relational competitive advantages requires the completion and success of both relational rent generation and relational rent appropriation.

Proposition 1b. There is a recursive relation between the generation and appropriation of relational rents.

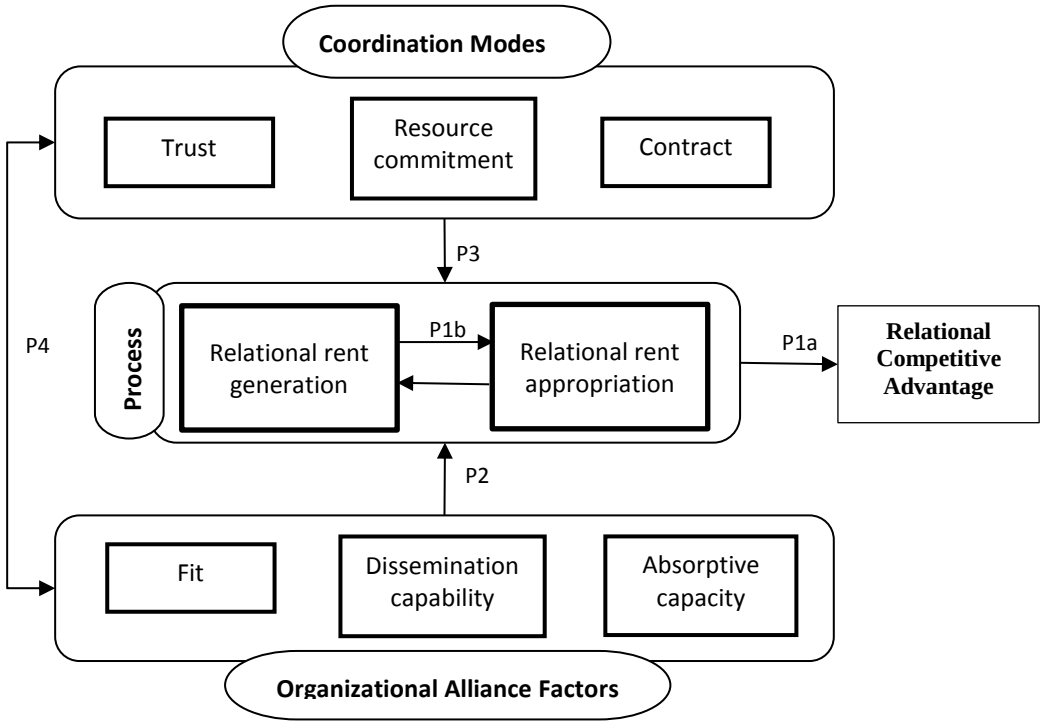


Figure 5.1. Conceptual framework of relational competitive advantage

There are three organizational alliance factors (fit, absorptive capacity and collaborative learning) that influence the process of an STP. Fit between partners can be both a precondition that determines the potential of establishing an STP, and a factor that impacts on the relational rents generation during the collaboration (Douma et al., 2000).

Significant asymmetry between member firms in terms of resource endowments, strategies and organizational features may cause conflicts and increasing costs during the collaboration, which may reduce the possibilities of relational rents generation and appropriation.

Since the objective of an STP is R&D and creating new knowledge resources, both dissemination capabilities and absorptive capacity are needed in order to, firstly, share and transfer know-how to partners, and secondly, to recognize and assimilate partner's know-how knowledge; and then co-create the new knowledge resources. On the other hand, absorptive capacity determines how much invisible relational rent such as knowledge spillover will be captured by member firms. However, relational rents appropriation will be harmed due to fewer captured relational rents and more counterparty appropriating. As a result, member firms need to show their willingness to disseminate knowledge resources to each other. Thus we propose:

Proposition 2. Fit, dissemination capability and absorptive capacity are positively related to relational rents generation and relational rents appropriation.

Every STP faces risks of unsatisfactory cooperation and underperformance, so in order to ensure the performance of an STP, different coordination modes are needed (Das and Teng, 2001). In this case, we see three coordination modes, i.e. trust, resource commitment, and the contract. Trust is a social coordination mode, while resource commitment is an economic coordination mode that bonds partners together. A contract is a legal coordination mode which is most effective when combined with other soft coordination modes such as trust and resource commitment (Blomqvist et al., 2005; Cullen et al., 2000). Therefore, we propose:

Proposition 3. The greater the volume of resources committed by each member, the more detailed the content of the contract ensuring members' responsibilities and mutual benefits must be. Thus, the greater the degree of trust between members, the more relational rents will be generated, and the more likely relational rents appropriation will be ensured.

Moreover, organizational factors and coordination modes mutually enhance each other as well. A firm that is regarded as having strong absorptive capacity will be regarded as trustworthy and capable by their counterparties, which therefore enhance trust between member firms. On the other hand, a trustful relationship and invested strategic knowledge resources will increase the extent of compatibility of member firms since both are more willing to search for a mutual fit. Trust and committed knowledge resources may also improve a firm's absorptive capacity by providing an environment of mutual learning and collaborative learning through the STP. Regarding the contract, it is mainly designed to prevent severe learning races, and since member firms' behaviors are

regulated according to the contract, their absorptive capacity and the extent of fit are enhanced as well. Thus, we hereby propose:

Proposition 4. The combined three coordination modes, i.e. trust, resource commitment, and the contract, are mutually reinforced by fit between member firms, dissemination capability and absorptive capacity.

6. Conclusion

This paper has investigated how companies gain relational competitive advantages from STPs during the process of the generation and appropriation of relational rents. By incorporating the study of the appropriation of relational rents, the formation of a new competitive advantage by STPs is better understood as a systematic mechanism, a lesson academia has largely ignored. Only when both the generation and the appropriation of relational rents are coherent in partners' management strategy, can the STP contribute to competitive advantages. In this sense, this study also provides the possibility of linking literature on partner selection, knowledge management, alliance management, and trust.

This study is an explorative case study that provides new insights into existing theories on relational competitive advantages (Eisenhardt, 1989; Yin, 2008). Unlike quantitative studies that can be generalized to populations statistically, case studies can only provide an analytical generation (Yin, 2009), which means that case studies are generalized to theoretical propositions, as we did in this study. People may also question whether this single case is able to provide analytical generation and whether it is a unique case which has happened within a unique context. The STP between Sunshine and Circular itself is an idiosyncratic cross-industrial collaboration that is hard to be precisely imitated by other companies. However, it is also a typical case showing the R&D collaboration between a Chinese company and a TNC. Thus, it is not an exceptional case for TNC's subsidiaries in China or other developing countries. Moreover, China shares many important characteristics with other emerging economies, making propositions drawn in this case relevant in many others.

This case also shows some practical implications for managing a strategic technological partnership between TNCs and Chinese local firms. Regarding initiating an STP with a Chinese partner, the social skills of finding the key personnel and trust building are important in the "guanxi-based" business context in which contracts are imperfect. Ensuring a potential Chinese partner largely focuses on its own specialized area will partly reduce potential opportunistic behaviors such as copying even before the formation of a partnership. An interesting future research topic would be investigating how to balance the three coordination modes (contract, trust and resource commitment) within different contexts.

Acknowledgement

We acknowledge the anonymous reviewers. The research was partially funded by NSF of China (Project No. 71273152) and Tsinghua University for providing financial support for the research. The Sino-Danish Centre for Education and Research was also greatly appreciated.

References

Alvarez, S. A., & Barney, J. (2004). Organizing rent generation and appropriation: toward a theory of the entrepreneurial firm. *Journal of Business Venturing, 19*, 621-635.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management, 17* (1), 99-120.

Blomqvist, K., Hurmelinna, P., Seppänen, R., 2005. Playing the collaboration game right-balancing trust and contracting. Technovation 25, 497-504.

Cantwell, J., & Janne, O. (1999). Technological globalisation and innovative centres: The role of corporate technological leadership and locational hierarchy. *Research Policy, 28*(3), 119-144.

Capaldo, A., & Petruzzelli, A.M. (2011). In search of alliance-level relational capabilities: balancing innovation value creation and appropriability in R&D alliances. *Scandinavian Journal of Management, 27* (3), 273-286.

Cohen, W., & Levinthal, D., 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly, 35*, 128-152.

Cullen, J.B., Johnson, J.L., & Sakano, T. (2000). Success through commitment and trust: the soft side of strategic alliance management. *Journal of World Business, 35*(3), 223-240.

Das, T.K., & Teng, Bing-Sheng (2000). A resource-based theory of strategic alliance. *Journal of Management, 26*(1), 31-61.

Das, T.K., & Teng, Bing-Sheng (2001). Trust, control, and risk in strategic alliances: an integrated framework. *Organization Studies, 22* (2), 251-283.

Datta, D.K. (1991). Organizational fit and acquisition performance: effects of post-acquisition integration. *Strategic Management Journal, 12* (4), 281-297.

Douma, M.U., Bilderbeek, J., Idenburg, P.J., & Looise, J.K. (2000). Strategic alliances: managing the dynamics of fit. *Long Range Planning, 33*, 579-598.

Durant, R., Bruyaka, O., & Mangematin, V. (2008). Do science and money go together? The case of French Biotech Industry. *Strategic Management Journal 29* (12), 1281-1299.

Duysters, G., Kok, G., & Vaandrager, M. (1999). Crafting successful strategic technology partnerships. *R&D Management, 29*(4), 343-351.

Dyer, J. H., & Singh, H. (1998). The relational view: cooperative strategic and sources of interorganizational competitive advantage. *Academy of Management Review, 23*(4), 660-679.

Dyer, J.H., Kale, P., & Singh, H., 2001. How to make strategic alliances work. *MIT Sloan Management Review, Summer*, 37-43.

Dyer, J., Hatch, N.W., 2006. Relation-specific capabilities and barriers to knowledge transfers: creating advantage through network relationships. Strategic Management Journal 27, 701-719.

Dyer, J.H., Singh, H., & Kale, P. (2008). Splitting the pie: rent distribution in alliances and networks. *Management and Decision Economics, 29*, 137-148.

Eisenhardt, K.M., 1989. Building theories from case study research. *Academy of Management Review*, *14* (4), 532-550.

Eisenhardt, K.M., & Schoonhoven, C.B. (1996). Resource-based view of strategic alliance formation: strategic and social effects in entrepreneurial firm. *Organization Science, 7* (2), 136-150.

Grant, R.M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal, 17*, 109-122.

Hagedoorn, J. (1993). Understanding the rationale of strategic technology partnering: Interorganizational modes of cooperation and sectoral differences. *Strategic management journa, 14*, 371-385.

Hagedoorn, J. (2002). Inter-firm R&D partnerships: an overview of major trends and patterns since 1960. *Research Policy, 31*, 477-492.

Hagedoorn, J., & Narula, R. (1996). Choosing organizational modes of strategic technology partnering: international and sectoral differences. *Journal of International Business Studies, 27*, 265-284.

Hamel, G. (1991). Competitive for competence and inter-partner learning within international strategic alliances. *Strategic Management Journal, 12*, 83-103.

Hsu, C. (2011). The comparison of international strategic alliance network between Chinese and American pharmaceutical industry. *Journal of International Management Studies, 6* (3), 109-120.

Håkansson, H., & Snehota, I. (1989). No business is an island: the network concept of business strategy. *Scandinavian Journal of Management, 5*(3), 187-200.

Ireland, R.D., Hitt, M.A., & Vaidyanath, D. (2002). Alliance management as a source of competitive advantage. *Journal of Management, 28* (3), 413-446.

Isobe, T., Makino, S., & Montgomery, D.B. (2000). Resource commitment, entry timing, and market performance of foreign direct investments in emerging economies: the case of

Japanese international joint ventures in China. *Academy of Management Journal, 43*(3), 468-484.

Jarillo, J.C. (1999). On strategic networks. *Strategic Management Journal, 9*, 31-41.

Kale, P., & Singh, H. (2009). Managing strategic alliances: what do we know now, and where do we go from here? *Academy of Management Perspectives*, *August*, 45-62.

Luo, Y. (2003). Market-seeking MNEs in an emerging market: how parent-subsidiary links shape overseas success. *Journal of International Business Studies*, *34*, 290-309.

McCutchen Jr., W.W., Swamidass, P.M., & Teng, B. (2008). Strategic alliance termination and performance: the role of task complexity, nationality, and experience. *Journal of High Technology Management Research, 18*, 191-202.

Lavie, D. (2006). The competitive advantage of interconnected firms: an extension of the resource-based view. *Academy of Management Review, 31* (3), 638-658.

Liao, J., Welsch, H., & Stoica, M. (2003). Organizational absorptive capacity and responsiveness: an empirical investigation of growth-oriented SMEs. *Entrepreneurship Theory and Practice, 28*(1), 63-85.

Lin, C., Wu, Y. J., Chang, C., Wang, W., & Lee, C. Y. (2012). The alliance innovation performance of R&D alliances - the absorptive capacity perspective. *Technovation, 32*, 282-292.

Mursitama, T.N. (2006). Creating relational rents: the effect of business groups on affiliated firms' performance in Indonesia. Asia Pacific Journal of Management 23, 537-557.

Park, S.H., & Ungson, G.R. (1997). The effect of national culture organizational complementarity, and economic motivation on joint venture dissolution. *Academy of Management, 40* (2), 279-307.

Narula, R, & Hagedoorn, J. (1999). Innovating through strategic alliances: moving towards international partnerships and contractual agreements. *Technovation,19*, 283-294.

Peteraf, M.A. (1993). The cornerstones of competitive advantage: a resource-based view, *Strategic Management Journal, 14*(3), 179-191.

Rindova, V.P., & Kotha, S. (2001). Continuous "Morphing": competing through dynamic capabilities, form and function. *Academy of Management Journal, 44* (6), 1263-1280.

Ritala, P., Armila, L., & Blomqvist, K. (2009). Innovation orchestration capability – defining the organizational and individual level determinants. *International Journal of Innovation Management, 13* (4), 569-591.

Thomas, D.R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation, 27* (2), 237-246.

von Zedtwitz, M., 2004. Managing foreign laboratories in China. R&D Management 34 (4), 439-452.

Wernerfelt, B. (1984). A Resource-based View of the Firm. *Strategic Management Journal, 5*, 171-180.

Wu, J. (2012). Technological collaboration in product innovation: the role of market competition and sectoral technological intensity. *Research Policy, 41* (2), 489-496.

Yasuda, H. (2005). Formation of strategic alliances in high-technology industries: comparative study of the resource-based theory and the transaction-cost theory. *Technovation, 25*, 763-770.

Yin, R.K. (2008). *Case study research: design and methods*, 4th ed. California: Sage.

Zhang, J., Baden-Fuller, C., & Mangematin, V. (2007). Technological knowledge base, R&D organization structure and alliance formation: evidence from the biopharmaceutical industry. *Research Policy, 36* (4), 515-528.

Zhou, K. Z., Poppo, L., & Yang, Z. (2008). Relational ties or customized contracts? An examination of alternative governance choices in China. *Journal of International Business Studies, 39*, 526-534.

5.3 Reflections on Paper 3

The second research question of this PhD dissertation is:

To what extent and how can we manage a network organization?

A successfully "managed" strategic technological partnership will bring about relational competitive advantages. Yet, existing literature on relational competitive advantage are mainly conceptual and focusing on relational rents generation as sources of relational competitive advantage. Based on this explorative case study, we argue that relational competitive advantage can only be achieved when both relational rents generation and appropriation are ensured. The proposed conceptual framework consists of systematic relation among a set of managerial issues that business managers need to take into account. I believe that this paper provides some implications on understanding the management of network organization, but to what extent this conceptual framework is applicable, requires future empirical researches.

A partnership is based on mutual benefits and interdependence, and its dynamic process can be regarded as the combination of cooperation and competition. The goal of cooperation is to optimize the integration of partnering firms' resource endowments and capabilities, and achieve joint innovation; while competition is about the capability of acquiring more spillover knowledge and the fluctuation of each side's power. This paper mainly focusing on cooperation and avoid learning races. However, from another angle, we can see that the power is shifting between Circular and Power. For example, as the customer, Sunshine has more power to make decisions at the beginning; while when problems happen and can't be solved by Sunshine, as a more research oriented company, Circular's power will be increased. Thus it could be another dimension to look into the case.

6. Intraorganizational Network Organization

6.1 Introduction to Paper 4

Following the three-level framework proposed in Paper 1, I will explore the network organization inside a company in this Chapter. In the literature, it says that firms are evolving from a traditional organization with hierarchies to a network organization that substitutes hierarchical structures and chain of commands with internal markets. However, we rarely see companies radically change their existing organization to a loosely coupled one with autonomous profit centers that are coordinated by a market mechanism. Hierarchy still persists in the existing organizations. I also could not help wondering whether adopting an internal market is the only way to move to an international network organization aiming at facilitating innovation. Based on these considerations, a multiple case study of three Danish transnational corporations' network organization has been carried out to explore the different understandings of network organization in business practice.

This paper mainly contributes to the first research question of the PhD dissertation:

How do transnational corporations perceive/design a network organization to facilitate their global innovation?

The above research question will be answered through the following three sub research questions of Paper 4:

- *How do business managers understand the concept of network organization for innovation?*
- *Are there any different ways of designing a network organization other than adopting an internal market?*
- *How can we understand the relationship between market, hierarchy and network within an organization in business practice?*

6.2 Paper 4

Exploring Network Organizations in Practice: the Duality and Triplicity of Market, Hierarchy and Network[14]

Yimei Hu

Department of Business and Management, Aalborg University

Abstract

Constructing a network organization for global R&D is presented as a common sense practice in existing literature. However, there are still queries about the network organization, such as the persistence of hierarchies which make a network organization merely a "bureaucracy-lite" organization. Furthermore, in practice, we rarely see radical organizational change towards a network organization that adopts an internal market. The co-existence of market, hierarchy and network triggered research interest. A multiple case study of three transnational corporations' global R&D organization shows that there are different logical considerations when designing a network organization to facilitate innovation. I identify three types of network organizations: market-led, directed and culture-led network organizations. Different types of network organizations show that organizations are dual and even ternary systems of three coordination modes, i.e. market, hierarchy and network. The three coordination modes are not discrete, but instead are complementary and mutually enhancing. The interactions of the three coordination modes and the dynamism of their interplay over time could be an interesting future research topic.

Key Words

Network organization, innovation, hierarchy, market, duality, triplicity

1. Introduction

Since the 1980s, in order to utilize technological resources across national borders, transnational corporations (TNCs) have begun to internationalize their R&D activities by setting up overseas R&D subsidiaries, and more and more R&D resources are becoming internationalized, entering developing and emerging economies (Boutellier, Gassmann, & Von Zedtwitz, 2008; Cantwell & Piscitello, 1999). Yet under the trend of internationalization of R&D, with the purpose of achieving sustained competitive

[14] Previous version presented at the 12th ISMD (International society for markets and development) Conference, Casablanca, Morocco, May, 2012.

advantages and continuous value adding, TNCs need to proactively adjust their strategies and internal organizations.

Network organization in literature is regarded as the appropriate organization for facilitating innovation. One major argument is that tight control and traditional hierarchies are no longer suitable and will even harm innovation performance (Andersson, Forsgren, & Holm, 2007; Boutellier et al., 2008; Child, Faulkner, & Tallman, 2005; R. E. Miles & Snow, 1986). More and more conceptual and empirical research has shown that there is a trend towards a so-called "network organization", especially when companies adopt a transnational strategy and carry out global R&D (Bartlett & Ghoshal, 2002; Gassmann & Von Zedtwitz, 1999).

However, since its development, the concept of a network organization is highly debatable, and it is not easy to find many companies that adopt an internal market and radically change their internal organization. Moreover, hierarchical structures, though highly criticized, still persist (Hales, 2002). As a result, though the principles of network organization in theory seem quite clear, TNCs' organizational designs may adopt dual coordination mechanisms in practice, i.e. using network organization to promote innovation and using hierarchies to control the process (Sundbo, 2001).

This dichotomy between theory and practice triggered my research interest of exploring the meaning of a network organization by focusing on TNCs' global R&D organizations. In particular, I am interested in seeing the relationship between market mechanism, traditional hierarchy and network in practice. In order to achieve the above research purpose, this paper provides an exploratory multiple-case study of three Danish TNCs which declare that either they already have a network organization for innovation or are moving towards a network organization.

This paper is organized as follows. After the introduction, the theoretical background of this research will be reviewed. Then I will discuss the research design of this paper, which will be followed by presenting the research findings. After exploring the three cases, a framework showing the duality of organization and typology of network organization will be presented and discussed. I will then conclude the paper.

2. Theoretical Background

This research is informed by three streams of literature: (1) the confusing concept of network organization; (2) the relationship between market, hierarchy and network; (3) the dualism of hierarchy and network.

2.1 A network organization: A confusing concept

A network can be defined simply as a combination of nodes and ties. According to Hatch and Cunliffe (2006), one distinguishing feature of a network form is

boundarylessness, meaning that network organizations exist in both intra- and interorganizational levels.

There has been extensive amounts of literature published on interorganizational and interfirm network forms such as strategic alliances, outsourcing, customer-supplier agreements, joint ventures, etc. (Freeman, 1991; Hagedoorn, 1990, 2002; Powell, et al., 1996). These network forms are most like to emerge "when organizations face rapid technological changes, shortened product lifecycles, and specialized and fragmented markets" (Hatch & Cunliffe, 2006, pp: 307). In particular, due to utilizing complementary and diversified knowledge resources from different organizations, such network forms are regarded as a suitable environment in which innovation can flourish (Freeman, 1991).

Yet, on the other hand, there are very limited studies on companies' internal transition towards a network organization (Zenger, 2002), which is also the focus of this paper. Organizational scholars notice that in order to survive in the high-velocity market, the demand of innovation is increasing, which brings about companies' internal organizational changes. One common trend is the evolution from a traditional hierarchical organization to a network organization. Here, a network organization mainly refers to those organizational structures deliberately created in order to achieve efficiency, flexibility, adaptability and innovation, and within which hierarchies are minimized (Child, 2005; Hatch & Cunliffe, 2006; Miles & Snow, 1986; 1992). Unlike interfirm networks of innovators that usually have similar definitions, the concept of network organization has been highly debatable since its appearance.

The definitions of network organization have two focuses: one stream focuses more on the internal market mechanisms, and the other focuses on the cooperation and interaction mechanisms. On the one hand, a network organization refers to "clusters of firms or specialist units coordinated by market mechanisms instead of chains of commands" (Miles and Snow, 1986, 1992), which is compatible with the strategy of being a prospector that aims at providing the market with innovative products or services. The suggestion of adopting an internal market is accepted by many scholars such as Baker, (1993), Foss,(2003)and Zenger (2002). Besides focusing on the introduction of market mechanism, some other scholars emphasize the collaborative aspects of networks such as trust and interdependence between employees and business units, autonomy and bottom-up decision making, collaboration across R&D subsidiaries, global responsibility, etc. (Child, 2005; Gassmann & Von Zedtwitz, 1999; Medcof, 1997; Medcof, 2003).

However, when many scholars advocate the emergence of a network organization as a radical organizational change, some scholars find this concept exaggerated and confusing. Despite the claims of radical organizational change, to some scholars network organization is just a postmodern bureaucracy-lite organization, within which resource allocations are still coordinated by the visible hand of hierarchy, and formal and informal

hierarchies still persist (Diefenbach & Sillince, 2011; Hales, 2002; Hatch & Cunliffe, 2006; Kastelle & Steen, 2010).

Some other scholars adopt a network perspective/paradigm and argue that all organizations are fundamentally network patterns of relationships between employees and their responsibilities, so there is no need to propose a concept of network organization (Baker, 1993; Borgatti & Foster, 2003). Following the network perspective, Baker (2003) argues that a network characterized by a hierarchical division of roles and tasks, vertical layers, and a central administration of resource allocation and decision making, is called bureaucracy. Conversely, a network characterized by decentralized decision making, flexibility, internal market and horizontal ties is similar to the concept of network organization.

The above discussions show that there are different ways of understanding and designing a network organization to facilitate innovation. Fundamentally, the different perspectives show different relationships between three basic organizational structures and coordination modes, i.e. market, hierarchy and network, which will be elaborated upon below.

2.2 Market, Hierarchy and Network

Market and hierarchy refer to two basic coordination modes and structures according to the transaction cost theory. Hierarchy serves as the "backbone for conventional forms of organization" (Child, 2005). A hierarchical organization is characterized by levels of authorities and responsibilities defined by employment contracts, chains of command, and vertical formal integration of positions within an organizational structure in which each position is subordinate to and dependent on a higher one (Child, 2005; Hatch & Cunliffe, 2006). In general, as a form of coordination that minimizes interdependencies between employees and maximizes repetition of tasks, the hierarchical form is suitable for governing the repeated and routinized production of stabilized goods and services; therefore it is not suitable when innovation and changes are required. In contrast, the market offers flexibility and choices, in which price mechanisms alone determine supply and demand of independent entities.

Within the dichotomy of market and hierarchy, hybrid forms are supported by neoclassical contracts, and they lie in between these two extremes (Foss, 2003; Williamson, 1991; Zenger, 2002). As proposed by Williamson (1991, pp: 280):

> Market and hierarchies are polar modes… A major purpose of this paper is to locate hybrid modes-various forms of long-term contracting, reciprocal trading, regulation, franchising, and the like-in relation to these polar modes…The hybrid mode is located between market and hierarchy with respect to incentives, adaptability, and bureaucratic costs.

Here, the concept of hybrid is very much similar to that of network (Demil & Lecocq, 2006). Similarly, Thorelli (1986) proposes that the network is a coordination mode that lies in between market and hierarchy, and Thorelli highlights some key features of networks such as trust, long-term oriented and reciprocity.

As opposed to Williamson (1991) and Thorelli (1986), Powell (1990) demonstrates that the network is a distinctive coordination mode that has a different underlying logic than the market and hierarchy. Complementarity, relational communication, reciprocity, reputation, trust, mutual benefits, and resource interdependence are some key features of a network form. In this paper, I agree with Powell's trichotomy of market, hierarchy and network.

2.3 Network organization and duality

In nature, hierarchy, market and network are theoretical constructs, so in practice, the relationship between them is even more complex since they are usually intermingled (Farjoun, 2010; Jarillo, 1988). Powell (1990) has noticed some mixed forms such as profit centers, transfer pricing, hierarchical market contracts, and formal rules within networks.

Zenger (2002) identifies interfirm networks and intrafirm hybrids as external and internal hybrids. Internal hybrid mainly refers to hierarchies infused with elements of markets, which is in line with Miles and Snow's (1986, 1992)'s definition on network organization. Though the concept of network organization has been discussed for more than two decades, we have not seen many radical changes in firms' internal organizations so far, especially with regards to adopting market mechanism to optimize internal resource allocation and mobilization. Foss (2003) does an in-depth case study on Oticon's spaghetti organization, which is a radical internal hybrid. However, after a decade, Oticon changed back to a more traditional matrix organization since the internal hybrid organization is "inherently hard to successfully design and implement because of a fundamental incentive problem of establishing credible managerial commitments to not intervene in delegated decision making" (Foss, 2003, pp: 331).

Despite the fact that organizations are becoming flatter, hierarchies still persist as mentioned before. In an acutely observant statement made by (Diefenbach & Sillince, 2011) pp: 1517, "organization means hierarchy, and hierarchy means organization". In many cases, there is a duality of hierarchy and network within an organization (Farjoun, 2010; Fuglsang & Sundbo, 2005; Sundbo, 2001). Each employee has a clearly defined formal position, while at the same time there is a loosely interactive network structure which ensures bottom-up initiatives. Employees' behavior is guided by formal rules, and it is up to managers at higher levels to make final decisions.

3. Research Questions and Design

Based on the above discussions, we can see that theoretically, the definition of a network organization is still ambiguous, especially when it comes to a firm's internal organizational design. Another interesting issue is that although the idea of designing a network organization to facilitate global innovation has been proposed for several decades, we seldom see a company radically changes its internal organization by adopting market mechanism and eliminating hierarchies, and therefore there is only a very limited amount of research in this area. A third issue is that there is a very limited amount of research discussing the relationships and co-existence of the three coordination modes: market, hierarchy and network.

Bearing in mind these research gaps, the aim of this paper is to enrich the network organization theory by focusing on companies' internal innovation/R&D related network organization. This paper attempts to answer the following research questions:

1. *How do business managers understand the concept of network organization for innovation?*
2. *Are there any different ways of designing a network organization other than adopting an internal market?*
3. *How can we understand the relationship between market, hierarchy and network within an organization in business practice?*

3.1 A Multiple case study and case profiles

In order to answer these research questions, a multiple-case study strategy has been adopted in this research with the purpose of theory expanding and building (Eisenhardt, 1989; Eisenhardt, 1991; Yin, 2009). Compared with single case studies, a multiple case study design enables researchers to have a better chance of building more persuasive theoretical constructs and propositions that can be generalized analytically (Eisenhardt, 1989; Yin, 2009).

Three Danish case companies have been thoughtfully selected following the theoretical replication principle, meaning that they provide possibilities of bringing different or even contradictory findings to existing theories (Yin 2009). Table 6.1 gives an overview of the three case companies, which shows the different types of network organization with different sets of underlying logic.

Table 6.1. Overview of case companies.[15]

Cases	Industry	Employees	Annual Turnover (2012):Dkk Million	Main Characteristics of network organization
InnoFlex	Textile	64	247.6	Internal market mechanism
Circular	Pump	17984	22,590	R&D managers plays a key role, top-down, promoting a global network organization
Biozyme	Biotech	6041	11,234	Long history of networking, key concept in organizational culture

InnoFlex (Case 1) is a world-leading niche company within the textile industry. It develops, manufactures and supplies upholstery fabrics. Unlike most companies that compete in the red ocean, InnoFlex adopts the blue ocean strategy and aims at being the prospector in its niche area. Innovation and value-adding cooperation are key words of its business concept. InnoFlex now has one Danish headquarters and one subsidiary located in China representing businesses in the Asian Pacific Area. InnoFlex has been transitioning from a functional organization to a network-like organization since 2006. The organizational change is radical since InnoFlex introduces a market mechanism to optimize internal resource allocation between different business units. Its new organization gives every business unit high levels of autonomy, and empowers every employee to "speak things into practice". Such a network organization coordinated by market mechanism facilitates InnoFlex's innovation strategy, enabling continuous revenue increase and allowing it to grow alongside the largest global market participants.

Circular (Case 2) is a world leader in developing, manufacturing and supplying pumps as well as pump solutions. It covers over 50% of the global market share of pumps, and has more than 80 companies in more than 55 countries. Circular has several global R&D subsidiaries and innovation has always been one of its core values. In recent years, Circular has been trying to promote a global R&D network organization which integrates globally distributed R&D subsidiaries, talents and resources. The organizational change is a top-down process, and business managers play an important role in facilitating the formation of network organizations.

Biozyme (Case 3) is a world leader in biotech innovation. It has 31 business branches and subsidiaries in 17 countries all over the world. It is an innovation-driven company which has more than 20% of the workforce working in R&D and devotes around 14% of revenue annually to R&D. Furthermore, Biozyme has more than 6,000 active patents,

[15] For confidentiality considerations, company names are aliases.

licensed patents and patent applications. Networking based on trust is one of Biozyme's core values, and trust has been deeply-rooted into every employee's mindset. Its R&D competent subsidiaries are globally coordinated rather than separated or subordinate to one central unit. Moreover, it continuously and proactively seeks partners to collaborate with R&D. Its ability to innovate, change, and adapt to the environment has put the company in a strong market position.

The network organizations studied in this paper are not general corporate networks but networks related to the innovation/R&D function. In the case of InnoFlex, since all functional business units are adopting an innovation strategy, corporate network and innovation networks are more or less the same. However, in Circular and Biozyme, network organizations mainly refer to their global R&D structures. Moreover, InnoFlex is a small company compared to the other two giant TNCs (Circular and Biozyme), so people may think it is not a suitable case. However, I would even call InnoFlex a TNC since it adopts a transnational mindset that aims at global innovation, operates as a broker in different knowledge networks, and provides differentiated furniture fabrics for different markets (Bartlett & Ghoshal, 2002). Neither size or nor number of employees were the main criteria when choosing cases for this research.

The case study companies were chosen because, on the one hand, they share something in common: they all have leading positions in their respective fields through a prospector's strategy, and they all declare that they have networked organizations. Yet, on the other hand, responding to the theoretical replication principle, though the three case companies have a network organization, their network organizations are achieved through different means, which will provide us with conclusions on diversity in practice and possibilities for theory building.

3.2 Data collection and data analysis

Both primary data and secondary data are used to support the analysis and theory building process, which reflects the principle of data triangulation (Yin, 2009). Primary data are collected from interviews and open discussions with R&D directors and R&D managers in both Danish headquarters and Chinese R&D subsidiary (See Table 6.2). Some interviews are open (discussions) and encourage key informants to discuss the most important issues related to their organizational design and management challenges. Most interviews are semi-structured and guided by a questionnaire of open-ended questions. An interview or discussion takes around 1 hour, some of which are up to 2 hours. Moreover, before choosing these three cases, I had a discussion with each of them to investigate their organizational structure and innovation management and to see whether they are suitable cases for this research.

Most interviews were recorded and transcribed, and notes were taken during discussions. Reflections on interviews and discussions were taken down after the

interviews. Besides primary data, secondary data are collected mainly from case companies' websites and annual reports. Each of the three case companies have detailed annual reports to which I had access, and I went through their annual reports from the past ten years; these reports added up to around 2100 pages in total. These reports provided me with very in-depth background knowledge about the case companies and even some interesting descriptions on internal networking and partnership with external firms.

Table 6.2. Overview of interviews and discussions.

Cases	Key informants	Interview & discussions	Total hours
Case 1: InnoFlex	5	9	11.75
Case 2: Circular	8	9	13.5
Case 3: Biozyme	6	9	10.25
Total	19	27	35.5

In an exploratory case study, data collection, analysis and theory building processes are usually integrated. I followed Glaser and Strauss (1967)'s data coding and theory building process, which is widely used in exploratory case studies (Bryman & Bell, 2007; Miles & Huberman, 1994). The interview transcripts, discussion notes, and secondary data of each case were coded through an iterative process, i.e. moving back and forth between theories, case data, and emerging theoretical patterns. Following the principle of theoretical saturation (Glaser & Strauss, 1967), the three cases' data were collected and analyzed sequentially. After finishing the analysis of Case 3, I found my theoretical framework logically complete, and therefore I stopped increasing the case numbers. The empirical findings will be presented in the next section.

4. Findings

As mentioned before, the research focus of this paper is on the internal organizational design. The three case companies represent three types of network organization that adopt different underlying logics, i.e. market-led network organization, culture-led network organization and directed network organization.

4.1 Market-led network organization

In order to create value and optimize resource allocation, Case 1 (InnoFlex) adopts an internal market mechanism to assist the strategy of being a prospector. Based on this remarkable feature, I labeled the first form as "market-led network organization".

In the same way as the other companies, InnoFlex differentiates business units according to their functions. Each business unit consists of a team of specialists. In InnoFlex, a business unit is an independent profit center with its own mission statements, targets, strategies, action plans and budgets. That is to say, each unit has a high degree of *autonomy* of decision making which can reduce dependency on the top management. Resources across different business units are no longer coordinated by the top

management, but are coordinated by an internal market mechanism. One business manager describes the organization as "an internal shopping mall" with different competences. Each of the business units and its employees are empowered to identify and search for resources that they need. For example, if one business unit needs support from another one, it must pay a commission to the collaborating units based on working hours. This also avoids internal resource redundancy, since non-profit employees or business units cannot survive in such a market-led network organization.

Such a market-led network organization also enables *flexibility* of the organization. Firstly, with no complex reporting systems and with the unit being responsible for their own profits, each business unit is faster to change and take action. Secondly, since each business unit and employee can choose their own partners, a business unit may not need to always collaborate with internal colleagues on innovation projects; it is allowed to choose external partners and establish innovation networks when necessary. This dynamic and flexible organization makes each business unit act as a broker in its respective business networks, thus enabling them to utilize innovation resources from both inside and outside of the firm. Thirdly, each employee is empowered to take the initiative to bring about innovation and "speak things into existence", which means that each employee is obliged to seek business and innovation opportunities proactively rather than waiting for jobs to be arranged by top management. Moreover, employees are encouraged to define their own job roles according to their specialties rather than being forced to do specifically laid-out jobs. This market-led network organization not only enables bottom-up innovation, especially employee-driven innovation, but has also helped InnoFlex overcome the financial crisis due to its flexibility and fast reaction to market changes. One business developer says,

> I would say that probably, if we had not changed at that time, we would have been dead by now.

These advantages aside, this market-led network organization also has some major challenges. First of all, a market mechanism could bring about fierce internal competition rather than collaboration. Responding to this challenge, InnoFlex makes sure there is very little overlapping between business units' responsibilities, which makes these business units interdependent to each other. Thus, although there is an internal market, business units are not competing with each other on the same part of the value chain. The only competition between different units may be the ability to create values. As described by one innovation manager:

> There is little overlapping as each unit has an area of responsibility. The relationships between masters are a supplier and customer relationship.

In addition, since internal business units are highly autonomous, they may have different interests and goals. Another challenge then, is how to unite internal business units. InnoFlex's top managers try to promote a strong corporate culture and common

strategy that glues the business units together. Therefore, as explained by a manager, each business unit tends to regard InnoFlex's other units as the first potential partner when considering an innovation project, due to the trust built up from previous collaboration experiences:

> The glue between business units is culture… Since each unit already knows that internal masters have the professional knowledge and there are trustful relationships between them, the internal units are still the first choice.

4.2 Directed network organization

The second type of network organization is labeled as "directed network organization". The idea of global network organization came out in 2008 in Case 2 (Circular), and it was based on the working atmosphere in the Danish headquarters, where colleagues interacted proactively. Thus, Circular aims to promote the working environment of a network to the whole global organization. As described by one technical director:

> We should have a network organization where we are working together as if we were sitting under the same roof.

Circular is trying to change to a global network organization, and the main reason for changing the existing organization is summarized by one technical director, i.e. utilizing global resources:

> The old organization was perfect if the whole development were in Denmark…But once you start having part of the development in different time zones, different cultures and different maturities, you have to create a different organizational structure than just a matrix organization. Because our present organization is really not scalable to take full advantage of new colleagues in other countries, our way of working has been very much designed by how we have been working in Denmark.

With the same purpose of mobilizing global resources efficiently, Circular uses different principles to design its global network organization when compared with InnoFlex. Its matrix structure has not radically changed and its global R&D network structure is developed based upon this structure. Global R&D subsidiaries hold specialized competences and complementary resources, so they are interdependent with each other. In addition, each R&D subsidiary has global responsibilities rather than focusing on its own local market. In addition, virtual departments that consist of geographically distributed employees and globally responsible teams are established to facilitate knowledge sharing and global innovation projects. Here are some descriptions made by one business manager:

> It's important to allow people to work in a network-like structure. For instance, colleagues working on electronic development globally are part of a community regardless of their reporting lines, so we tried to create what we call a virtual version of a technical department. One manager will have resources in China, Hungary, Denmark, and the US…We will sort of have a matrix structure, in which we establish global delivery streams. For instance, in one delivery stream there will be pumps, and that

> stream will deliver all pump development to the entire Circular group. I mean to the site in China, Hungary and Denmark, and probably also constitute employees at all sites.

Circular's managers direct and are responsible for the networking performances. For such a big TNC, Circular believes that managers' support and supervision is absolutely necessary. The networking statistics such as knowledge sharing, cooperation times and trust levels are gathered, and the networking performances of each employee and business unit are mapped and evaluated, so managers can find more isolated areas and employees. In addition, within a network consisting of global employees, for example the aforementioned virtual technical department, there will be one manager responsible for the internal knowledge sharing and innovation performance. Moreover, within such a technical department, a core team is established around the manager for driving the activities in the network. Therefore, if one site's networking is unsatisfactory, the responsible manager will answer for that. One example is given by a commercial director:

> We've had some problems with our Hungarian colleagues, they are not very active. But that's mainly because their manager thought it was a waste of time and wouldn't allow them to do so. The manager is no longer there, we do not think he is suitable for our organization.

In actual fact, Circular's high level managers are quite aware of the "academic version" of network organization that introduces a market mechanism, but they are not fully convinced. Budget and innovation projects are still centrally coordinated. As explained by an R&D director:

> Probably we are not convinced that it (spaghetti organization) will give better results. There are always some projects that are considered more important than others. For the top projects, I guess as managers we would like to give our best project to the best people, making sure that those projects become a success. Also, if one project has a problem, we may know who is able to solve the problem, and we assign that person to the problem.

One of the challenges that such a directed network organization may come up against is cultural differences, i.e. some regions are reluctant to interact with others. The example of Hungary mentioned before demonstrates this. Another challenge is that since the autonomy of decision making is restricted from the top, employees may feel that they are being forced to network. Also, the incentives of networking may be merely satisfying managers and meeting the requirements. One technical director explained the reason for enforcement:

> We have tried to enforce that for the first couple of years to encourage the habit of sharing knowledge. We were in doubt as to whether it was a good idea, but we did a complete competence mapping of all the staff within each of the communities… and most people are proactive now.

4.3 Culture-led network organization

Similar to Case 2, Case 3 (Biozyme) also maintains its matrix organization while having their version of global network organization. According to one senior R&D director:

> For 30-40 years, networking has become their way of working and their gene. Nowadays, more than 80% of R&D projects are global rather than local. Global R&D subsidiaries' resources are integrated.

Therefore I label the third type of network organization a "culture-led network organization". To me, such a culture-led network organization can be regarded as the improved/upgraded version of directed network organization, in which global R&D subsidiaries are interdependent and globally coordinated. One key feature of Biozyme's network organization is that although it has a formal structure with different levels of authority still in place, the decision making is made by global teams of specialists rather than a sole executive. One example of such group decision making is the project portfolio committee, as described by a senior technical manager:

> We have a committee called project portfolio committee. They are responsible for all the R&D projects that are running across different industries in the whole company. They prioritize the entire project and the resource allocation. Every half year, they will have a meeting to review all the progress for all the projects. During that meeting, each project should be reviewed on the status, resource allocation, and next steps in the next half year, etc.

Another example is the industry strategic group (ISG), which is a functional group that makes decisions regarding the approval of developing a new idea into an innovation project, resource allocation, and termination of innovation projects. Each industry will respectively have an ISG group. As described by a senior business manager:

> The ISG is a cross-functional group. We are responsible for the whole project setup and termination. We also launch the project and decide whether we should invest more on this project or less. Normally there is a marketing director for a specific industry. Then we have an R&D director overseeing the R&D activities in that specific industry. And then we have a production director, a director from patent and licensing. Normally it consists of these four people. So they make most of the decisions related to the specific industry.

Besides these two decision-making groups, employees are encouraged to identify their own network organization consisting of stakeholders inside the whole Biozyme group, so when they encounter problems or discover opportunities, they know where, and to whom they can go. Such a stake-holder management style is described by a senior technical manager as follows:

> We just had a so-called stake-holder management tool in our department. So we asked each scientist to figure out who the internal stakeholders are for their projects. And then they have to figure out who the stakeholders will be and they also make a plan as to how they should maintain our established relationships. These are internal partners, so it's also a big internal organization.

In order to facilitate internal networking across global business units, Biozyme has a full-disclosure information system that provides global employees with an infrastructure and platform for knowledge sharing and communication. An internal IT system serves several functions. Firstly, by using the internal IT system, project members may be able to track the job processing and discuss problems related to the project. Secondly, the internal IT system serves as a knowledge pool in which employees are able to find the knowledge they need. Thirdly, the IT system can also be used for bottom-up idea generation and innovation project initiation since employees can propose their ideas on the ideation database. The bottom-up project generation process is described by a technical manager as follows:

> When I have a new idea, I will do some scouting work first without formal resource allocation. I need to squeeze in my schedule and do it. If the idea turns out to be promising after some proof-of-concept trials then I will discuss this idea with my colleagues and write a formal proposal. After the approval of the ISG, I can initiate a project based on this, and probably be the project leader.

There are some challenges related to such a culture-led network organization. Firstly, long-term cultivation is needed to substitute traditional hierarchical control and administration. Secondly, networks of internal projects are sometimes too loosely coordinated. A third issue is related to the tension between high level management's commitment and project member's enthusiasms, which is a fundamental conflict between hierarchy and bottom-up innovation. Since resource allocation is still held in the hands of higher management groups such as the ISG, one project may not get enough attention from the top. One senior business manager describes the challenge:

> Technically they rarely formed a real "group" to work together and to solve problems or issues from the trials in that project. Maybe from the top level side, they didn't commit that we should make this happen. My guess could be that for this project, it is not something of top priority in their head, so they don't think this project is very important to them, but to Biozymes, we felt that this should have been very important.

5. Discussion

5.1 The Dual Organization?

The above findings show that companies may adopt their own logic when designing a network organization to facilitate global innovation. Moreover, the three case companies show dualities of the three coordination modes, i.e. market, hierarchy and network.

Case 1's network organization by nature has the duality of network principles and market mechanism. However, though there is little hierarchy left in Case 1, it still has a CEO that is over and above all business units. It is difficult to pinpoint the role of the CEO, since a CEO can be regarded as a combination of authority, guidance, rich knowledge, and the capability to see business potential across all the business units. Perhaps we can say that the CEO is like a bee moving around and collecting information

from all business units in order to facilitate the prosperity of all of them. Thus, Case 1 still maintains hierarchies within the organization to a small extent, which are regarded as necessary for maintaining some formal guidance and in order to unite the internal business units by its managers.

Case 2 and 3's formal matrix structures have been maintained, and it is based upon this structure that their global network organizations have been established. Compared with Case 2, Case 3 has a softer version of directed network organization, in which a strong culture that is commonly shared by all global R&D subsidiaries acts as an invisible power that stimulates internal knowledge sharing and innovation collaboration. In addition, traditional hierarchy in Case 3 has been changed to leadership, guidance, cultivation and facilitation of a collective vision, team-based decision making, etc.

Furthermore, we can also identify market mechanism in Case 2 and 3. For example, after finishing production, their global production sites will sell the batches to their sales companies based on internal prices. However, these transferring prices are set from the top rather than being negotiable. In addition, there are some departments in Case 2 and 3 that have the autonomy of setting market prices rather than waiting for arrangements from the top. Thus, from the above findings, we can see that an internal network organization in practice is dual or even ternary in terms of the three coordination modes, i.e. market, hierarchy and network.

5.1 Summary of the three network organizations

Table 6.3 summarizes the key features and main challenges of the three types of network organizations shown in Section 4, i.e. market-led, directed, and culture-led network organizations.

Table 6.3. Three types of internal network organizations.

Categories	Features	Main challenges
Market-led network organization	Internal market mechanism instead of commands and directions	How to unite different units to work towards a common goal and identity problems.
Directed network organization	Top-down promoting, managers as supervisors and facilitators. Creation of a set of index or targets to measure the performance of networks.	Loss of autonomy and the ability to self-organize. Employees are forced to be networked. Motivation comes from satisfying bosses.
Culture-led network organization	Strong corporate culture and core values as invisible hand guiding employee's behaviors. Group decisions.	Culture differences, long-term cultivation. Floating and too loose, inefficiency of resource allocation, incentive problems.

The first form of network organization, in accordance with Miles and Snows (1986, 1992)'s suggestions, adopts an internal market mechanism to allocate resources between business units. It is worth noting that, in economics, market transactions are one-off and a rational man has no memory about the past. In a market-led network organization, the market mechanism twists with the accumulation of trustful relationships and successful experiences. If we consider an extreme case of a market-led network organization, where each employee generates business value and work as a self-employed entrepreneur inside a company, there will be intense competition within a firm. In the long run, a firm may lose its internal cohesiveness and its network organization may turn into chaos. Employees may snatch customers from each other, and although this may stimulate each employee's potential, it is a waste of resources. Thus, the main challenge is how to unite internal business units and make these units consider themselves as part of a company, i.e. identify the challenge (Kogut & Zander, 1996). The solutions to this challenge could be, firstly, to make sure that different functional units located at different parts of the value chain are interdependent to each other, and secondly, cultivating a strong corporate culture that glues these business units together .

The top managers of directed network organizations believe that experienced managers may have a better understanding of where strategic resources should be allocated. The main purpose of such a network organization is to fully utilize global competences, which can avoid duplicate investment in the same competency in different subsidiaries. Guided by managers, globally distributed subsidiaries are becoming interdependent, and employees from different subsidiaries are able to work together seamlessly on a global project. Virtual departments consisting of globally distributed employees with global responsibilities are emerging across the TNC's formal structures. The main problem of this network organization is that the autonomy of employees and business units are restricted, which might harm the employee's potential. Another issue is that employee's motivation for establishing their own innovation networks is to fulfill their manager's requirements, and once the control becomes too loose, employees may become passive again.

The third type of network organization is based on its strong corporate culture and long history of cultivation. In Case 3, different forms of group (network) decision making and responsiveness are adopted, and the employee's innovation potential is highly encouraged. For example, employees can generate their own innovation idea, do some trials, apply resources from the top, and initiate an innovation project from a bottom-up process. The hierarchical reporting structures are hidden behind the overlapping networks between employees, and groups of managers act as gate keepers at each stage of the R&D project, while still leaving much space for self-organizing. Thus, there is a challenge for

managers as to when they should play the control card and when they should let the organization self-organize.

In the extreme case of a culture-led organization, there may be two potentially challenging situations. One situation could be that internal business units would be strongly tied through the cultural values and behaviors. The organization is not a hierarchy in the traditional sense but is rendered stable though values and routines. Therefore, the flexibility and dynamism of a network organization could be harmed. Another situation could be that the organization would lose cohesiveness since little control remains. Employees might do things according to their own interests, having lost the incentive of achieving the common objectives of the company since they won't gain any benefits from doing so. Moreover, employees with more critical knowledge resources may receive more collaboration invitations and hierarchies may emerge again, i.e. resources will be more concentrated within a few employees or business units (Diefenbach & Sillince, 2011). The above two situations could cause an organization to turn back to a certain degree of hierarchical control, just like in Case 2. Yet another direction may be that the company adopts a market mechanism such as Case 1 does, making individual business units and employees into profit centers and creating incentives of value-adding collaborations. Indeed, a profit-seeking company is not a social network of groups, it can hardly rely solely on network features such as trust, knowledge sharing, self-organizing and interdependence to create value-adding innovation.

5.3 Overlap of market, hierarchy and network

Market, hierarchy and network are theoretical constructs, and it's hard to find pure forms of these three modes. From this study, we can see that the relationships between the three coordination modes in reality are overlapping rather than discrete (See Figure 6.1). According to different design principles, we can see that directed and market-led network organizations are in reality based on duality, so they are placed respectively in the overlapping areas of market and network, and hierarchy and network.

In a culture-led network organization, a strong culture acts as an invisible hand and stimulator that guides and regulates employees' behavior. Employees believe that they are capable of bringing about changes and therefore proactively engage in innovation related networking activities. Thus, the culture-led network organization mainly shows the principles of networks (Powell, 1990). However, as shown in Case 3, hierarchies are "hibernated" rather than completely eliminated. Whenever immediate decision making and resource mobilizing are needed, we may still see strong authority held in top managers' hands. As discussed in Section 5.2, we can see that an organization cannot rely solely on network principles, so it is not stable and may become a directed-network organization or a market-led network organization. In essence, as proposed by Farjoun (2010) and Sundbo (2001), organizations must integrate and reconcile the requirements

of keeping both stability through formalized rules and structures, and innovation and change through networks. Thus, stability (hierarchy) and change (network) are fundamentally co-existent and even mutually enhancing in an organization.

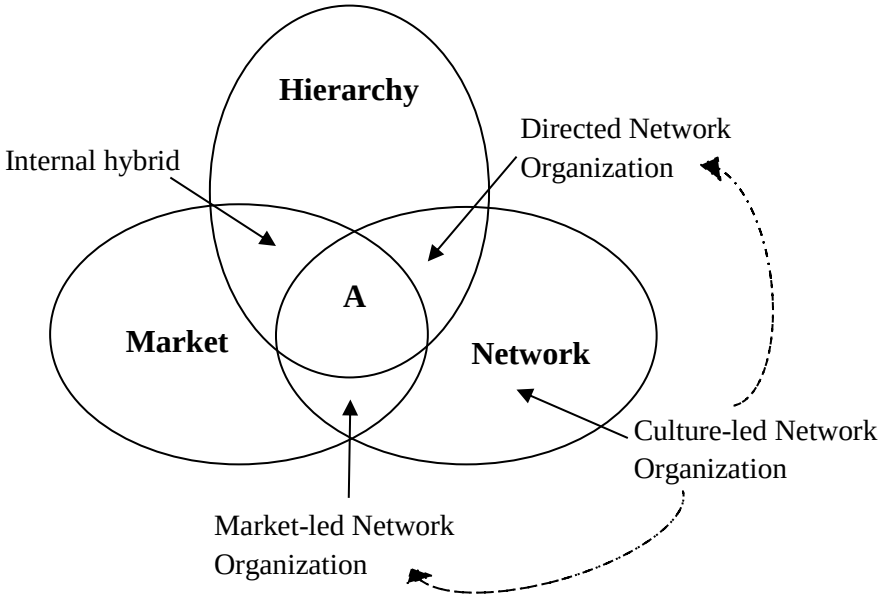


Figure 6.1. Overlap of market, hierarchy and network.

If we take a look at the highly cited propositions of Miles and Snow on internal network organization, which has a set of key elements such as vertical disaggregation, brokers, and full-disclosure information systems (Miles and Snow, 1986), we may find that they don't even mention trust, interdependence, mutual benefits, long-term oriented, etc. It seems that Miles and Snow's network organization is actually based on Williamson (1991)'s dichotomy of market and network. Their network organization is actually in line with the concept of internal hybrid (Foss, 2003; Zenger, 2002), or we may say it is a dual organization of market and hierarchy. In Figure 6.1 internal hybrid is shown in the overlapping areas between hierarchy and market.

Besides the above discussions on dualism, Zone A in Figure 6.1 integrates all three coordination modes, i.e. a ternary organization of market, network and hierarchy, which is still mysterious to us. Generally speaking, three coordination principles as well as three ultimate presumptions are integrated within Zone A as shown in Table 6.4.

As a coordination mode, network assumes that every employee has the innovation potential, and the motivation of hardworking comes from gaining reputation among peers. Therefore, a network encourages bottom-up innovation potentials through cultivating internal trust, interdependence and knowledge sharing opportunities between different

business units. In order to facilitate the global innovation strategy, a ternary organization may use network as a main design to facilitate flexibility and bottom-up innovation while mixing market mechanism ensuring fair cooperation and hierarchies ensuring responsibilities and formality. Hierarchy clarifies chains of responsibility and regulatory rules to ensure the stability of an organization. Moreover, a hierarchical form assumes that every employee likes to be regarded as more important in a group and wants to own more authority and resources than others, which is also the source of incentives. A market form assumes that all individuals are rational profit seekers. Therefore, adopting an internal market mechanism can optimize internal resource allocation and track value creation clearly.

Table 6.4. Comparison of the three coordination modes regarding firms' internal organizations.

Coordination Mode	Ultimate Presumptions on Employees	Coordination Purpose	Coordination Principles
Market	Rational profit seekers	Clearly track value creation and optimize internal resource allocation	Internal market mechanism: buying and selling based on market price, internal competition.
Hierarchy	Promotion seekers	Stabilization and formality of organization	Routines and regulations, chains of commands and responsibilities
Network	Potential innovators, gaining reputation among peers	Innovation and flexibility, especially employee-driven innovation	Trust, interdependence, mutual benefits, commonly shared culture

Yet, does such a ternary organization exist in reality? From the case companies, we can see that the ternary organization that integrates principles of market, hierarchy and network has already been a common phenomenon. In a market-led network organization (Case 1), the remaining hierarchy manifests itself in the CEO's leadership and guidance. In a directed network organization (Case 2), internal transfer prices and departments with autonomy for price setting are emerging. Thus, at the end of this paper, we propose the following: organizations, especially transnational corporations' organizations, are moving towards a ternary organization with the triplicity of market, hierarchy and network.

5.4 Dynamism of a ternary organization

The balance of three forms, i.e. market, hierarchy and network, in a ternary organization depends on each TNC's practical situation. It may relate to several factors, such as external business environments, a firm's history, the local context and culture, strategies, etc. For example, when the business strategy is to provide innovative products and services in order to strive for a competitive stance in the market, we may see internal

networking being encouraged, and along with that, an internal market mechanism may also be adopted to promote resource mobilization. In such a situation, the hierarchical restrictions and commands may be limited. When an organization has diversified business divisions, and there are limited cross-divisional knowledge flows, a suitable solution may be to render each business division as an independent profit center and adopting an internal market to track value exchanges between businesses units. However, when the organization is suffering from the economic recession, it is no longer wise to give employees freedom to investigate their own interests. In this case, internal networking will be confined, and resource control and regulatory rules aiming at saving costs and surviving in the recession will emerge again. However, research on the dynamism of a ternary organization that integrates market, hierarchy and network is very limited in existing literature, and to address this gap, perhaps this could be a future direction of research.

From the above discussions, I could not help but wonder whether the concept of a network organization is still viable, or whether it just represents the tendency of leaning to the network pillar of the triplicity of market, hierarchy and network modes when companies' current strategy is focused on innovation. Following this logic, the dualism mentioned before means the salience of two coordination modes out the three. An internal hybrid is thus leaning more towards the market and hierarchy pillars, while a directed network organization mainly promotes hierarchy and network coordination modes.

6 Conclusion

This paper investigates network organization in practice based on a multiple-case study of three TNCs' global R&D organization. This research is exploratory in nature and has the following contributions. Firstly, based on an exploratory multiple case study of three Danish transnational corporations' internal network organization, I identify three types of network organization that have different sets of underlying logic, i.e. market-led, directed, and culture-led network organization. Only the market-led network organization adopts an internal market mechanism as proposed by the academia. The alternative ways of designing a network organization lead to a discussion on the viability of the contemporary definitions of a network organization. In particular, we may have to reconsider the advocation of eliminating hierarchies to facilitate innovation. To me, the hierarchical mode for network organization needs to replace rigidness and commands with guidance and leadership, and when this is the case, it can facilitate rather than hinder innovation.

Secondly, this research discards the view of regarding market, hierarchy and network as discrete and exclusive coordination modes and structures. Here the three modes are seen as complementary to each other and mutually enhancing. Based on the integration of

different modes, different types of network organizations emerge. Thirdly, I show the possibility of creating a ternary organization that integrates all three modes, and actually, in practice, companies are already doing that unconsciously. However, how to balance the three modes and the dynamism of the three modes within an organization along the business cycle could be interesting future research topics. Finally, this research shows different experiences of designing a network organization for TNCs' global innovation, which can provide some managerial implications for business managers.

References

Andersson, U., Forsgren, M., & Holm, U. (2007). Balancing subsidiary influence in the federative MNC: A business network view. *Journal of International Business Studies, 38*(5), 802-818.

Baker, W. E. (1993). *The network organization in theory and practice*. Boston: Harvard Business School Press.

Bartlett, C. A., & Ghoshal, S. (2002). *Managing across borders: The transnational solution*. Boston, Massachusetts: Harvard Business Press.

Borgatti, S. P., & Foster, P. C. (2003). The network paradigm in organizational research: A review and typology. *Journal of Management, 29*(6), 991-1013.

Boutellier, R., Gassmann, O., & Von Zedtwitz, M. (2008). *Managing global innovation: Uncovering the secrets of future competitiveness* Springer Verlag.

Bryman, A., & Bell, E. (2007). *Business research methods*. New York: Oxford University Press.

Cantwell, J., & Piscitello, L. (1999). The emergence of corporate international networks for the accumulation of dispersed technological competences. *MIR: Management International Review, ,* 123-147.

Child, J. (2005). *Organization: Contemporary principles and practice*. Oxford: Blackwell.

Child, J., Faulkner, D., & Tallman, S. (2005). *Cooperative strategy: Managing alliances, networks, and joint ventures*. New York: Oxford University Press.

Demil, B., & Lecocq, X. (2006). Neither market nor hierarchy nor network: The emergence of bazaar governance. *Organization Studies, 27*(10), 1447.

Diefenbach, T., & Sillince, J. (2011). Formal and informal hierarchy in different types of organization. *Organization Studies, 32*(11), 1515.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532-550.

Eisenhardt, K. M. (1991). Better stories and better constructs: The case for rigor and comparative logic. *Academy of Management Review, 16*(3), 620-627.

Farjoun, M. (2010). Beyond dualism: Stability and change as a duality. *Academy of Management Review, 35*(2), 202-225.

Foss, N. J. (2003). Selective intervention and internal hybrids: Interpreting and learning from the rise and decline of the oticon spaghetti organization. *Organization Science, 14*(3), 331-349.

Freeman, C. (1991). Networks of innovators: A synthesis of research issues. *Research Policy, 20*(5), 499-514.

Fuglsang, L., & Sundbo, J. (2005). The organizational innovation system: Three modes. *Journal of Change Management, 5*(3), 329-344.

Gassmann, O., & Von Zedtwitz, M. (1999). New concepts and trends in international R&D organization. *Research Policy, 28*(2), 231-250.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.

Hales, C. (2002). 'Bureaucracy-lite'and continuities in managerial work. *British Journal of Management, 13*(1), 51-66.

Jarillo, J. C. (1988). On strategic networks. *Strategic Management Journal, 9*(1), 31-41.

Kastelle, T., & Steen, J. (2010). Are small world networks always best for innovation? *Innovation: Management, Policy & Practice, 12*(1), 75-87.

Kogut, B., & Zander, U. (1996). What firms do? coordination, identity, and learning. *Organization Science,* , 502-518.

Medcof, J. W. (1997). A taxonomy of internationally dispersed technology units and its application to management issues. *R&D Management, 27*(4), 301-318.

Medcof, J. W. (2003). Network centrality and power among internationally dispersed technology units. In M. G. Serapio, & T. Hayashi (Eds.), *Internationalization of research and development and the emergence of global R&D networks (research in international business* (pp. 179-203). Oxford: Elsevier.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks: Sage.

Miles, R. E., & Snow, C. C. (1986). Organizations: New concepts for new forms. *California,*

Miles, R. E., & Snow, C. C. (1992). Causes of failure in network organizations. *California Management Review, 34*(4), 53-57.

Powell, W. W. (1990). Neither market nor hierarchy: Network forms of organization. *Research in Organizational Behavior, 12*, 295-336.

Sundbo, J. (2001). The organizational structure: The dual organization. In J. Sundbo (Ed.), *The strategic management of innovation* (pp. 91-109). Cheltenham: Edward Elgar Publishing.

Thorelli, H. B. (1986). Networks: Between markets and hierarchies. *Strategic Management Journal, 7*(1), 37-51.

Williamson, O. E. (1991). Comparative economic organization: The analysis of discrete structural alternatives. *Administrative Science Quarterly*, *36*(2), 269-296.

Yin, R. K. (2009). *Case Study Research: Design and methods* (4th ed.). California: Sage.

Zenger, T. R. (2002). Crafting internal hybrids: Complementarities, common change initiatives, and the team-based organization. *International Journal of the Economics of Business, 9*(1), 79-95.

6.3 Reflections on Paper 4

As the key concept being explored in this dissertation, a network organization has always been a highly debatable phenomenon. Regarding interorganizational or interfirm network organization for innovation, we see numerous examples in practice such as different forms of innovation networks among partnering firms and research institutions.

However, it is the complete opposite if we investigate firms' internal organizations. We may find many companies trying to promote cross-functional or cross-departmental knowledge sharing and collaboration, substituting rigid regulations and commands with leaderships, and encouraging global R&D subsidiaries to explore and utilize host country knowledge resources to facilitate innovation. These are all attempts to promote internal networking as well as encouraging all employees' potential capability of initiating innovation. Yet does promoting internal networking mean that these companies are moving towards a network organization that discards hierarchies? In the literature, many scholars (e.g. Miles and Snow, 1986, 1992; Baker, 1993) argue that a network organization should substitute hierarchies with an internal market mechanism. Thus, even though firms are trying to facilitate innovation through promoting internal networks, they cannot be regarded as having a network organization in this sense since no market mechanism is involved. No wonder some scholars argue that a network organization is merely hierarchy-lite or bureaucracy-lite in practice. Besides, we also see cases of network organization coordinated by internal market mechanism returning to more formal organizational structures such as matrix (e.g. the Oticon case), because such an organization is difficult to design and manage. As a result, it may be very interesting to investigate the confusing concept of network organization in practice.

Luckily, I had the chances to talk to three case companies that declare that they have network organizations. Through the exploratory multiple case studies, I find that the advocation of adopting an internal market to facilitate innovation is not accepted by all business managers. We do see a case company that radically changes its original organization by adopting an internal market to track value creation and optimize resource allocation (market-led network organization). However, many more business managers are not convinced by the notion of replacing hierarchies with internal market mechanism, because they still believe that the experienced managers are the most knowledgeable as to when and where to allocate resources. For this reason, they have developed their network organizations based on existing organizational structures, in which managers play an important role in promoting networking inside their teams and are responsible for the performances of networking (directed-network organization). After a certain period of cultivation, managers may not need to direct and push anymore since all employees have formed the habit of proactively sharing knowledge with colleagues, proposing their own

new ideas and initiating innovation projects. That is to say, networking has become a core value in the corporate culture (culture-led network organization).

The identification of the three types of network organizations in reality, i.e. market led, directed and culture-led network organizations, opens the door for a more complicated discussion on the relationships between the three coordination modes, i.e. market, hierarchy and network. In existing literature, most scholars regard these three coordination modes as exclusive. From the multiple case studies discussed here, it is promising that companies integrate the three coordination modes in practice. Therefore, this research boldly proposes that *companies, especially transnational corporations are inherently ternary organizations that integrating market, hierarchy and network structures.* Different coordination modes ensure different purposes: the network mode facilitates exploitation and exploration (innovation); the hierarchy mode ensures the stability of the operation; and the market mode tracks value creation and encourages the profit seeking potential of each individual employee.

Based on the above propositions, we will gain some interesting insights when revisiting existing definitions on network organization. The argument of adopting an internal market to establish a network organization for innovation (e.g. Miles and Snow. 1986, 1992; Baker, 1993), to me is highly ambiguous. Such a definition overlooks the essential features of a network such as trust, interdependence, mutual benefits, reciprocity, etc. Yet, it emphasizes vertical disaggregation, decentralization and delayering, which are actually ways of reducing internal hierarchical regulations or commands. Thus, it is confusing to call such a structure a hierarchy-lite organization, or an organization restricting hierarchy while adopting an internal market mechanism network organization, since it does not include all the key features of networks. Overall, as shown in Figure 6.1, I tend to regard Miles and Snow's version of a network organization as an internal hybrid, or it can be called *a dual organization of market and hierarchy.*

To me, it is a very challenging task to understand the concept of a network organization. I believe what I have done so far is only in the beginning stages, which can serve as an opportunity to open up further discussions. The biggest limitation of this paper is the lack of discussion on the feasibility of integrating the three coordination modes, i.e. market, hierarchy and network. Since each mode represents different underlying principles, how organizational managers integrate these different principles in practice and what subsequent challenges they face, surely must require further discussion.

In conclusion, this paper mainly contributes to the first research question of this dissertation:

How do business managers think of this concept and how do they design their versions of network organization?

7. Integration of Intra- and Inter-organizational Network Organization

7.1 Introduction to Paper 5

As the last paper of this dissertation, I integrate both intra- and inter-organizational levels of analysis and try to show how an SME adopts a transnational innovation strategy by establishing a network organization. The case company's network organization consists of its own internal business units and external partners.

Besides showing a network organization for innovation, Paper 5 also explores the management of network organization by focusing on the concept of orchestration capability. Since member organizations located in network organization are interdependent with each other, no single organization can fully control others. As a result, new managerial capabilities such as orchestration capability are needed in regards to network organizations. Orchestration capability is defined as a set of purposeful activities undertaken by the hub firm as it seeks to create value through establishing innovation networks and extract value from the maintenance of the network (Dhanaraj & Parkhe 2006; Ritala, et al., 2009). Also, it is regarded as the managerial role of the hub organization within a network, which is significantly different from traditional administration of hierarchical organizations. As a result, exploring the meaning of orchestration capability may contribute to the understanding of the ambiguous topic of managing network organizations.

Therefore, Paper 5 explores the following two research questions:

- *How can an SME foster open innovation through a network organization?*
- *How can we make sense of orchestration capability in both multifirm innovation networks and an internal network organization for an SME?*

This paper contributes to both of the main research questions of this dissertation:

- *How do transnational corporations perceive/design a network organization to facilitate their global innovation?*
- *To what extent and how can we manage a network organization?*

7.2 Paper 5

Open Innovation in Networks: Specifying Orchestration Capability for SMEs[16]

Yimei Hu, Olav Jull Sørensen,

Department of Business and Management, Aalborg University

Abstract

Open innovation in multifirm networks has been a popular topic for long, and the focal firm with orchestration capability will enhance its innovation performance through networks. However, only recently, researchers started to study SME's open innovation and networks, especially those from the low-tech industry. Besides multifirm networks, some organizational researchers are interested in the internal network organizational design of prospector firms putting innovation on top of the agenda. This paper analyzes how an SME from a traditional industry implements the prospector strategy through purposively built multi-level networks, i.e. an internal network organization and a multifirm innovation network. In order to get more innovation output from external and internal networks, orchestration capability is needed and should be applied in both levels of network organizations.

Keywords

Open Innovation, Multifirm Innovation Network, Network Organization, Orchestration Capability

1. Introduction

Open innovation, has been widely accepted as a new paradigm for innovation (Chesbrough 2003). It introduces a new organizational innovation which targets at utilizing both internal and external innovation resources to advance firms' technologies and capabilities. Open innovation theory assumes that "knowledge is widely distributed, and that even the most capable R&D organizations must identify, connect to, and leverage external knowledge sources as a core process in innovation" (Chesbrough 2006). Furthermore, another important issue is that open innovation theory emphasizes converting R&D into commercial value (Chesbrough 2006).

[16] Published on Ledelse & Erhvervsoekonomi, Vol. 77, No. 2, pp. 7-24. Draft version presented at Conference: Open Innovation and New Business Creation 2011, Billund, Denmark.

Since firms cannot rely entirely on their own technology capabilities, they can acquire new technology in many ways, including licensing, strategic alliances, joint ventures, and can develop new markets by technology spin-offs, which refer to a networking way of innovation. Open innovation scholars suggest companies to set up and manage interorganizational networks, knowledge networks, or value constellations not only to tap into external technology sources in the early stages of an innovation project, but also to commercialize new products successfully (Hu & Sørensen 2011a; Vanhaverbeke 2006). Generally speaking, networks can be classified into interorganizational or multifirm networks, and intraorganizational or internal networks (Hu & Sørensen 2011b). Innovation researchers have noticed multifirm networks for innovation, such as strategic alliance, joint ventures, industrial clusters, value chains (Gereffi 2005), etc. However, organizational researchers move one step further to conceptualize a new organizational design for firm's innovation, i.e. the network organization, which is different from traditional hierarchical organizations (Miles & Snow 1986, 1992; Snow et al. 2011).

Though network organization is recognized as a suitable design for innovation, how to manage a network organization in order to avoid chaos remains uncertain. Based on Dhanaraj & Parkhe (2006), in order to successfully construct and maintain innovation networks, orchestration capability is needed for a "hub" firm. A hub firm has a central position in the network structure, and performs a leadership role in integrating the dispersed innovation resources and capabilities of network members. In order to do so, a hub firm needs "orchestration capability" (Dhanaraj & Parkhe 2006; Ritala et al. 2009). However, the orchestration capability has not been applied to an intra-network organization yet.

Besides, when talking about open innovation, it seems that SMEs' innovation potential and their roles in networks have been excluded from mainstream literature (Boutellier et al. 2008; Lee et al. 2009). Thus, this paper will show that in order to pursue open innovation, SMEs must have orchestration capability to construct and maintain a network organization. The research questions of this paper are:

1. *How can an SME foster open innovation through a network organization?*
2. *How can we make sense of orchestration capability in both multifirm innovation networks and an internal network organization for an SME?*

The paper is organized as follows. First, we will review literature on multifirm innovation networks, network organization and orchestration capability. Second, the paper will discuss the conceptual framework and methodology of this paper. Third, we will provide a profile of the case company. This will be followed by an analysis of a case: open innovation in networks; network organization; orchestration capability in multifirm networks and a network organization. Based on the analysis, there will be discussions on

some findings from analyzing orchestration capability. Finally, implications for innovation management and strategic management will be outlined.

2. Literature Review

2.1 Multifirm Network and Innovation

From the resource-based view and the knowledge-based view of firm (Barney 1991; Grant 1996; Wernerfelt 1984), resources are heterogeneously distributed across firms, thus critical resources, especially knowledge for innovation may located outside a firm. Business network theorists conceptualize the business environment as a network of connected business relationships evolved from interaction between actors (Holm et al., 1996). Thus an R&D network aiming at a cooperative strategy that provides the right balance between efficient use of resources and the control of technology is an important form of business networks (Håkansson & Snehota 1989; Håkansson & Laage-Hellman 1984).

Since the 1980s, "networks of innovators" which are characterized by flexibility and mutuality are seen as a proper design for innovation (Freeman, 1991; Powell, 2005). The locus of innovation is found in networks of learning rather than in individual firms (Powell et al., 1996). Strategic alliance and joint R&D have proved their advantages on enhancing product and process innovation performance, as well as both exploitation and exploration (Capaldo 2007; Hagedoorn 2002; Schilling & Phelps 2009). The locus of innovation is not only multifirm, but also global. Transnational corporations globalize their R&D activities and try to find global partners to utilize cross border R&D resources, which is what we call global innovation networks (Cantwell & Piscitello 1999; Millier 1994). TNC's global R&D will contribute to firms' innovation capabilities, and then is positively related to product and process innovation, as well as the ability on basic research and engineering (Zander 2002). Recently, some open innovation scholars are shifting their interests from big high-tech multinational corporations to smaller low-tech companies. For example, Wincent et al. (2009) show it has been more and more popular to form small-firm networks to enhance R&D activities, and the effectiveness and performance of these small-firm networks is highly related to a unit that is responsible for coordinating. Similarly, Lee et al. (2010) show that the input of an intermediary in facilitating innovation is crucial to the success of SMEs' open innovation.

Open innovation researchers have paid much attention to innovation networks and multifirm ties. There are four types of innovation ties which help to construct multifirm innovation networks: deep, wide, formal and informal (Simard & West 2006; Vanhaverbeke 2006). Deep (exploitative) ties enable companies to tap into key resources for incremental innovation; wide (explorative) ties lead to new technologies and markets; formal ties are based on contract; and informal ties will lead to more formal arrangements to cooperate. When a firm wants to create value from the early stage of technology

development as well as commercialization of products, it is crucial to establish a "value network" with partners and to shape the role that suppliers, customers and other parties play in influencing the value captured from commercialization of an innovation (Chesbrough & Rosenbloom 2002).

2.2 Network Organization and Prospector

Global innovation networks usually consist of the focal firm and its partners all over the world. Some scholars however move their focus from outside to inside of the firm. Under complex, rapidly changing, and turbulent environments, hierarchical structure is not suitable for innovation, especially global innovation (von Zedtwitz & Gassmann 2002). Gassmann & von Zedtwitz (1999) classify five evolutionary types of R&D, which are ethnocentric centralized, geocentric centralized, polycentric decentralized, R&D hub, and integrated R&D network, and their empirical multiple case studies show a general trend towards the integrated network model. Medcof (2004) proposes four types of structural cells for internationally dispersed technology, i.e. star, cluster, network and satellite. Among them, the network has strong communication links among both the central and periphery units.

Not only the R&D function of a firm evolves toward a network organization, in order to enhance innovation, all the functions of a firm have to be mobilized. Based on different strategies, there are three types of firms, i.e. prospectors, defenders, and analyzers (Miles & Snow, 1986; Snow et al. 2010). Prospectors are firms that continually develop new products, services, technologies and markets. They achieve success by moving first, either by own efforts on R&D or by building a market through their customer-relating capabilities. Analyzers have a "second-in" strategy, and they imitate and improve the products offered by competitors, i.e. have innovation on the periphery and also efficiency. Defenders are firms focusing on stable product or service lines, thus standardization and efficiency are the main focuses. Based on different strategies, there will be different organizational design. Defenders usually have functional organization, analyzers employ matrix structure, and prospectors usually have more flat and flexible organizations with autonomous work groups, i.e. network organization.

According to Miles & Snow (1992), there are three types of network organizations: the stable network, the internal network, and the dynamic network. The stable network consists of independent organizations along a certain product or service value chain. The internal network is configured as a market inside a firm. The dynamic network involves different firms or units of firms, which are collaborating temporarily on a new product or service. In other words, a network organization enhances flexibility and innovation. Similar definitions on network organization can be found in Borgatti & Foster (2003), Jarvenpaa & Ives, (1994), and Baker (1993).

If should be noted that, Miles & Snow (1986)'s definition and typology of network organization has nothing to do with ownership, thus a network organization can be constructed by a set of firms, i.e. "multifirm network organization" (Snow et al. 2010), which means that strategic alliances, joint ventures, virtual organization, and outsourcing can all be regarded as network organizations (Jarillo 1988; Child et al. 2005). However, in order to avoid confusion, we make a difference between a multifirm network organization and an internal network organization when analyzing the case.

2.3 Orchestration Capability

In most situations, it is not possible for a firm to control other partners in a network organization since different partners are autonomous organizations and the networking relationships are based on mutuality and interdependence. Dhanaraj & Parkhe (2006) define the management role of networks as orchestration. The network orchestration can be defined as "the set of deliberate purposeful actions undertaken by the hub firm as it seeks to create value (expand the pie) and extract value (gain a larger slice of the pie) from the network" (Dhanaraj & Parkhe 2006). Hub firms are key actors within a network (Jarillo 1988). They possess prominence and power in a network and thus can perform a leadership or orchestrator role in integrating dispersed resources and capabilities of network members (Dhanarj & Parkhe 2006). According to Ritala et al. (2009), orchestration capability is defined as "the capability to purposefully build and manage multifirm innovation networks".

Generally speaking, orchestration capability is aiming at more network innovation output, including product and process innovation, exploration and exploitation, etc. According to Dhanaraj and Parkhe (2006), and Ritala et al. (2009), there are three key processes in orchestration capability, which are knowledge mobility, innovation appropriability, and network stability. These three key processes are positively related to innovation output. Knowledge mobility means that distributed knowledge resources can be accessible to network members, which refers to sharing, acquiring and deploying knowledge within the network, and it can be enhanced through knowledge absorption, network identification and socialization. Innovation appropriability means the orchestrator has to ensure that the value created is distributed equitably among network members, which is actually ensuring mutuality. If there is no mutuality among network members, the network may end in failure. Network stability refers to the network members' willingness to continue the collaboration, which is related to dynamism of an innovation network. These three elements are not separated but positively related to each other. For example, knowledge mobility will enhance innovation appropriability and network stability. Furthermore, Ritala et al. (2009) elaborate the organizational and individual level determinants of orchestration capability. On the organizational level, orchestration capability requires organizational capabilities in operational and entrepreneurial issues such as collaboration, visioning, competence leveraging,

legitimizing and influencing. On the individual level, orchestration capability requires individual skills such as social skills, entrepreneurial skills, operational skills and balancing skills.

3. Conceptual Framework and Methodology

Based on the above literature review, Figure 7.1 shows a conceptual framework for this paper. Unlike most literature researching on big transnational firms, this paper focuses on a SME's open innovation, and makes an attempt to specify the orchestration capability in both multifirm network organization and internal network organization. It is almost impossible for an SME to have a dominant position in an industry, but as we shall see, it is possible for it to be a prospector by focusing on a niche area and relating to leading customers. In order to generate more innovation outputs from networks and becoming a prospector, orchestration capability is needed to relate external partners and to utilize internal innovation resources. The three key processes of orchestration capability, i.e. knowledge mobility, innovation appropriability, and network stability, can be orchestrated by different means in a firm's internal network organization compared to those used in multifirm networks.

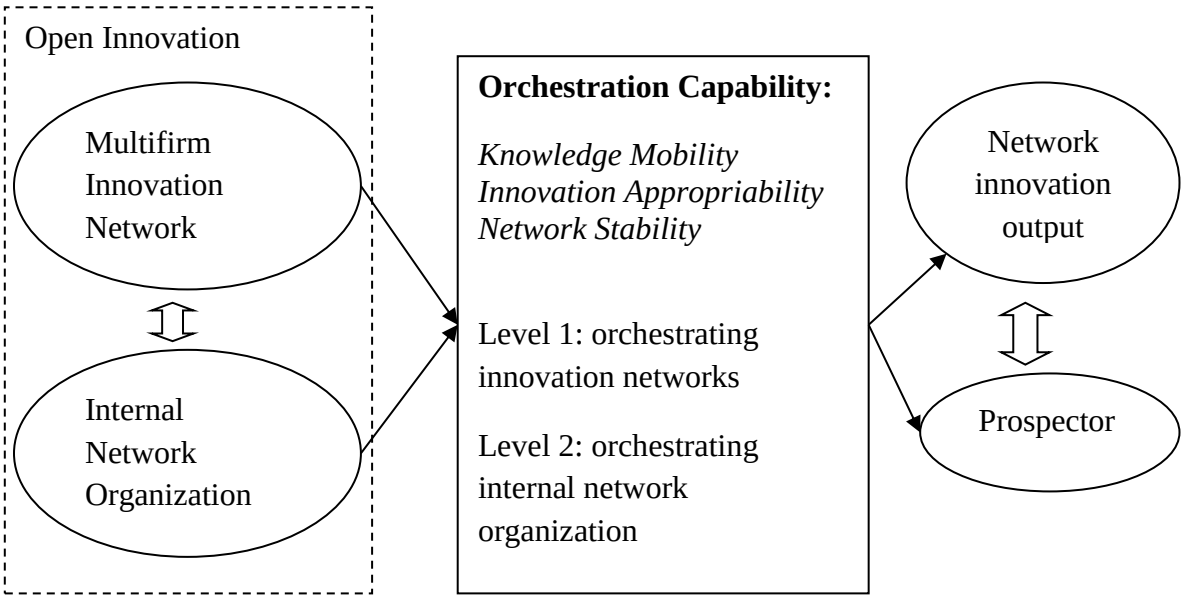


Figure 7.1. Orchestration capability at two levels.

This paper is an explorative single case study on a Danish SME called InnoFlex[17], which has a branch in China. This study uses both primary data collected from interviewing and discussing with managers and key employees from both Denmark and China, and rich secondary data such as ten years' annual reports and information on its

[17] Innoflex and Unit are aliases.

website. Discussions and interviews add up to 11.75 hours. Most interviews are recorded and transcribed, and minutes are made after each discussion. Two of the interviews are taken in Chinese, thus the Chinese transcriptions are then translated to English. Minutes are sent to the interviewees, and comments as well as revisions are made to ensure the validity of data. Secondary materials add up to around 300 pages. Analysis is then made based on triangulation of data. Also, we used Nvivo for coding data and assisting our analysis.

4. Case Profile

InnoFlex develops, manufactures and sells textile products. It is an SME with a business unit in China, i.e. InnoFlex China. InnoFlex is a well-known brand in its niche area and puts innovation at the top of the agenda. InnoFlex has constructed a multifirm network with long-term partners, such as world-leading furniture companies as key customers and OEM companies with specialized abilities as suppliers. Close collaboration with InnoFlex's network of customers, users, suppliers, and advisors ensures the generation of new ideas and new business opportunities. To cope with its outside networks, InnoFlex designed a special internal organization which consists of "strategic business units" (units). A unit is an independent profit center with its own mission statements, visions, targets, strategies, action plans and budgets. Most units are named after different functions, e.g. DesignUnit, LogisticsUnit, MarketingUnit, etc. When cooperating with internal units, each unit is expected to buy and offer services at the most competitive prices and other conditions. In the following section, this paper will firstly show how an SME constructs multifirm innovation networks and internal network organization to foster open innovation, and then analyze the orchestration capability of the case company from both levels.

5. Findings

5.1 Open Innovation in Multifirm Networks

Table 7.1 offers an overview on InnoFlex's multifirm network for innovation. According to the open innovation theory, there are four kinds of ties, i.e. deep and wide, formal and informal. Through different types of ties, InnoFlex initiates innovation projects and communicates with various outside partners, and proactively engages in activities relying on core competencies such as textile construction, furnishing, upholstery design and technology, etc.

Cell A shows InnoFlex's formal deep ties with long-term partners based on exclusive agreements and long-term contracts. These partners are usually global customers and suppliers. InnoFlex's value creation and innovation rely heavily on collaborating with world leading furniture or design customers that always open new areas in the industry. InnoFlex finds it needs to be there together with these big customers wherever there is a new business area, and it is obliged to proactively interact and offer new ideas to its

customers. On the other hand, InnoFlex outsources its textile production to a set of qualified suppliers in Europe and China rather than do the production itself.

Informal ties are needed to maintain deep ties (Cell B). InnoFlex regards key account management as one of the core processes, which means that it needs to ensure long-term relationships. Also, InnoFlex should be able to bring benefits for both customers and suppliers based on continuous innovation. Wide ties keep a firm from locking-in existing networks and encourage more innovation potential from. As shown in Cell C and Cell D, InnoFlex never stops looking for new opportunities for innovation and cooperation, either through formal contract-based cooperation with new partners, or communicate informally with potential partners from various areas.

Table 7.1. Multifirm Ties Enabling Open Innovation.

	Formal	**Informal**
Deep Ties (exploitation)	**A**. Exclusive agreements or contracts with selected key account customers and qualified suppliers, aiming at continuous innovation on products and processes. *E.g. 1. "InnoFlex targets its product development at around 50 selected key account customers accounting for around 55% of the total revenue" (Annual report 2009/10, pp: 10).* *2. "InnoFlex needs to input a lot of money when cultivating a supplier. For example, we need time to let them be familiar with InnoFlex's quality system. Their engineers may have different experiences and levels of skills, so we have to train them to be qualified for InnoFlex's working pace, e.g. lead-time, production, and plan, and all steps should be synchronized and coordinated. All these need time."* *3. InnoFlex and Pera (a leading innovation advisor), have jointly developed projects targeted at improving InnoFlex's business performance and innovation potential (Annual report 2006/07, pp: 15; Annual report 2007/08, pp: 14).*	**B**. Recognizing key account management as a core process. Socialization and dialoguing with long-term partners besides formal projects, such as visiting key accounts regularly, ensuring each key account and supplier's benefits; developing potential for future cooperation. *E.g. 1. "We need to visit or contact our partners now and then."* *2. "Not only the owner of the supplier, but also the employees such as engineers, workers, salesmen. You know, sometimes engineers or workers may not care about your order, so the personal relationships may determine whose order has the prioritization."* *3. "I will bring some invisible gifts. For example, the dialogue between the engineer from our supplier and me can be regarded as an informal training experience....What I say (to the design companies in China) may bring some new ideas and concepts on design or their products or even broaden their horizons."* *4. "InnoFlex must have market insight into and be in close contact with the entire value chain to produce solutions*

		adding value for customers and users (Annual report 2005/06, pp: 43)."
Wide Ties (exploration)	**C**. Seeking new competent partners, and cooperating on identifying new business opportunities and possibilities on innovation. *E.g. 1. "We pre-discuss with our engineer and team from Denmark from here. We inspected the facility, and looked and evaluated the machines, and say what is good and what is not good and what can be used and what cannot be used. Then we will tell them basically where we would like to have our products to be made."* *3. One designer got inspiration from the car industry, and introduced the Electro Welding technology in the car industry to a new project with two clients (Annual report, 2006/07, pp: 12).*	**D**. Engaging in various communication opportunities and searching knowledge from various resources, such as forums, exhibitions, research collaboration with universities, etc. *E.g. 1. "We go to exhibitions and searching online."* *2. "InnoFlex's designers are constantly on the lookout for new materials, new technology and, not least, new methods of promoting the interplay between furniture and upholstery fabrics" (Annual report 2006/07, pp: 12).*

Source: Adapted from Vanhaverbeke, 2006.

5.2 Network Organization

The previous section has made sense of an SME's open innovation under the multifirm context. In this section, the focus will be moved from outside of the firm to its internal organization. InnoFlex's organizational design is an application of network organization to an SME. The main characteristics of InnoFlex's organization are: autonomy, flexibility, market mechanism, and interdependency.

First, as mentioned in the case description, a unit is an independent profit center with its own mission statements, targets, strategies, action plans and budgets. That is to say, each unit has high degree of autonomy which can reduce dependency on the top management, and at the same time, each employee is empowered to take the initiatives to bring about innovation and "speak things into existence".

Second, flexibility is in line with autonomy. To elaborate more, here "flexible" means: first, each unit is easier to change and take actions faster; second, each unit and employee is obliged to seek business and innovation opportunities proactively rather than waiting for jobs; third, employees are encouraged to define their job roles rather than waiting for arrangements from top managers; fourth, whenever there is a project, suitable units and external partners will be invited to form a network to carry out the project, rather than

fixed units, which also shows the main features of a "dynamic network". Since the whole organization is quite flexible, and the job roles are not always specific and standardized, employees will start thinking what can be done, which will possibly generate innovative ideas.

Third, there are market transactions between different units. Thus, InnoFlex is able to track the value creation clearly and optimize resource allocation. For example, if one unit needs supports from another unit, it should pay a commission to compensate for the efforts of the collaborating units. However, when mentioning market mechanism, normally competition will be included. In this case, each unit has its own expertise, but they are complementary and interdependent to each other in nature which creates a basis for supporting each other. Thus, though there is an internal market, units are not competing with each other on the same part of the value chain or striving for customers with each other. The only competition between different units may be the ability to create values.

To conclude, this organization prioritizes innovation and has proved its advantages so far in these aspects. First, this organization can fully mobilize every employee's enthusiasm. Second, the value creation can be seen clearly between different units. Third, since employees in different units are working proactively, innovation will be generated from interaction and cooperation among different units and with outside partners. One employee appraises the advantage of the organization as,

> I would say that probably, if we had not changed at that time, we would have been dead now.

5.3 Orchestration Capability in Multifirm Networks

In the following two sections, the paper elaborates the orchestration capability at two levels, i.e. multifirm innovation networks and internal network organization, and from three core processes: knowledge mobility, innovation appropriability, and network stability (See Table 7.2). Illustrative data are shown in Appendix 1 and 2.

The first level is multifirm innovation networks. According to Table 7.2, enhancing knowledge mobility firstly requires a basis that comprises heterogeneous and complementary knowledge sources. However, one thing interesting is that the potential partner can't be too strong to cooperate with. As mentioned by an employee from InnoFlex China, some Chinese suppliers are strong enough to develop advanced products and have got a lot of orders, so they don't need InnoFlex's technology and orders. Indeed, abilities of firms should match each other. Here "match" means not only complementary knowledge is needed, but also the extent of profundity and richness of knowledge should be in step. As a result, in this case, InnoFlex should keep its pace with its world leading customers in order to match the customers' requirements and capabilities. Since InnoFlex is supplying the world leading design companies or furniture companies, it should be able

to design and produce the world leading product to be integrated into the customers' products. Enhancing knowledge mobility is also about "understanding", which requires both effectiveness and efficiency in understanding. Effectiveness means grasping the essence of what others mean, while efficiency means understanding quickly. In this case, InnoFlex needs to sense the industry trend together with its customers, select useful external information to develop new business opportunities, and cultivate its suppliers in order to improve the overall performance of its networks rather than only improving its own ability.

Table 7.2. Orchestration capability at both intra-and inter-organizational levels.

Levels / Orchestration Capability	**Multifirm Innovation Networks**	**Internal Network Organization**
Knowledge Mobility	1. Matching: complementary knowledge and in step with each other. 2. Understanding: Effectiveness and Efficiency.	1. Knowledge sharing and idea generation. 2. Employee-driven innovation.
Innovation Appropriability	1. Mutuality: bringing mutual benefits and visions. 2. Negotiating skills: bargaining and balancing. 3. External brokering skills	1. Tracking value creation. 2. Facilitating. 2. Internal brokering skills.
Network Stability	1. Long-term contracts and agreements 2. Risk sharing and problem solving. 3. Building trust externally: Social relationships, expertise and reputation.	1. Creating overall vision and strategy. 2. Innovation culture. 3. Building trust internally.

The second key process is *innovation appropriability*, which can be achieved through ensuring mutual benefits, negotiating skills and brokering skills. First, as an orchestrator, InnoFlex needs to identify customers' and suppliers' needs, and then provide them with visions that they will get something new and especially real benefits from the innovation cooperation with InnoFlex. Second, within an innovation network, there are tensions or even conflicts between different partners since there are different goals and working styles. Thus, the firm needs to have some *negotiation skills*, i.e. bargaining power and balancing skills with other partners in order to reduce opportunistic behaviors that will harm the cooperation as well as balancing interests of divergent actors. The most important issue in innovation appropriability is the brokering skills, i.e. *external brokering skills* in this situation. Brokering skills here means the orchestrator has to identify highly distributed useful resources and information in a network, and try to assemble and integrate them in order to solve problems and generate innovation. InnoFlex's innovation network consists of external independent customers, suppliers and other partners, there has neither a central office, nor organizational chart or vertical

integration, thus the whole network can be regarded as a quasi-virtual enterprise, where InnoFlex works and sees itself as a broker. According to the social network theory, structural holes are the source of value added, and actors across structural holes will generate advantages (Burt 2000). As a result, InnoFlex's external innovation networks with customers and suppliers, provide it with an advantageous position (structural holes) alongside the whole value chain, and a richer information and knowledge pool than other separated firms, which suggests that a company like InnoFlex can enhance innovation appropriability by working as a broker bringing resources together and later transfer results to the larger operating system.

The third process is *network stability*, which will be achieved through: long-term contracts or exclusive agreements (deep ties in Cell A, Table 7.1); risk sharing and problem solving; and trust building. InnoFlex need to invest a lot to develop a new qualified supplier, and also to maintain the collaborations with world leading customers, thus the contracts or agreements are usually long-term and in detail in order to ensure the a stable relationships with each other. Wherever there is cooperation, there will be risks or problems. It is not only important for the orchestrator to share benefits with partners, but also important to share risks and solve problems proactively. It is quite important to take the responsibility voluntarily rather than blaming others. Actually, *risk sharing* and *problem solving* are all related to *trust building*. Generally speaking, trust means positive expectations on one's integrity, fairness and good faith, and it can be derived from: social relationships, reputation and expertise in one area. InnoFlex's professional knowledge in its niche creates trust for both customers and suppliers. Customers need InnoFlex's help on improving existing products and new product development, while suppliers want to improve their own knowledge through cooperating with InnoFlex. Reputation is related to InnoFlex's behavior, which are proactively cooperation as well as timely payment and deliver. Besides, according to one manager's experiences, contracts are useless sometimes, while trustful relationships provide more powerful guarantee.

While stability through Cell A in Table 7.1 is important, dynamics is equally important. The dynamics of the network can be visualized and demonstrated by looking at Table 1 as a portfolio of partners with different affiliations to InnoFlex. While stability is primarily derived for Cell A, dynamics stems from Cell D with gradual movements through Cell C and D to become the future stability partnership. Thus, it is crucial for InnoFlex to have a balance between the four kinds of ties.

5.4 Orchestration Capability in a Network Organization

The second level is internal network organization. In a network organization, there is few hierarchy or command from the top management, thus how to make autonomous units work together towards a common goal requires orchestration capability inside the firm. This paper will then apply theories on orchestration capability to a network organization.

Promoting *knowledge mobility* in a firm will create a rich knowledge basis for different units, thus bring in innovation potentials. The key issues are: *knowledge sharing*, *idea generation*, and *employee-driven innovation*. Since the whole organization is quite flexible, thus there will be multiple information flows rather than top down. Through social communications, project cooperation, IT systems, meetings and workshops, etc., knowledge is shared among Danish and Chinese employees. Through knowledge sharing, new ideas are generated and then discussed either with colleagues or put up in an open IT system. Promoting knowledge sharing is also related to competent employees. If every employee feels it is obliged or empowered to share and express his/her ideas, knowledge will be better mobilized inside a firm, which is recognized by InnoFlex as employee-driven innovation.

In this case, different units are highly independent, thus the *innovation appropriability* means that each of the units should be able to benefits from cooperating with other units. Market transactions between different units create basis for *tacking the value creation* from an innovation project. Within a network organization, the role of management has to change from directing or commanding to *facilitating*. In this case, the top managers of InnoFlex and the InnovationUnit usually act as a facilitator to help different units to cooperate with each other on innovation, or support them to figure out the direction in which they are going. Similar to external brokering skills, *internal brokering skills* are needed, which means the capability to find suitable units or people with the resources needed. In the InnoFlex case, one thing interesting is the ProjectUnit is a virtual business unit, and whenever there is a project initiated, a project manager need to invite suitable inside units and then these units will "meet" at the ProjectUnit to cooperate with each other. After the project is finished, documents and records are kept in the ProjectUnit.

Network stability is needed to maintain the flexibility and innovativeness of the network organization. In this case, different units can make their decisions independently, thus how to unite them is a main issue. Network stability can be enhanced through creating *overall vision and strategy*, promoting *innovation culture* and *building trust internally*. Different units' own strategies and specific missions should in line with the overall strategy of InnoFlex. Besides, a strong corporate culture will also act as an invisible hand that unites different units, which means that units are guided to work together under a common identity, i.e. InnoFlex. In order to keep innovative, InnoFlex is promoting a corporate culture aiming at innovation, which not only unites different units, but also exploits each employee's full potential in innovation. One principle for a network organization is market transactions between different units. In this case, a unit can choose to cooperate with external partners or even competitors. Thus internal trust, which means internal confidence on each other's ability, is essential to unite different units. Internal trust is built on long-term cooperation experiences as well as expertise.

6. Discussion and Reflection

6.1 Does Boundary Matter?

This paper analyzes two levels of networks, one is multifirm innovation networks, and the other is an internal network organization. If we take a look at the new trend in organization theories, we can see that a firm's boundary is blurred (Child et al. 2005; Miles and Snow, 1986; Snow et al., 2010). According to resource-based view (Barney, 1991; Wernerfelt, 1984) and resource dependency theory (Pfeffer and Salancik, 1978), critical resources, especially knowledge for innovation may be located outside a firm, thus there are resource dependency relationships between firms and then networks are formed. Following this logic, one unit of a firm (in this case, a "unit") may have deeper and more resource dependency relationships with external partners than internal units, and at the same time, the unit may engage in different innovation networks. Thus from this point of view, it is no need to mention the boundary of a firm. However, this paper divides between multifirm networks and internal network organization. The boundary is divided by firm's ownership, which creates a common identity and value for internal units, i.e. "InnoFlex" in this case. This common identity also brings a common goal and mind-set for internal units, which can be quite different from other firms within the network even though they are interdependent and pursuing mutual benefits.

6.2 Internal, Stable and Dynamic Networks

This paper discusses an SME's orchestration capability in two levels of innovation networks. The internal network organization corresponds in the characteristics of an internal network as defined by Miles & Snow (1992). In terms of the multifirm network, InnoFlex has both stable and dynamic partners. The stable network is constructed by InnoFlex and its long-term contracted customers and suppliers, and the dynamic network brings various communications and opportunities. Also, the internal network organization can be regarded as both stable and dynamic, since all the units are working under a common and stable identity, while at the same time temporarily gathered for innovation projects. As a result, the three types of networks are overlapping with each other. Moreover, when relate the open innovation theory with Miles & Snow's typology, we can see that formal and wide ties create stable network, while informal and wide ties may create dynamic ties.

6.3 Interplays

This paper applies orchestration capability in two levels. The three processes that have to be orchestrated in an innovation network, i.e. knowledge mobility, innovation appropriability, and network stability, are also positively related to each other (Dhanaraj and Parkhe, 2006). Within the same level, the three processes reinforce each other. However, the interplay between the two levels' orchestration capability remains unclear. Generally speaking, successful internal orchestration will help a firm to be a prospector,

thus will enhance its role as an orchestrator within a multifirm innovation network. That is to say, internal orchestration capability may positively impact external orchestration capability. However, the cross-level interplay between each element is even more complex. Here we propose that internal network stability and external network stability may positively impact each other, because a stable firm may concentrate better on innovation, and a stable external environment will creates basis for more innovation and value creation for each firm inside and thus reduce the possibilities that make a firm unstable internally. Similarly, if there is only internal knowledge mobility, the firm will be isolated in a network and lose its external orchestration capability, and gradually it may lose its internal orchestration capability due to less innovation appropriability from outside. There is space for future research.

6.4 Who is the Orchestrator?

This paper shows an SME's orchestration capability in two levels. However, who are the orchestrators? Within a multifirm network, the orchestrator is always regarded as a hub firm, focal firm, flagship firm or lead firm (Ritala et al., 2009). In InnoFlex's case, since it has a network organization, every internal unit, i.e. unit can be an orchestrator since it is empowered to do so whenever they are cooperating with external partners. Yet internally, the orchestrator can be InnoFlex' top manager who guides each unit inside to work towards a common goal and facilitates them to be more innovative. Moreover, whenever there are conflicts through cooperation, it is each project members' obligation to solve the conflicts. As a result, within a network organization, each competent employee of InnoFlex can be an orchestrator in both internal and external networks.

However, one thing interesting is that the CEO of InnoFlex is not located in any specific units. To some extent, the CEO is still high up there. Why not include the CEO in a unit with the function of orchestration or facilitation, maybe called StrategyUnit or OrchestrationUnit?

6.5 Limitations of Orchestration Capability

The definition of orchestration capability actually has two parts: one is innovation generation and finding innovation partners, the other is maintaining innovation networks and extracting more values. However, among the three elements, it seems only knowledge mobility is partly related to innovation generation. Also, orchestration capability has a presumption that a firm has already owned some resources, but has nothing to do with how to generate innovation resources. Thus, the framework of orchestration capability has limitations, and if a firm wants to become a successful orchestrator, we shall integrate more theories in future research.

7. Conclusion

This paper discovers the open innovation reality of an SME, and shows how an SME from traditional industry aiming at being a prospector constructs an internal network

organization and a multifirm network to utilize resources in and out of the firm, which can be seen as a contribution on integrating open innovation theory and organization theory. In order to ensure innovation output, an SME needs to apply orchestration capability both internally and externally, which is another contribution of this paper. Based on the analysis of this paper, we can get a more specific understanding on orchestration capability, especially the experiences that can be used by an SME.

References

Baker, W.E. (1993): The network organization in theory and practice. In Nitin Nohria and Robert G. Eccles (eds.), *Networks and Organizations*, 397-429, Harvard Buiness School Press: Boston.

Barney, J. (1991): Firm resources and sustained competitive advantage, *Journal of management*, 17(1): 99-120.

Boutellier, R., Gassmann, O. & von Zedtwitz, M. (2008), *Managing Global Innovation: Uncovering the Secrets of Future Competitiveness* (3rd Ed.), Springer, Berlin Heidelberg.

Burt, R.S. (2000): The network structure of social capital, *Research in Organizational Behavior*, 22: 345-423.

Capaldo, A. (2007): Network structure and innovation: the leverage of a dual network as a distinctive relational capability, *Strategic Management Journal*, 28: 585-608.

Cantwell, J. & Piscitello, L. (1999): The emergence of corporate international networks for the accumulation of dispersed technological competences, *Management International Review*, 1: 123-147.

Chesbrough, H. (2003): The era of open innovation, *MIT Sloan Management Review*, Spring, 44(3): 34-41.

Chesbrough, H. & Appleyard, M.M. (2007): Open innovation and strategy, *California Management Review*, Fall, 50(1): 57-76.

Chesbrough, H. & Teece, D.J. (2002): Organizing for innovation: when is virtual virtuous, *The Innovation Enterprise*, August: 127-131.

Chesbrough, H. & Rosenbloom, R.S. (2002): The role of the business model in capturing value form innovation: evidence from Xerox corporation's technology spin-off companies. *Industrial and Corporate Change*, 11(3): 529-555.

Chesbrough, H., Vanhaverbeke, W. & West J. (2006): *Open Innovation: Researching a New Paradigm*, Oxford University Press, New York.

Child, J., Faulkner, D. & Tallman, S. (2005): *Cooperative strategy: Managing alliances, networks, and joint ventures*, Oxford University Press, USA.

Dhanaraj, C. & Parkhe, A. (2006): Orchestrating innovation networks, *Academy of Management Review*, Vol. 31(3), pp. 659-669.

Freeman, C. (1991), Network of innovators: a synthesis of research issues. *Research Policy*, 20: 419-514.

Gassmann, O., Enkel, E. & Chesbrough, H. (2010): The future of open innovation, *R&D Management*, 40(3): 213-221.

Grant, R.M. (1996): Toward a knowledge-based theory of the firm, *Strategic Management Journal*, 17: 109-122.

Hagedoorn, J. (2002): Multifirm R&D partnerships: an overview of major trends and patterns since 1960, *Research Policy*, 31(4): 477-492.

Holm, D.B., Eriksson, K. & Johanson, J. (1996): Networks and cooperation in international business relationships. *Journal of International Business* Studies, 27(5): 1033-1053.

Hu, Y. & Sørensen, O.J. (2011a): Innovation in virtual networks: evidence from the Chinese online game industry. *Journal of Knowledge-based Innovation in China*, 3(3): 198-215.

Hu, Y. & Sørensen, O.J. (2011b): In Search of a Network Organization for TNC's Innovation, Paper presented at *CICALICS Academy 2011*, Beijing, China.

Håkansson, H. & Laage-Hellman, J. (1984): Developing a network R&D strategy. *Journal of Production Innovation Management*, 4: 224-237.

Håkansson, H. & Snehota, I. (1989): No business is an island: the network concept of business strategy, *Scandinavian Journal of Management*, 5(3): 187-200.

Jarillo, J.C. (1988): On strategic alliances. *Strategic Management Journal*, 9 (1): 31-41.

Jarvenpaa, S.L. & Ives, B. (1994): The global network organization of the future: information management opportunities and challenges. *Journal of Management Information Systems*, Spring, 10 (4): 25-57.

Lee, S., Park, G., Yoon, B. & Park, J. (2010): Open innovation in SMEs-an intermediated network model, *Research Policy*, 39: 290-300.

Miles, R.E. & Snow, C.C. (1986): Organizations: New concepts for new forms, *California Management Review*, Spring, XXVII (3): 62-73.

Miller, R. (1994): Global R&D networks and large-scale innovations: the case of the automobile industry. *Research Policy*, 23: 27-46.

Pfeffer, J., & Salancik, G.R. (1978): *The External Control of Organizations: A Resource Dependence Perspective*, New York: Harper & Row.

Ritala, P., Armila, L. & Blomqvist, K. (2009): Innovation orchestration capability – defining the organizational and individual level determinants, *International Journal of Innovation Management*, 13 (4): 569-591.

Scott, W.R. & Davis, G.F. (2007): *Organizations and organizing: Rational, natural, and open systems perspectives*, Pearson College Div.

Schilling, M.A. & Phelps, C.C. (2007): Multifirm collaboration networks: the impact of large-scale network structure on firm innovation, *Management Science*, 53 (7): 1113-1126.

Simard, C. & West, J. (2006): Knowledge networks and the geographic locus of innovation, in Chesbrough, C., Vanhaverbeke, W. & West, J. (Eds), *Open Innovation: Researching a New Paradigm*: 220-240.

Snow, C.C., Fjeldstad, Ø.D., Lettl, C. & Miles, R.E. (2011): Organizing continuous product development and commercialization: the collaborative community of firms model, *Journal of Product Innovation Management*, 28(1): 3-16.

Vanhaverbeke, W. (2006): The interorganizational context of open innovation, in Chesbrough, C., Vanhaverbeke, W. & West, J. (Eds), *Open Innovation: Researching a New Paradigm*, Oxford University Press, UK: 205-219.

von Zedtwitz, M. & Gassmann, O. (2002): Market versus technology drive in R&D internationalization: four different patterns of managing research and development, *Research Policy*, 31: 569-588.

Wernerfelt, B. (1984): A Resource-based View of the Firm, *Strategic Management Journal*, 5: 171-180.

Wincent, J., Anokhin, S. & Boter, H. (2009): Network board continuity and effectiveness of open innovation in Swedish strategic small-firm networks, *R&D Management*, 39 (1): 55-67.

Zander, I. (2002): The formation of international innovation networks in multinational corporation: an evolutionary perspective, *Industrial and Corporate Change*, 11 (2): 327-353

Appendices

Appendix 7.1. Orchestration Capability in Innovation Networks: Illustrative Quotes.

Knowledge mobility 1. Matching: complementary knowledge and in step with each other. 2. Understanding: Effectiveness and Efficiency.	1. Matching: complementary knowledge and in step with each other *"You should say that they (the suppliers) all get their own specialties and expertise."* *"They (the suppliers) are willing to listen to InnoFlex or tractable."* *"The supplier's production capacity matches InnoFlex's requirements and needs exactly. You know, some of the suppliers are really strong in technology and devices, but they don't need your order or design ideas because they are strong enough to do everything themselves. Some of them may have shortcomings, but when they marry InnoFlex, there will be a perfect supply chain."* 2. Understanding: Efficiency and Effectivity *"Well, it is about communication and speed."* *"If you can't communicate quite quickly and disable to include all the records with all the engineers or quickly understand and see what they want, then the project will probably land here."* *"Value-adding key account management depends on the quality of the regular identification of customer needs (Annual report 2005/06, pp: 43)."* *"(In terms of business development, InnoFlex) should first understand their products then suggest which fabric and products of ours may look good in their products."*
Innovation Appropriability 1. Mutuality: bringing mutual benefits and visioning. 2. Negotiating skills: bargaining and balancing. 3. External brokering	1. Mutuality *"In one word, InnoFlex is Niche Company which focuses on fabrics for office furniture. As an employee from a European professional company, I need to bring something new to our customers otherwise they may not choose InnoFlex."* *"Value-adding key account management depends on the quality of the regular identification of customer needs (Annual report 2005/06, pp: 43)."* *"Customer satisfaction among selected key account customers is regularly surveyed (Annual report 2005/06, pp: 43)."* 2.Negotiating skills

skills: finding the suitable problem solver.	*"That's all about bargaining power."* *"It is about carrot and stick."* *"If that (copying) happened you are risk at losing all your products for export …I would take them away from you if you start copying us."* *"It's again about balancing out."* *"I have to admit that our supplier may become our competitor in the future…Our whole supplier group may be competitive enough to be our competitor, but single one of them is not strong enough now."* 3. Brokering *"Generally speaking, InnoFlex now is a logistics company."* *"Basically, InnoFlex can do everything for the customer whenever there is a need. InnoFlex will try to find the solution for the customer either by doing it inside InnoFlex or outsourcing it to a proper problem solver as long as it fits with InnoFlex's overall strategic mission, vision and strategy.* *"FurnUnit is intended as a One Stop Shop for furniture production in abroad. When customers choose to outsource to us, we can take care of the entire process from start to finish. (Annual report 2010/11, pp:20)"*
Network Stability 1. Long-term contracts and agreements 2. Risk sharing and problem solving. 3. Building trust: Social relationships, expertise and reputation.	1. Long-term contracts and agreements *"KAM-Unit's core competencies involve the co-ordination and optimization of the co-operation between the individual key account's organization and InnoFlex's business units for the purpose of fostering the highest long-term value for each key account and KAM-Unit (Annual report 2006/07, pp: 20)".* *See also Cell A in Table 1* 2. Sharing risks and problem solving *"Whenever there is a problem, InnoFlex will sit together with the supplier and try to solve the problem together."* *"Maybe share the loss, or InnoFlex undertake all the loss. InnoFlex will never pass the buck to our supplier, and at this point, InnoFlex is quite generous."* *"Not much should be left for our surprises".* 3. Building trust: social relationships, expertise and reputation *"If you like a person, that's chemistry, and you can feel that they respect you, and over time, you respect them also.*

	That's very important, you can feel that we have the same, common goal; otherwise you wouldn't have chosen that person at the first place to be a supplier." *"We should make the potential suppliers trust us and believe that we are a very competitive company which can bring them opportunities and substantial profits".* *"To be an excellent customer, the first rule is to ensure the timely payment. InnoFlex has a good reputation on timely payment."* *See also Cell B in Table 1.*

Appendix 7.2. Orchestration Capability inside a Network Organization: Illustrative Quotes.

Knowledge Mobility 1. Knowledge sharing and idea generation 2. Employee-driven innovation	1. Knowledge sharing and idea generation *"We have meetings every week from where we share knowledge. I do a lot of initiative to promote the knowledge share, but knowledge share is also a challenge in China."* *"We share knowledge and information, and of course communication is needed, which means that you may communicate within a project, your group, or Danish colleagues from other groups."* *"InnoFlex intends to attract and retain well-qualified employees to foster innovation and growth in their international endeavors. For this purpose, knowledge sharing is an important parameter (Annual report 2010/11, pp: 9)."* *"There is a software system called 'InnoFlex 360', aiming at collecting ideas from employees and idea generalization. One part of this software is called 'idea-spinning' in which employees can put their thinking and ideas inside."* 2. Employee-driven innovation *"The current organization can fully mobilize every employee's enthusiasms."* *"Now every employee is obliged to be innovative."* *"It is always you to take the initiatives rather than sit and waiting for other people give you instructions, and also every employee should take the initiative to find a customer proactively."* *"You are responsible and you are empowered to do this."*
Innovation Appropriability 1. Tracking value creation 2. Facilitating 3. Internal brokering skills	1. Tracking value creation *"You can see the value creation clearly between different units."* *"FinanceUnit participates actively in the visibility of value creation in the entire group and handles the company's financial management and risk management (Annual report 2010/11, pp: 8)."* 2. Facilitating *"This organization needs some units working as a facilitator."* *"Of course, they can come to me, but I am not the problem solver. I can tell them, I want them to call the persons in headquarter directly in charge."* *"The overall role is facilitator or supporter…he will set up some screens alongside an employees' track in the right direction."*

	3. Internal brokering skills *"…a project manager will try to encourage and invite different units to join a project."* *"There is nobody in the ProjectUnit now …all the important emails and meetings based on projects or tasks are recorded there."*
Network Stability 1. Creating overall vision and strategy 2. Innovation culture 3. Building trust	1. Creating common goals: overall vision and strategy *"The mission, vision and strategy are very general, so it is depending on each unit to make their own strategies and specify their activities under the overall umbrella. Each unit's strategy must be in line with the overall internal strategy of InnoFlex, and also be able to attract and offer their services to external customers."* 2. Innovation culture *"The glue between units is InnoFlex's culture."* *"An innovative culture should be able to: exploit the full potential of our employees' competences, and then 'speak things into existence'."* *"(We) have created a language consist of a set of words to illustrate innovative culture, for example: inception, stakeholder management, workshop, facilitation, change management, process leadership as opposed to project innovation, employee-driven innovation, leadership as opposed to management, etc."* 3. Building trust *""That takes time. You need personal relations, and when the trust started, people start to share."* *"They had not been that loyal to us lately, we need to change this. We need to improve our service and our speed market, and this is what we are looking for."* *"The units can find outside partners, but it takes time and cost to build a relationship with an outside partner, to make sure they are suitable and qualified, and to check whether they can work proactively together with InnoFlex. As a result, since every unit already knows that internal units have the professional knowledge and there are trustful relationships between them, the internal units are still the first choice."* *"If you really follow the business model, I should be able to sell it even to the competitor … but I haven't tried."*

7.3 Reflections on Paper 5

A network organization is a combination of strategy, organizational design and management process. This is clearly showed and proved in this paper (See also the framework in Figure 7.1). A network organization is compatible with the strategy of innovation, and from the case of InnoFlex, we can see that its organizational design has facilitated its innovation performance which is shown in its continuous sales growth, product improvement and development, and awards on innovation.

This paper contributes to both research questions, i.e. the meaning and design of network organization for innovation, and the management issues. The case company adopts an internal market to optimize internal resource allocations and encourage bottom-up innovation, which is in line with one streams of definition on network organization that suggests the adoption of market mechanism. InnoFlex's internal network organization design also reflects what I labeled as "*market-led network organization*" in Chapter 6 (Paper 4).

For an SME like InnoFlex, it is not possible to cover many parts of a global value chain or all functions needed to an innovation project, thus an open innovation strategy that utilizes complementary resources and capabilities from external partners are an optimal choice for an SME to go global or even transnational. Thus, together with an internal network organization, an interorganizational innovation networks that relies on interdependence and mutual benefits are also parts of network organization. However, such a network consists of internal autonomous business units and different external partners cannot be administrated by an SME or even a big company, since its existence relies highly on interdependence, mutual benefits and trust, and within which every organization or business unit may have the power to influence others. Thus, the managerial role of a focal organization is changed to a softer version: from administrator to orchestrator.

Orchestration capability is shown in ensuring three aspects: knowledge mobility, innovation appropriability, and network stability. It originally only considers interorganizational innovation networks. However, from this case, we see that possibility of expanding it to a firm's internal network organization. This is actually one contribution of this paper. Moreover, conceptual framework of orchestration capability was given more specific meanings from this in-depth case study. Though it is a single case study that cannot provide statistical generation, it represent a typical situation and example showing how an SME develop a network organization to pursue its innovation strategy, and it could also happen to another company. Thus, I believe that the specified managerial issues in this study can provide implications for business managers especially when regarding network management.

8. Summary and Concluding Remarks

In this Chapter, the PhD dissertation will be concluded. The two main research questions will be reflected upon based upon summarizing the five papers. Then a framework that integrates all five papers will be proposed. This will be followed by a presentation of the contributions of this dissertation. Finally, the limitations of this dissertation and future research possibilities will be discussed.

8.1 Revisiting the Research Questions and Main Findings

Two major research questions of this PhD dissertation were proposed in Chapter 1,

1. *How do transnational corporations perceive/design a network organization to facilitate their global innovation?*
2. *To what extent and how can we manage a network organization?*

The first research question clarifies the meaning of network organization in both theory and practice, and based upon that, the second research question aims to explore the management of network organization. As *network organization* is an interdisciplinary research topic, it is difficult to cover every aspect of it when trying to answer the two research questions. As a result, this dissertation is comprised of five papers that focus on exploring five topics related to the main research questions, i.e. a literature review of the network organization for innovation; the internationalization of the triple helix; the generation of relational competitive advantages from strategic technological partnerships; categorization of internal network organizations; and orchestration capability. Table 8.1 gives an overview of the main findings of each paper and their relationships with the two main research questions. In the following paragraphs, I will briefly summarize the findings of each paper, and more importantly, how each paper reflects upon the research questions.

Table 8.1. Summary of the main findings of each paper.

Paper No.	Title	RQs	Main Findings
1	In search of a network organization for innovation: A literature review	1	• There are many different understandings and definitions of network organization for innovation. • Network organization is an interdisciplinary research topic. • Network organization can be understood from three levels: networks as innovation contexts, interorganizational and intraorganizational network organizations.
2	Triple helix going abroad? The case of Danish experiences in China	1	• Expanding the existing theory on the triple helix framework by adding an internationalization dimension. • The trend of internationalization of the triple helix has three stages: pioneering stage, exploration stage and integration stage.
3	Gaining relational competitive advantages: A conceptual framework on rents generation and appropriation	2	• A strategic technological partnership can create relational competitive advantages for partnering firms. • The two essential stages of relational competitive advantage are relational rents generation and relational rents appropriation. • Three coordination modes, i.e. trust, contract and resource commitments are usually integrated in the management of a strategic technological partnership.
4	Exploring network organizations in practice: The duality and triplicity of market, hierarchy and network	1	• There are different ways of designing an internal network organization to facilitate TNCs' global innovation. • Based on different relationships between the three fundamental coordination modes, i.e. market, hierarchy and network, there are three types of network organizations, i.e. market-led, directed and culture-led network organizations. • The triplicity of hierarchy, market and network within an organization has become a common phenomenon.
5	Open innovation in networks: specifying orchestration capability for SMEs	1 & 2	• This research shows how an SME designs an internal network organization by adopting market mechanism, and interfirm innovation networks with external partners. • The management style regarding network organization needs to be changed from administration to orchestration. • Orchestration capability that focused on knowledge mobility, innovation appropriability, and network stability, can be applied in an internal market-led network organization.

Paper 1 is a literature review that investigates the concept of network organization for innovation. The paper provides a foundation and acts as a theoretical point of guidance for the whole dissertation. Based on reviewing articles published in top journals and some other influential literature, I find that there are many different and even contradictory ways of defining network organization. One major debate is the *boundary* of network organization. Many scholars tend to break the existing legal boundaries between companies or organizations since different levels of networks are connected by resource network and social networks. Thus, a network organization for innovation refers to both an innovation network that consists of different firms or organizations (interorganizational network organization) and an internal network organization aiming at innovation (intraorganizational network organization). Moreover, since the business market can be regarded as consisting of networks of firms/organizations, the business context for innovation can be referred to as a macro network organization. As a result, one of the major findings of Paper 1 is that there are three levels necessary to understand network organization, i.e. networks as the global innovation context, interorganizational network organization, and intraorganizational network organization.

A second major debate on defining network organization is the debate on its *content* regarding the intraorganizational level, i.e. whether network organization is a new organization that is radically different from previous organizational forms such as functional, divisional, and matrix organizations. In the existing literature, one stream of scholars proposes that network organization is a new organizational form that evolves from traditional organizational forms such as functional organization and matrix, and has almost no internal hierarchies. Among these scholars, some of them argue that an internal market mechanism is a must for a network organization; while the other scholars emphasize collaborative features such as trust, interdependence, knowledge sharing, and mutual benefits among internal business units. Another stream of scholars argues that network organization is merely delayering and reducing hierarchical structures within an organization, and hierarchy has and will remain in the organization whether there is an internal market mechanism or not.

Based on Paper 1's three-level framework, Paper 2, 3, and 4, respectively, explore the three levels of network organizations for innovation, i.e. network as innovation contexts; interorganizational network organization; and intraorganizational network organization. Paper 5 integrates both inter- and intra-organizational networks. The divergence of the content of an internal network organization is discussed in detail in Paper 4 and 5.

Paper 2 brings about an interesting discussion on the network context for global innovation by focusing on an emerging phenomenon, i.e. the internationalization of the triple helix between government, university, and industry (business). Here, we investigate the Danish triple helix's innovation activities in China, and find that the Danish governmental agencies, universities and the subsidiaries of TNCs have formed a triple

helix in China and are interacting with the Chinese triple helix actors. That is to say, the Danish triple helix has extended and internationalized to another nation.

The internationalization of the triple helix consists of three evolutional stages: pioneering, exploration and integration stages. In the pioneering stage, we see the establishment of each triple helix actor abroad, i.e. internationalization of companies, universities and governments. In the exploration stage, the three actors start to interact abroad with each other and collaborate with counterparties in the host country. In the integration stage, helix to helix collaboration is emerging.

This paper implies that TNCs are embedded in the global innovation context that consists of networks of companies, universities (research institutions) and governmental institutions. Such an innovation context provides TNCs with opportunities of utilizing global innovation resources in host countries, especially emerging economies. Thus, instead of struggling alone, TNCs may improve their innovation performance through networking with triple helix actors from both home and host countries.

Paper 3 moves to the interorganizational (dyadic) level, and explores how partnering companies create relational competitive advantages through a single case study on a strategic technological partnership between a Danish TNC and a Chinese firm.

The relational viewpoint of competitive advantages focuses on the dyadic or network level, and argues that competitive advantages may come from relational rents that alliance partners cannot generate independently (Dyer and Singh, 1998; Lavie, 2006). A strategic technological partnership can be seen as a quasi-network organization since partnering firms are interdependent, are trying to achieve a common goal that benefits both sides. , and are coordinated by the mechanism agreed upon by both parties. In order to achieve relational competitive advantages, partnering firms need to successfully generate relational rents and then make sure that the relational rents are appropriated to all members. From the single case study, we propose that the generation and appropriation of relational rents on the one hand relies on the integration of three coordination/governance modes, i.e. trustful relationships, resource commitment, and the legal contract. Likewise, partnering relationships are positively facilitated by having the right fit between partners, as well as the absorptive capacities and dissemination capabilities of member firms. This paper contributes to both the understanding and the management of network organization for innovation at the interorganizational level.

Paper 4 responds to the debate of the understanding and definition of an intraorganizational network organization proposed in Paper 1. Paper 4 explores the concept of network organization in practice through a multiple case study of three Danish TNCs that all declare they have an internal network organization. These three case companies' internal network organizations are following different principles and show

three disparate forms, i.e. market-led, directed, and culture-led network organizations. A market-led network organization substitutes internal hierarchy with market mechanism, and turns each business unit into a profit center. Directed network organization is promoted from a top-down process, and managers are supervisors of and responsible for the internal networking. Culture-led network organization can be seen as an improved version of a directed network organization, within which hierarchies are hidden behind the invisible guidance of corporate culture that encourages internal networking and bottom-up innovation initiatives.

Furthermore, the debate on network organization is fundamentally the divergent understandings of the relationship between three coordination modes, i.e. market, hierarchy, and network. The market-led and directed network organizations show the dualism of market and network, and hierarchy and network. Moreover, in practice, it is very common that market, hierarchy, and network are integrated and overlapping within a TNC, which can be referred to as the triplicity of market, hierarchy, and network. The balance of the three coordination modes within an organization is influenced by its current strategic focus and external business environment. In conclusion, instead of regarding market, hierarchy, and network as discrete and separate coordination modes, Paper 4 opens a door for further discussions on integrating them.

As the last paper of this dissertation, **Paper 5** not only shows how an SME adopts a transnational innovation strategy through establishing a network organization consisting of its own internal business units and external partners, but also explores the management of network organization through investigating the concept of orchestration capability (Dhanaraj & Parkhe 2006; Ritala, et al., 2009). In particular, this case company's internal business units are coordinated by an internal market mechanism. Within a network organization, since partnering firms or business units are interdependent to each other, no single individual or organization has the ability to fully control others. Thus, traditional administration such as giving commands or directions is not applicable to a network organization. As an orchestrator, the case company needs to achieve knowledge mobility, innovation appropriability, and network stability in both intra-and inter-organizational network organizations.

In conclusion, regarding the first research question, we may find different understandings on network organization both in theory and practice. Generally speaking, a network organization can be defined from three levels, i.e. network as innovation contexts, interorganizational level, and intraorganizational level. The disparities on how to design an internal network organization to facilitate global innovation are actually in line with the debate on the relationship between market, hierarchy, and network. It has already been a common phenomenon that companies integrate all three coordination modes.

Regarding the management of network organization, which is the main focus of the second research question, a traditional administration is not applicable for a network organization. In terms of the network context, no single company is able to manage the whole business context; thus, companies are required to adapt to the external environment by adjusting their strategies and organizations. In terms of inter- and intra-organizational network organization, business units or partnering firms are interdependent to each other since they hold complementary critical resources that are needed by the others. Therefore, no single organization can fully control others, but every organization has the chance of being an orchestrator that establishes and maintains network organizations, and through which the focal organization's innovation purpose can be achieved.

8.2 An Overall Framework

As stated above, the five papers are arranged according to the three levels of network organizations, i.e. networks as innovation contexts, interorganizational network organization and intraorganizational network organization. Moreover, each paper has its own contribution to the two main research questions of this dissertation. However, the relationship between the key concepts explored in all five papers remains undiscussed so far. Figure 8.1 provides an overall conceptual framework of this dissertation, liking the five papers together. Building on Paper 1, Figure 8.1 is divided into three levels of network organizations, i.e. the contextual level, the interorganizational level, and the intraorganizational level.

On the first level, i.e. networks as the global innovation context, the trend of internationalization of a triple helix constitutes the context for global innovation which enables TNCs to utilize global knowledge resources (Paper 2). Based on such a trend, the triple helix of government (G), university (U), and industry (I) from different nations are interacting with each other with the aim of promoting value-adding innovations and improving innovation performances.

The concept of context can be described in many ways. In most cases, context is described in a national frame, where the theory of the National Systems of Innovation (Lundvall, 2010) has been dominant. However, as this dissertation is concerned with the international dimension, our frame is more the global one. Existing literature is more limited when it comes to contextual studies. Recently, the concept of "the transnational community" (Morgan 2001) has emerged with a potential to become a contextual frame for global innovation although innovation has not yet been discussed within that framework. In this dissertation, I have contributed to the global contextual level by using the triple helix framework in an international perspective. Though each triple helix actor has its own internationalization path and rationale, their internationalization constitutes a global context with two potential synergies as clearly documented in Paper 2. The first

potential synergy is the usual helix synergy in the home market, i.e. the synergy from the interaction between the three helixes, i.e. industry (I), government (G) and university (U), now however taking place in a host country context. This synergy may help enhancing each triple helix actor's innovation performance in a host country. Moreover, forming such a triple helix "community" in a host country may help overcoming the liability of foreignness that all three helixes face. The second potential synergy is that of the collaboration between the Danish and the Chinese triple helixes. This could be the formation of the TH-TH collaboration as shown in Figure 8.1. The TH-TH collaboration may result in a specific project/program which integrates resources of triple helix actors from both countries, such as the greening of China[18] or the Sino-Danish Centre for Education and Innovation[19]. The TH-TH collaboration could also be that parts of the triple helixes collaborate across the two countries, such as an international strategically technological partnership consists of members from both countries as shown in Paper 3.

In conclusion, the advantages of using the triple helix framework as the contextualizing frame for global innovation are three: firstly, the framework is concerned with innovation; secondly, the framework includes actors that each have an internationalization agenda and rationale to build on; and the third advantage is that the context includes the core actor of this thesis, the TNC, and thus we have a natural bridge between the contextual level and the two other levels in Figure 8.1.

Within the triple helix to triple helix interaction, the innovation networks between companies from different countries such as strategic technological partnerships is the main research focus of Paper 3. The achievement of relational rents generation and appropriation may bring about sources of relational competitive advantages for partnering firms. On key issue related to relational rents generation and appropriation is the integration of three coordination/governance modes, i.e. resource commitment, contract and trust. If we move to a single TNC's internal organizational design, Paper 4 explores different patterns of designing an internal network organization for global innovation, i.e. market-led, directed, and culture-led network organizations. These three patterns of network organization also show the duality or triplicity of the three fundamental coordination modes, i.e. market, hierarchy, and network, within an organization

The term "three coordination modes" is mentioned and used in both Paper 3 and Paper 4. In Paper 3, the three modes refer to the integration of resource commitment, contract, and trust, while in Paper 4 they refer to market, hierarchy, and network. The six modes mentioned in the two papers can be grouped into three pairs: resource commitment-market, contract-hierarchy, and trust-network. The more critical resources, especially knowledge resources, are invested in a technological partnership by a firm, the

[18] http://www.ens.dk/en/policy/renewable-energy-cooperation-china/news-archive/chinese-delegation-visits-denmark-study-use
[19] http://www.sinodanishcenter.com/

less likely it will behave opportunistically and the more likely it wants to sustain the partnership. Thus, as a coordination mode, resource commitment uses economic means to regulate partnering firms' behaviors, which is in line with the market mechanism that optimizes resource allocation economically. Similarly, a contract is a legal way to restrain partnering firms' behaviors, which is in line with hierarchical relations such as contractual employment relations. Trust is a key feature of a network organization, which can be seen as a social way of coordinating partnerships.

While Paper 1 clearly showed that research on network organization could be divided into the three levels, it is interesting to note that when companies globalize, we tend to see a merge across different levels and a convergence between coordination modes/mechanisms. The TNCs globalizing through the establishment of overseas R&D subsidiaries may restructure its organizational design and adopt coordination mechanisms that originally belong to the market, i.e. creating internal markets; while the TNCs globalizing through externalizing activities may adopt coordination mechanisms that originally belong to the organization literature, i.e. establishing alliances and long-term relationships. Thus, we witness a merger of two streams of literature, i.e. the market/marketing literature and the organization literature, that in the past had little overlap and interest for each other since they focus respectively on what's happening outside and inside of an organization. This implies that when globalizing and thereby having more complex organizations, the TNCs enlarge their hierarchical "toolbox" by drawing on market as well as organization literature, and mix the mechanisms as is appropriate for the situation. As will be shown, the two globalization strategies that integrate both intra- and interorganizational network organizations also require overlapping capabilities, e.g. orchestration capabilities.

In order to create relational competitive advantages in interorganizational networks (Paper 3) and successfully manage an internal network organization, orchestration capability of the focal firm is needed at both levels (Paper 5). Generally speaking, orchestration capability is shown in three aspects, i.e. knowledge mobility, innovation appropriability, and network stability. In reality, knowledge mobility and network stability may improve relational rents generation, while innovation appropriability is in line with relational rents appropriation.

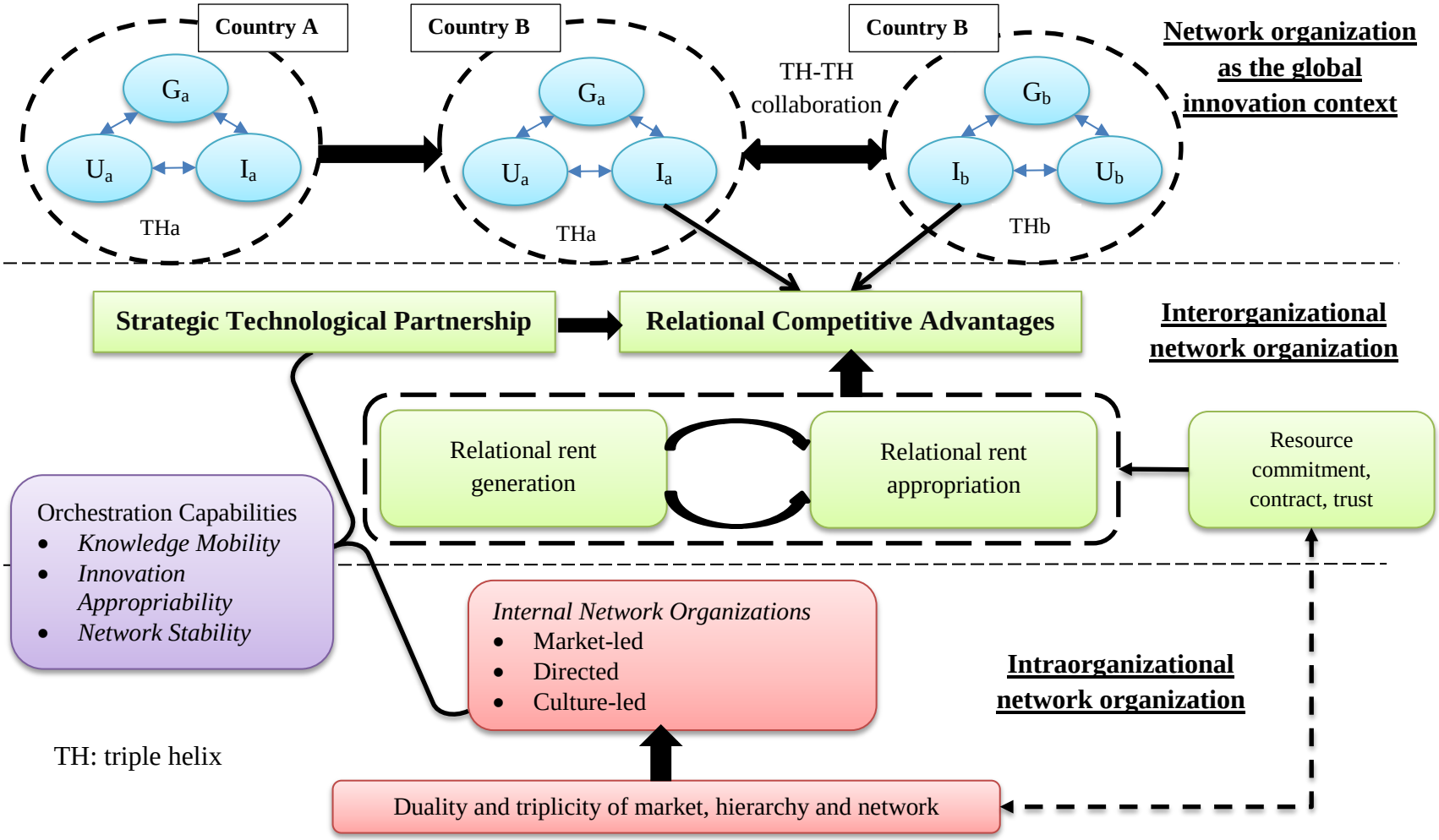


Figure 8.1. An overall framework showing the relationships between all papers

8.3 Contributions to Theory and Practice

In this section, the contributions of this dissertation will be briefly summarized from both theoretical and practical perspectives. Generally speaking, this dissertation mainly contributes to theories on global innovation organization and management. The cases such as triple helix, strategic technological partnerships, and internal network organizations for global R&D are all innovation-related, and the proposed theoretical frameworks and propositions based on these cases may only apply to global innovation organization and management.

Regarding the theoretical contributions of this PhD research:

- This dissertation develops a three-level framework of understanding network organization for innovation, which partly clarifies the divergent definitions of network organizations in the literature.
- Regarding the internal network organization, this dissertation discusses alternative ways of designing an internal network organization in practice. For example, some TNCs may utilize existing hierarchical structures and the leadership of mangers to create a global network organization rather than adopting an internal market. Thus, these findings may expand existing theories on the intraorganizational network organization.
- Unlike most literature touching on the three fundamental coordination modes (market, hierarchy, and network) as discrete forms, this dissertation argues that these three modes are integrated and overlapping in business practice. This opens a door for research into the balance and dynamism of the three modes.
- The dissertation contributes to theories on the management of network organization through specifying the concept of orchestration capability and expanding the emerging theory of relational competitive advantages.
- Finally, this research contributes to the triple helix theory by adding an internationalization angle.

The findings of this dissertation suggest that TNCs can facilitate global innovation in three ways: searching for innovation resources in the global business environment, establishing technological partnerships, and designing an internal network organization. Therefore, in addition to theoretical contributions, this dissertation also has the following practical implications:

- Companies need to have a network mindset especially when they want to promote innovation. Such a mindset encourages TNCs to search out, tap into and utilize global innovation resources by establishing overseas R&D subsidiaries and collaborative network relations with companies from the host countries.

Technological partnerships may bring relational competitive advantages for all member firms as long as partnering firms can successfully generate and appropriate relational rents. In particular, a network mindset may be quite helpful when collaborating with Chinese partners. Social skills such as finding the key person, earning trust, and visioning are widely used.

- The second practical implication is related to all triple helix actors, i.e. companies, governments, and universities. It is worth noting that a TNC's subsidiaries are not only embedded in the networks of the host countries, but are also part of the internationalized triple helix of the home country. Therefore, these subsidiaries are not struggling alone, and they can utilize innovation resources by interacting with other triple helix actors from their home countries such as overseas governmental institutions, universities' overseas campuses, and other TNCs' R&D subsidiaries. This also indicates that the policy makers not only need to promote the triple helix interaction within their own national boundaries, but must also facilitate the establishment of a triple helix in the other country in order to utilize global innovation resources and improve innovation performances thanks to synergistic effects.
- The network mindset not only applies when companies want to establish R&D collaboration with external partners, but also applies when companies adopt an innovation strategy and need to change their internal organization. An internal network organization is highly contingent, meaning different companies can have different versions of network organizations. For example, a company can reduce its internal hierarchy dramatically and introduce market mechanisms to coordinate internal resource allocation, yet it can also maintain its internal hierarchies and change the management style to orchestration and leadership. However, it is accepted that a strong corporate culture is the optimal invisible power that unites employees and business units together and stimulates all employees' innovation potential. The three case companies shown in this dissertation provide some experiences for designing an internal network organization for global innovation.
- Regarding emerging economies such as China, in recent years the central government has greatly emphasized the need for indigenous innovation capabilities to be cultivated. Therefore, this dissertation provides some inspiration for TNCs and governments from developed countries (Denmark) that can be used for reference by Chinese business managers and/or policy makers.

8.4 Limitations and Future Research

Besides theoretical and practical contributions, this dissertation is subject to several limitations. Based on discussing limitations of this dissertation, several future research possibilities will be proposed.

Table 8.2. An overview of limitations and future research possibilities.

No.	Limitation	Future Research Possibilities
1	Number of cases in general is limited, and only focus on Danish cases.	• Find cases from emerging economies, including both intraorganizational and interorganizational network organizations from emerging economies. • Carry out comparative case studies.
2	Innovation is broadly and loosely understood and defined in the dissertation.	• Focus on specific types of innovation, such as reverse innovation, disruptive innovation, radical innovation, incremental innovation, knowledge exploitation and exploration, etc. • Explore the relationships between network organization and special types of innovation.
3	Only qualitative case studies.	• Use quantitative researches to test the research findings of this dissertation. • Social network analysis and survey could be possible future research methods.
4	Focus more on current organizational structures of case companies and lack of dynamism in cases.	• Collect more longitudinal data, and carry out longitudinal research. • Explore the dynamism of organizational change or organizational transition.
5	Since the dissertation covers three levels of analysis, the profundity is influenced.	• Focus on one or two levels of analysis, and enhance the depth of research. • My own research interest is the internal network organization.

Firstly, regarding the methodology of this dissertation, the number of case companies in general is limited. Since the main research purpose of this dissertation is theory expanding and theory building, case study strategies are adopted in four papers (Paper 2-5) with the aim of fulfilling the research purpose. There are three single case studies (Paper 2, 3, and 5) and one multiple-case study in this dissertation, and the cases are mainly TNCs, originating from Denmark (Scandinavian/developed countries). Thus, it would be interesting to see whether the research findings and proposed theoretical frameworks make sense when applied to more cases. Therefore, one future research possibility is to investigate more cases, especially cases from emerging economies such as Chinese TNCs, to see whether my findings so far make sense when applied to TNCs from different contexts, which can strengthen, expand or revise the proposed theoretical propositions and frameworks.

Regarding the intraorganizational network organization, recently I found a few Chinese companies that are changing or have already changed their internal organization to a network organization. Among them, one Chinese TNC has what it calls an "inverted pyramid" structure that requires every employee to be an independent profit center. Thus, a second future research possibility is to carry out comparative case studies including TNCs from both developed and developing countries. Similarly, regarding the

interorganizational level network organization, this dissertation shows one successful strategic technological partnership that gained relational competitive advantages, and based on that, a conceptual framework is proposed. However, I could also add a failure case, and create a comparative case study.

A second limitation is related to the research questions in general. The two main research questions aim to explore the meaning and management of network organizations for TNCs' global innovation. In this dissertation, innovation is broadly and loosely understood as value-adding activities that bring about changes. In future research, I could focus on specific innovation types, such as reverse innovation, disruptive innovation, knowledge exploitation and exploration, radical innovation or incremental innovation, and to see how network organizations influence on different types of innovation. Here, I would take reverse innovation and disruptive innovation as examples.

In general, TNCs global innovation activities in emerging economies (Reddy, 2011), may bring about two special types of innovation, i.e. reverse innovation and disruptive innovation. *Reverse innovation* refers to the situation "where an innovation is adopted first in poor (emerging) economies before 'trickling up' to rich countries" (Govindarajan & Ramamurti, 2011, pp: 191). On the one hand, being located in one of the biggest markets in the world, TNCs' Chinese R&D subsidiaries not only focus on utilizing local knowledge resources and cheap labor forces to develop products that fulfill global markets' needs, but also try to explore innovation potential grounded in the Chinese market and then apply the innovation results to global markets. In fact, this is the case of the companies that I studied (Circular, InnoFlex, and Biozyme). On the other hand, companies from emerging economies have already become key innovators due to the increase of their innovation capabilities. Therefore, how network organizations facilitate reverse innovation carried out by companies from both developed and developing countries could be an interesting future research topic.

Disruptive innovation refers to those innovations that facilitate the creation of new markets and customer needs, and eventually disrupt existing markets and an established trajectory of performance improvement (Christensen & Bower, 1996; Christensen, 2006; Christensen, et al., 2006; Yu & Hang, 2010). Disruptive innovation in particular, emphasizes the commercial application of innovation and the close relation between innovation and market. Therefore, those innovation results already in existence from developed countries can be transferred to emerging economies by TNCs, and then change the current market status of emerging economies through establishing technological partnerships with local companies and working together on marketing or adjusting the product in order to better fit local customers' needs. Another way to bring about disruptive innovation in emerging economies is for an individual company or networks of innovators to develop something radically new by. Thus, it could be interesting to investigate how companies establish network organizations such as technological

partnerships to facilitate disruptive innovation, change existing market status, and enhance partnering firms' competitive stances (earn relational competitive advantage).

A third limitation is related to the research design. This dissertation is qualitative research aiming at theory building based on exploratory case studies. Therefore, to what extent the generated theoretical propositions and frameworks are valid requires future deductive statistical testing. Another research direction in the future could be quantitative researches such as social network analysis on TNCs' internal network organization as well as in an innovation context (an industry, a cluster, etc.) consisting of overlapping networks.

A fourth limitation is related to the dynamism of organizations. This PhD research focused more on TNCs' current organizational structures and management, and did not track the whole organizational transmission process of these case companies. Thus the dissertation in general lacks a dynamic or longitudinal perspective. Therefore, it could be interesting in the future to track the whole process of a company's transition to a network organization and compose a longitudinal case study. This would help me to gain more in-depth understandings of the challenges and management of an internal network organization.

A fifth limitation is related to the depth of analysis. This dissertation covers three levels of analysis, i.e. contextual level (networks as innovation contexts), interorganizational, and intraorganizational levels. However, when more levels of analysis are involved, the profundity of the research may be compromised. Therefore to be honest, though this dissertation raises many interesting discussions and has contributed to several theories, the depth of each level of analysis could be improved. For instance, the paper proposing the internationalization of the triple helix could involve multiple case analyses on those overseas triple helix institutions, such as the Danish Innovation Centre and the Sino-Danish Centre for Education and Research. From my own research interests, I would like to see more in-depth studies on the internal network organization design and management in the future. Related topics could be the balance and dynamism of market, hierarchy, and network within an organization, the process of organizational transition, the role of managers in organizational change, how employee-driven innovation is cultivated, to what extent internal units should be coordinated by market mechanism (every employee or every business unit as a profit center), etc.

References

Christensen, C. M., & Bower, J. L. (1996). Customer power, strategic investment, and the failure of leading firms. *Strategic Management Journal*, *17*(3), 197-218.

Christensen, C. M. (2006). The ongoing process of building a theory of disruption. *Journal of Product Innovation Management*, *23*(1), 39-55.

Christensen, C. M., Baumann, H., Ruggles, R., & Sadtler, T. M. (2006). Disruptive innovation for social change. *Harvard Business Review*, *84*(12), 94.

Dhanaraj, C. & Parkhe, A. (2006): Orchestrating innovation networks, *Academy of Management Review*, *31*(3), pp. 659-669.

Dyer, J. H., & Singh, H. (1998). The relational view: cooperative strategic and sources of interorganizational competitive advantage. *Academy of Management Review*, *23*(4), 660-679.

Govindarajan, V., & Ramamurti, R. (2011). Reverse innovation, emerging markets, and global strategy. *Global Strategy Journal*, *1*(3-4), 191-205.

Lavie, D. (2006). The competitive advantage of interconnected firms: an extension of the resource-based view. *Academy of Management Review, 31* (3), 638-658.

Lundvall, B.-Å. (2010). *National systems of innovation: Toward a theory of innovation and interactive learning*. London: Anthem Press.

Morgan, G. (2001). Transnational communities and business systems. *Global Networks*, *1*(2), 113-130.

Reddy, P. (2011). *Global innovation in emerging economies*. New York: Routledge.

Ritala, P., Armila, L. & Blomqvist, K. (2009): Innovation orchestration capability – defining the organizational and individual level determinants, *International Journal of Innovation Management*, 13 (4): 569-591.

Yu, D., & Hang, C. C. (2010). A reflective review of disruptive innovation theory. *International Journal of Management Reviews*, *12*(4), 435-452.