

In Search of a Network Organization for Innovation: A Literature Review¹

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 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

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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 0 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 Error! No text of specified style in document..1 and each stage will be elaborated upon below.

Table Error! No text of specified style in document..1. Key steps in systematic literature review.

Step	Actions
1. Define the research	Defined three research questions.

question	
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 appear², 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 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 total³.

² When searching *network organization* AND *innovation*, in the ABI/Inform database, there are 52175 journal articles all together.

³ Searches conducted in January, 2013.

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 ranking⁴, i.e. general management, strategic management, international business and area studies, innovation, organization studies, and social science (See Table Error! **No text of specified style in document.**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 Academic journal quality guide version 4, online access:
<http://www.myscp.org/pdf/ABS%202010%20Combined%20Journal%20Guide.pdf>

Table Error! No text of specified style in document. **.2. List of selected top journal articles.**

Selected Journals	All	Selected	Research Domain
Academy of Management Review	9	5	
Academy of Management Journal	10	5	
Administrative Science Quarterly	10	4	
Journal of Management	2	2	General management
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	
Technovation	17	9	Innovation
R & D Management	15	9	
Organization Science	8	3	
Organization Studies	5	3	Organization Studies
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.⁵ 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

⁵ 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 Error! **No text of specified style in document.**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 Error! **No text of specified style in document.**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 Error! **No text of specified style in document.**¹.

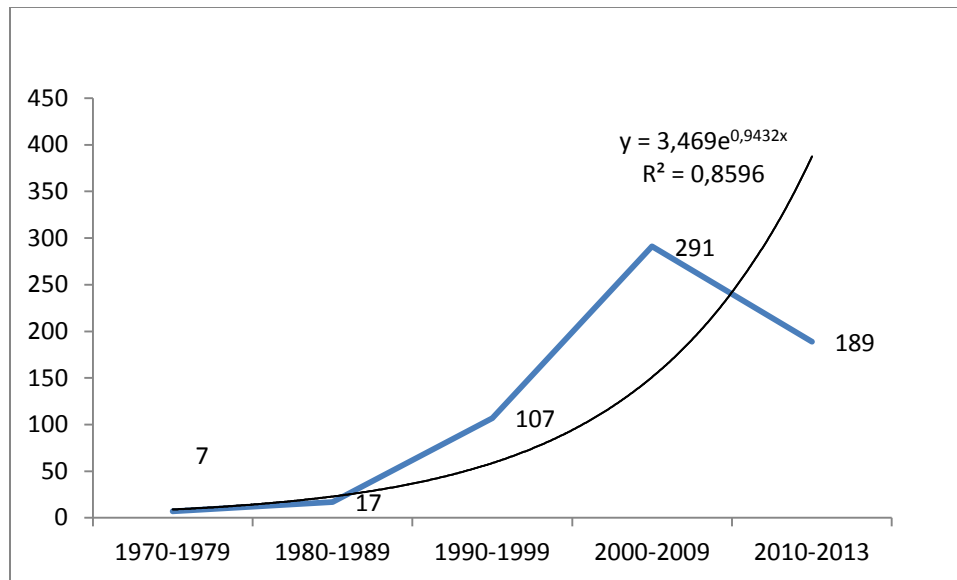


Figure Error! No text of specified style in document..1. Found articles (1975-2012).

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 Error! **No text of specified style in document..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 Error! No text of specified style in document..3. Research methods and types of data.

Research methods & Article types	Number of articles
Literature review	1
Conceptual articles	15
Empirical research articles	
	6
Mix of quantitative & qualitative data analysis	<ul style="list-style-type: none"> • <i>Social network analysis: 1</i> • <i>Case studies: 2</i> • <i>Survey or database + interview: 2</i> • <i>Text analysis: 1</i>
	14
Qualitative	<ul style="list-style-type: none"> • <i>Interviews without focusing on specific cases: 2</i> • <i>Longitudinal case study: 1</i> • <i>Multiple case study: 6</i> • <i>Single case study: 5</i>
	38
Quantitative	<ul style="list-style-type: none"> • <i>Longitudinal: 2</i> • <i>Computer simulation: 1</i> • <i>Hypothesis testing based on survey or existing databases: 27</i> • <i>Modeling: 5</i> • <i>Social network analysis: 3</i>

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 Error! **No text of specified style in document..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 quantitative 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 Error! No text of specified style in document..4, most empirical articles focus either on the focal firm level or the network level.

Table Error! No text of specified style in document..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 Gargiulo (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 Error! No text of specified style in document..5). The concept of network will be discussed in detail in Section 0, and the other four main streams of researches will be summarized below.

Table Error! No text of specified style in document..5. Paper summary based on research topics.

Topics	Nodes	Number of Articles
Conceptualization of network organizations: 8	<i>Concept</i>	7
	<i>Literature review</i>	1
Innovation performance of network organizations: 24	<i>Innovation performance</i>	24
Design, structure and management of network organizations: 17	<i>Complexity</i>	1
	<i>Design</i>	6
	<i>Structure</i>	6
	<i>Management capabilities</i>	5
Formation, change and evolution: 13	<i>Innovation diffusion in networks</i>	1
	<i>Network change and evolution</i>	7
	<i>Network formation</i>	5
TNCs and network organization: 11	<i>TNCs network organization for innovation</i>	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; Jossierand, 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 Error! No text of specified style in document. **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 Error! No text of specified style in document.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 very interested 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 transactional 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 of rules, 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.

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corporate culture theories, can be considered as supporting theories of culture-cognitive dimension of institutional theory. In terms of global R&D, a subsidiary of a TNC may construct a local innovation network with host country's partners, not only due to low cost, but also may due to host country's policy requirements, business systems, peer pressure, as well as culture and beliefs. Also, the features of an innovation network, such as content, size, density, and hierarchy of a network, will be influenced by institutional environment. More important, national innovation systems (Lundvall, 2010) and Triple Helix (Etzkowitz and Leydesdorff, 2002) of host countries can be seen as part of 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 0 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 Error! No text of specified style in document..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 Error! No text of specified style in document..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 Error! No text of specified style in document..2).

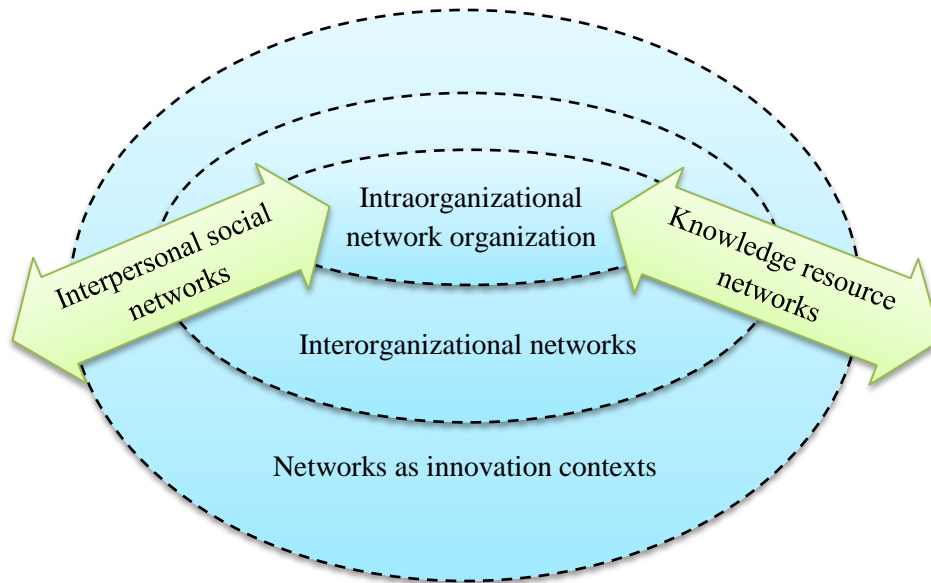


Figure Error! No text of specified style in document..2. A framework showing different levels of network organizations.

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 Error! **No text of specified style in document..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 firm's 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 organization 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 ($N \geq 2$) 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 Error! No text of specified style in document..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 pursuing 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 promoters 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 Management Review*, 34(4), 53-57.
- 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., & Rodríguez, 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, Massachusetts: 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.

