**In Search of a Network Organization for TNC’s Innovation**

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# Abstract

During the past three decades, there are massive researches on innovation networks and network organizations. However, researchers are holding different understandings, some of which even conflict with each other, thus this paper makes an inductive conceptual analysis to clarify what is a network organization among many kinds of innovation networks based on review of relative literatures. Then this paper moves one step further to introduce a network perspective, i.e. network is the context of firms as well as TNCs, and market and hierarchy can be analyzed from a network approach. Further on, this paper discusses the theoretical foundation of network organization, and proposes that since a focal firm has different strength of power in different levels of network, it will have different roles and may not always have the power to “manage” an innovation network.

# Key Words

Innovation Network, Network Organization, Network Context, Transnational Corporations

# Introduction

From 1980s, more and more scholars have realized a set of undergoing transitions in innovation, which also introduced a paradigm shift: from information to knowledge, from training and development to learning, from national to transnational, from competitive to collaborative or “coopetition” (Bengtsson and Kock, 2000), from core competence to interorganizational competitive advantage (Dyer and Singh, 1998) and interorganizational competitive advantage (Lavie, 2006), and from hierarchy or matrix to network organization (Child, 2001; Miles and Snow, 1986; Podolny and Page, 1998; Powell, 1990; Rogers, 1996). Imai and Baba (1989) proposes that “network organization is a basic institutional arrangement to cope with systemic innovation”. Nowadays, innovation theories such as national systems of innovation, triple helix, open innovation and user innovation are taking “network” into account: Gelsing used the concept of industrial networks as a description of sub-systems of national innovation systems (Lundvall, 2010, pp: 119). Etzkowitz (2002) used network of innovation, networked incubators to discuss the relationship between university, industry and government. Open innovation mentioned inter-organizational context, knowledge networks, and value networks (Chesbrough, et al., 2006, pp: 205-258). von Hippel (2004) discussed horizontal innovation networks and user communities.

Besides innovation researchers, scholars in business, marketing, organization and sociology are all talking about “network”. Gereffi et al. (2005) characterized five types of global value chains, within which modular, relational and captive value chains are networks rather than linear chains. International Marketing and Purchasing (IMP) scholars hold an interactive and networking view of business, marketing as well as R&D (Ford, 2002; Håkansson and Laage-Hellmanm 1984; Håkansson, 2006; Håkansson, et al., 2009), i.e. “No business is an island”. Child (2001, 2005), Scott and Davis (2007), Mile and Snow (1986, 2011), as well as many organization scholars have noticed and conceptualized so called “network organization”. Podolny and Page (1998) argue that a firm is a social entity rather than a production or economic function, and they highlight that network forms of organization foster learning, represent a mechanism for the attainment of status or legitimacy, provide a variety of economic benefits, facilitates the management or resource dependencies, and provide considerable autonomy for employees.

However, among all the network researches, we can easily find that scholars hold different understandings of network and network organization though they are using the same word. Different types of networks and definitions make us feel confused and couldn’t help wonder: “what is a network (organization) and when show we call it a network organization?” In this paper, the author will try to answer this question based on inductive analysis of massive literatures and researches on network organization, especially those related to innovation. Those literatures are either from from top journals (such as Academy of Management Review, Academy of Management Journal, MIS Quarterly, Strategic Management Journal, Research Policy, Organization Studies, etc.), or from influential books.

Since the 1970s, the growth and international expansion of technological capabilities in the MNC has received attention (Johanson and Wiedersheim-Paul, 1975; Johanson and Valhlne, 1977, 1990; Zander, 1999). Later on, Barlett (See Porter, 1986, pp: 377-382) discussed the differences between international, multinational, global and transnational companies, and he also proposed an “integrated network model” for TNCs. Since the focus of this paper is firms’ network organization and innovation, the concept “transnational corporation” (TNC) will be used instead of multinational corporation (MNC). When taking about innovation, this paper will focus more on transnational corporation (TNC)’s global R&D, and won’t join the debate on the definition of innovation. In the next section, different researches will be provided as examples of innovation networks and network organization, then a networking way of thinking and network perspective will be built, and after that this paper will distinguish what is network and what is network organization. In Section 3, this paper will touch the theoretical foundation of network organization, and five key components of a network organization will be discussed in Section 4. In the last section, the role of a focal firm in different levels of network will be developed.

# Different Levels to Understand Network

## 2.1 Innovation in Networks: Towards a Network Context

Since 1980s, network, as a form to implement innovation, has been discovered and put into practice. This section will first give examples of different innovation networks and then try to summarize different levels to understand networks.

The first level is inter-personal network. 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. von Hippel (2007) find that innovation development, production, distribution and consumption networks can be build up horizontally with only innovation users. This happens both in ICT industry (e.g. open source software such as Apache Server) and physical products (such as rodeo kayaking). Also, sociologist usually regard inter-personal network as social networks and in which social capital is generated.

Since a multinational corporation is consisted by a group of geographically dispersed and goal-disparate organizations, with which different units interact, Ghoshal and Bartlett (1990) propose that a MNC can be conceptualized as an interorganizational network. Thus, the second level of network organization is a TNC’s intraorganizational (internal) network. The role of subsidiaries has turned from local implementer, to specialized contributor, and world mandate (Birkinshaw and Morrison, 1995), and it is possible for subsidiaries to have autonomy and form a loosely coupled network with each other. Tsai and Ghoshal (1998) collect data from all business units of a large MNC, and find that intrafirm network and social capital will benefit value creation and product innovation. Based on the study of 33 MNCs, Gassmann and von Zedtwitz (1999) identify five types of R&D organizations according to the dispersion of R&D activities and the degree of cooperation between individual R&D units, i.e. ethnocentric centralized, geocentric centralized, polycentric decentralized the R&D hub, and the integrated R&D network organization. Chen and Vang (2008) conceptualize a TNC’s globalization of R&D as a global innovation network based on the single case study of Motorola. However, the research on intraorganizational network and its operation mechanism is still insufficient.

When we move out of a firm’s boundary, network organization can be understood from a third level, i.e. interorganizational level. Powell et al. (1996) argue that the locus of innovation will be found in networks of learning rather than in individual firms, and the large-scale reliance on interorganizational collaborations in the biotechnology industry supports their hypothesis. There are many types of interorganizational networks based on different criteria, so it is hard to give a perfect classification but only offer some empirical evidences.

Firstly, many researchers focus on a focal firm’s network (ego network) and to see the relationship between the focal firm and other actors. Capaldo (2007) employs comparative longitudinal case study of three design-intensive furnishing companies to investigate their strong and weak inter-firm ties. His study shows that the ability to integrate a core of strong ties and a large periphery of heterogeneous weak ties will lead a distinctive lead firm’s relational capability and dynamic innovative capability. Hu and Sørensen (2011) show that leading Chinese online game companies tend to form a producer driven innovation network, i.e. focal firm is central in the network and select its partners, to generate both technological and content innovation.

Secondly, when we move from focal firm to a group of actors that constitute a network, strategic alliances, outsourcing, joint ventures, or virtual corporation can be seen as network organization (Child, et al., 2005, pp: 145; Tidd and Bessant, 2009, pp: 304). Hagedoorn (1990) gives a classification of six modes of inter-firm cooperation based on organizational interdependence. He proposes that the organizational design of cooperation is expected to be related to the performances of companies in economics and technological development. Narula and Hagedoorn (1999) and shows that strategic alliances are becoming ever more popular since 1980s, particularly to undertake technological development activities. In another research, Hagedoorn (2002) explores 40 years of data on inter-firm collaboration or strategic partnering on R&D, and analyzes some basic historical trends and sectoral patterns in R&D partnering since 1960. Also, value chains can be seen as networks, there can be hierarchy, captive, relational and modular network based on different levels of authority and specialization (Dicken, 2011; Gereffi et al., 2005).

Thirdly, when we take a broader look and try to understand a network as a whole, there can be either geographically concentrated networks such as cluster, or also virtually connected network such as an industry and Blade.org. 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 showed a positive answer. Schilling and Phelps (2007)’ longitudinal study on patent performance of 1,106 firms in 11 industry-level alliance networks shows 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.

Many firms are networked though they are not located together. Tomlinson (2010) explores the impact of co-operative ties upon levels of innovation (both product and process) in five UK manufacturing industries based on survey data from 436 firms. The paper finds that stronger dyadic relations and horizontal co-operative ties between firms have a positive and significant impact upon levels of innovation. Snow et al. (2011)’s research on “blade.org” can be seen as an open collaborative innovation project or community-based organization since “blade.org” nearly has no authority inside though IBM acts as a coordinator. They show firms have moved from stand-alone organizations to multiform network organizations. “Blade.org” is a collaborative community of more than 250 firms based on the ‘‘BladeCenter’’ computer server technology invented by IBM. Any member firm within this community can find willing partners to form temporary collaborative innovation networks. Thus, a firm can maintain its existing independent businesses while simultaneously collaborating with other firms to explore and develop new products and customized solutions. Hu and Sørensen’s research (2011) show that all geographically distributed actors can join an open collaborative platform to share their innovative ideas on the development of Chinese Online game industry, which is a more open community than “blade.org”.

## 2.2 Overlapping Networks as Business Environment

Until now, we have see that networks are getting bigger, and then here is the question: “what is outside of an innovation network?” One may answer “market”. Then, outside a network, there is a dangerous jungle full of competition and all relationships are based on transaction. However, we all know that strangers are not so unreachable according to Milgram’s famous experiment and his “six degrees of separation” proposition. That is to say, networks are not separated with each other, and we can always reach another network by building some relationships. Also, a network is not a totally closed one and the role of actors inside may change, i.e. one network member could be a competitor before. One unit of a TNC can be part of many innovation networks, e.g. different local industrial networks as well as different project networks. That is to say, outside a firm and a network there will be overlapping networks. Based on some Scandinavian scholars, these overlapping networks which constructed by a web of relationships is the essence of international business environment rather than a neoclassical market with many independent suppliers and customers, (Johanson and Mattsson, 1988; Johanson and Vahlne, 2003, 2009). Interaction is essential in network relationships.

Until now, we have moved to a new level of seeing overlapping network (or a web of relationships) as a business environment that firm lies in rather than a neoclassical market (Johanson and Vahlne, 2009). In this way of thinking, an organization’s environment is regarded as a network of other organizations. Other firms are no longer enemies but potential partners holding resources, and also fit the thinking of TNC as “network within networks” (Dicken, 2011, pp: 121). To a TNC, it is facing a network of business relationships which provides it with an extended knowledge base, and based on this thinking, the internationalization of the firm can be seen as a process driven by the interplay between learning about international operations on the one hand and commitments to international business on the other (Kogut, 2000; Johanson and Vahlne, 2003, 2009). Managing international business then is a matter of establishing, developing and maintaining the firm's positions in the international business networks (Ford, 2002; Gordon and Breach, 1992). In terms of innovation, innovation and technology are driving forces behind the formation of business networks (Johansson and Mattsson, 1992; Ojasalo, 2008), and innovation itself should be regarded as the result of interplay between several actors (Håkansson, 1987).

Under this situation, networks are infrastructure or even pipes providing channels for a firm to be connected to the global business environment. Also, networks serve as prisms, which means the identity as well as status of an organization are created through relations with others (Podolny, 2001). As a result, outside one network which a firm lies in, it is not a separated world but an open context constructed by massive overlapping networks.

In conclude, network can be understood and analyzed from different levels, i.e. basically inter-personal, intraorganizational, interorganizational and overlapping networks. However, these are no clear boundaries between different levels. Inter-personal social networks can be both inside and among firms. An R&D unit can act as an intermediate between TNC’s internal global R&D network and local R&D network in host country, so the intra- and inter-organizational networks are overlapping. Besides, they are all inevitably influenced and constructing a network environment.

## 2.3 Network Organization, Market and Hierarchy

Later on, they begin to move from dyadic relationships to business networks, and propose an Activity-Resource-Actor (ARA) model, which indicates that the outcomes of interaction process can be described in terms of three layers of networks between counterparts: activity links, resource ties and actor bonds (Håkansson and Johanson, 1992; Håkansson and Snehota, 1995; Håkansson and Snehota, 2006). Here, business network is defined as sets of interconnected business relationships, and then market structure can be seen as business networks rather than an outside environment with many independent suppliers and customers (Holm, et al., 1996; Johanson and Vahlne, 2003, 2009). Their researches can be seen as a paradigm shift in business research and also a foundation of regarding network as business context. However, they tend to focus on interorganizational networks and don’t concern inside an organization.

So far, we have known different types of networks for innovation without giving a definition. There is no consensus about the definition of network, based on different focuses there will be different definitions. 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. Network is about relationships, which could be market transactions or contract-based relationships, and here is one burning discussion: “what is the relationship between network, market and hierarchy”?

One stream thinks that network lies in between of market and hierarchy. Imai and Baba (1989) proposes that “networks can be viewed as an inter-penetrated form of market and organization.” Here, “organization” means conventional hierarchical or functional organizational structure. Similarly, Teubal et al. (1991) argues that a network organization linking firms or economic agents represents an intermediate “system of governance” that lies between hierarchic organization (the firm) and classical or spot transactions (the market). According to different levels of integration, between fully integrated hierarchy and independent market forms, there are strategic alliance, virtual corporation, dominated network, unilateral agreements and equal-partner networks (Child, et al., 2005, pp: 153). These ideas are based on Williamson’s transaction cost theory, especially his 1991 paper. Williamson (1991) argues that markets can efficiently organize economic activities characterized by low transaction costs, hierarchies are advantageous when transaction cost is high, and “hybrids” deals with the situation when transaction cost is intermediate. Here, hybrids mean various forms of long-term contracting, reciprocal trading, regulation, franchising, and the like, so it is what we called network organization now. According to Williamson (1991), the hybrid mode is “characterized by semi-strong incentives, an intermediate degree of administrative apparatus, displays semi-strong adaptations to autonomy and cooperation, and works out of a semi-legalistic contract law regime” (See Table 1).

|  |  |  |  |
| --- | --- | --- | --- |
| Attributes |  Market | Hybrid | Hierarchy |
| Incentive intensity | ++ | + | 0 |
| Administrative controls | 0 | + | ++ |
| Adaption (Autonomy) | ++ | + | 0 |
| Adaption (Cooperation) | 0 | + | ++ |
| Contract law | ++ | + | 0 |
| \* ++ = strong; + = semi-strong; 0 = weak |

Table 1. Distinguishing attributes of market, hybrid and hierarchy.

Source: Williamson, 1991.

The above idea is based solely on transaction cost, which is always challenged as it ignores the social aspects of a network organization. The basic assumptions of transaction cost theory are bounded rationality and opportunism, which mean that people are all alike. Apparently, an organization is not only a combination of costs and benefits, but a social entity constructed by people with different personalities and abilities. For example, Sørensen (2008) proposes that besides bounded rationally, human beings have the cooperative inclinations and the need for and ability to trust. As a result, no wonder some scholars see network as a distinctive form of coordinating economic activity which is different from market and hierarchy (Hämäläinen and Schienstock, 2000; Johanson and Mattsson, 1992; Powell, 1990). In the influential paper “Neither market nor hierarchy: Network forms of organization”, Powell (1990) criticized transaction cost theory and its proposition that network as an intermediate of market and hierarchy, he developed a coherent set of factors to prove that network forms of organization is unique (See Table 2). In a market, transactions are guided by the invisible hand (price mechanism), while a hierarchical organization is regulated by a visible hand (routines). In a network organization, transactions occur through “networks of individuals engaged in reciprocal, preferential, mutually supportive actions” though the behaviors in a network may be regarded as naive. One important point is that trust will be generated through long-term network transactions based on mutual and reciprocal benefits. Trust will then in turn reduce transaction cost, uncertainty of reality and complexity of coordination. Thus, here network organization seems to be a unique and more complicated structure guided by both economic and social rules.

Table 2 shows that network organization is based on mutuality and reciprocity. However, market transactions can be also seen one kind of reciprocal mutuality since both parties get what they need and are satisfied, i.e. product or services and money. On the other hand, an employment relationship shows some reciprocal and interdependence as well. As a result, are market and hierarchy quasi-networks? Also, at the bottom of Table 2, we can also see that there are mixing forms with characteristics or market, hierarchy and network.

|  |  |  |  |
| --- | --- | --- | --- |
| Key features | Market | Hierarchy | Network  |
| Normative basis | Contracts-property rights | Employment relationship | Complementary strengths |
| Means of communication | Prices | Routines | Relational |
| Methods of conflict resolution | Haggling-resort to courts for enforcement | Administrative flat –supervision | Norm of reciprocity-reputational concerns |
| Degree of flexibility | High | Low | Medium |
| Amount of commitment among the parties | Low | Medium to high | Medium to high |
| Tone or climate | Precision and/or suspicion  | Formal, bureaucratic | Open-ended, mutual benefits |
| Actor preferences or choices | Independent | Dependent | Interdependent |
| Mixing of forms | Repeat transactions, contracts as hierarchical documents | Informal organization, market-like features | Status hierarchies, multiple partners, formal rules |

Table 2: Stylized comparison of forms of economic organization.

Source: Powell, 1990.

Podolny and Page (1998) argues that it is wrong to make a trichotomy among market, hierarchy and network, because each market actor is a node with rather loose or no ties with other actors, and a hierarchical organization can be seen as a centralized network in which most or even all ties flow to one central node. Moreover, Reddy and Rao (1990) make a proposition that we can treat market as an interfirm organization since interdependencies among organizations “engender formal arrangements that replace the price system as a coordinating mechanism of exchange.” Thus, here we have a third understanding on the relationship among market, hierarchy and network, i.e. market and hierarchy are two extreme cases that can be analyzed under the logic of network organization (Burt, 2000).

Since 1970s, the IMP (industrial marketing and purchasing) and Uppsala scholars have been trying to search 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 (Turnbull, et al., 1996). Within an interaction approach, it is not what happens within companies but what happens between them that constitutes the nature of business (Håkansson, et al., 2009, pp: 27) and it is through interaction that the benefits of these resources and activities flow between and into the companies in the network (Håkansson, et al., 2009, pp: 28).

Podolny and Page (1998) define a network form of organization as “any collection of actors (N≥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.” Here they excludes pure market arrangements as well as employment relations in a hierarchy, but it still means that it is hard to find a pure case of network organization since you can always to some extent find hierarchy or market transaction in a network organization. We can find evidences in previous researches to prove it.

After researching on big project innovation, Kastelle and Steen (2010) discover that though networks are good for innovation, the problem solving within networks are always reflecting the formal management hierarchy of the firm. According to von Hippel’s user innovation theory, user innovators are motivated by their own needs, reputations and the enjoyable process of innovation, not by economic benefits. When user innovators freely reveal their output to producers, they are part of the innovation network of producers. However, it is hard to say that user-producer relationship is based on trust. Sørensen (2008) identifies three kinds of network based on their duration. He suggests that a short-term transaction may be task-oriented networks which are more hierarchical, a medium-term frame work contract may be social-business networks which can be a mixture of both hierarchy and horizontal relationships, and long-term relations are more likes to be social network build on trust. That is to say, within a network, not only hierarchy exists, but also more horizontal relationships. Miles and Snow (1986) propose a network organizational form which meets the need of prospector firm, i.e. dynamic networks. A dynamic network is characterized by vertical disaggregation, internal and external brokering, full-disclosure information systems, and market substitutes for administrative mechanisms. In this definition, we can see that firm’s intraorganizational structure is no longer a hierarchy but an internal market. In line with this logic, different R&D units and teams within a TNC can be competitors and their behaviors and performances are more likely guided by a market mechanism, which means that “organizational units buy and sell goods and services among themselves at process established in the open market” (Scott and Davis, 2007, pp: 295).

In section 2.1, the author summarized a third level to understand network, i.e. network as context and environment. Based on this understanding, pure market and hierarchy can be seen as extreme cases of network contexts as well. As a result, here we conclude that this paper accepts the network perspective, i.e. network is the context of firms as well as TNCs; market and hierarchy can be analyzed from a network approach. Following this perspective, it is not difficult for us to understand why some networks are rather horizontal and some are quasi-hierarchy but still called “hierarchical network” (See Burt, 2000; Powell, 2001).

## 2.4 Network and Network Organization

In Section 2.1 and 2.2, we have given a definition of network and established a network perspective. However, within examples presented in Section 2.1, some of them are “networks”, and some are “network organizations”, so when can we call a network as an organization? Borgatti and Foster (2003) regard this as a linguistic chaos, i.e. some scholars think all firms should transform from separated organizations to networks; while confuse those who think organizations as a combination of networks. Also, Betts et al. (2004) questioned the differences between network perspective and network organization. Thus, the differences between network and network organization will be discussed.

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. More simply, a network organization is always more formal than a network. From this definition, we can see that there are two basic criteria to identify a network organization from networks, i.e. goals and rules. Here, we can make a typology based on four levels of networks (See Table 3), i.e. interpersonal, intraorganizational, interorganizational, and network context.

|  |  |  |
| --- | --- | --- |
|  | Network  | Network organization  |
| Interpersonal network  | Social network, friendship, kinship | User innovation community |
| Intraorganizational network  | Internal knowledge network  | TNC’s structure, project teams, business units, subsidiaries |
| Interorganizational network  | Industrial clusters, and some quasi-organizations (“blade.org”, federations, consortia)  | Innovation project network, modular network, a focal firm’s ego network, value chains |
| Network context | Global business environment | \ |

Table 3. Network and network organization in different networks.

Within all kinds of interpersonal network relationships, there are some informal ones that build on trust or genetic connection, e.g. friendship or kinship networks. These interpersonal networks are social networks and can not been regarded as an organization. There are some formal interpersonal networks based on contract or regular rules, e.g. employment relationships and expert committee. These can be seen as an organization or at least an important part of an organization. Moreover, some are not contract based formal networks but still guided by a clear goal, e.g. user community aiming at user innovation. Here, the author thinks that user network can be seen as a network organization because of the common goal though their communications are very flexible and informal.

An intraorganizational network, in this paper, basically internal networks of firms especially TNCs, is usually based on formal employment contracts and managed by routines. No matter hierarchical structures or flexible teams, no matter head quarter in home country or globally distributed subsidiaries and units, they all share a common goal, which is to enhance the performance of the firm, so it is easy to understand that a firm’s intraorganizational network can always been regarded as an organization made up of a network of smaller organizations. However, under some circumstances, for example, a TNC’s information and knowledge flows and networks, are networks that are flexible, hard to control and without a clear goal, thus they are merely networks rather than organizations.

Interorganizational networks can take massive types. Usually, a project innovation network or a modular network coordinated by one firm can be always seen as a quasi-organization, because they are coordinated based on common goals and some formal arrangements to ensure the success and punctuality of the innovation project. In line with this thinking, captive, relational and modular value chains are also network organizations constructed by different firms with the aim of adding value and coordinated by a focal firm (Gereffi et al., 2005). Besides, dyadic, triadic, or multiple strategic alliances are also network organizations, because they are build on trust, and when carrying out innovation projects they will have a agreed coordination. However, when researching on networks like “blade.org” and geographically concentrated clusters, can we still call them network organizations?

In Snow et al. (2011)’s article, “blade.org” is an innovation network but also been regarded as a “multiform network organization”. Here, the author can only partly agree. “Blade.org” is a relatively closed community constructed by strictly selected innovative members, and it is coordinated by IBM with little authority inside. Thus, it definitely shows some formality. However, the goal of IBM is to develop a better way to communicate and generate new knowledge, and the goal of members is to develop different innovation products with different members through temporarily constructed innovation networks. As a result, here we can’t say there is a specific goal of the “blade.org”, but to some extent it looks like a quasi-network organization that definitely can be analyzed through a network perspective. Similarly, some industry consortia or federations are multiform networks that can be seen as quasi-organizations as well since firms inside usually hold regular meetings and agree on some routines.

A firm with in an industrial cluster usually enjoys prosperous knowledge spillovers and motivated by the synergy of network effects, so here the cluster itself is a context where the firm embedded in (Reddy and Rao, 1990). Though Reddy and Rao (1990) even think this context is an organization, i.e. they propose that “industrial market as an interfirm organization”, the author still think that an industrial market or clusters can hardly been called an organization since it lacks a clear common goal. In a more open collaborative innovation network (See Hu and Sørensen, 2011) and even a global business network (See Ford, 2002; Håkansson et al., 2009; Johanson and Vahlne, 2009), there is no leading or coordinating firm, no common goal and no rules, and is very open and flexible, so here to avoid confusion, all network contexts or environments can not be seen as network organizations.

In this section, the author discussed the characteristics and definition of a network organization, and based on the definition, the author clarified network and network organization among interpersonal, intraorganizational, interorganizational networks and network context. One thing to emphasize is that, there is not a clear cut between network organization and network since the former is part of the latter, so when to use network and when to use network organization is based on specific research topics. If the research focus is the network structure as well as the content, goal, coordination mechanism, then it is more likely to view a network as an organization. In the next section, another important topic which is related to the emerging and advantages of network organization, i.e. the theoretical foundation of network and network organization, will be discussed.

# Theoretical Foundation of Network Organization

At the beginning of this paper, the author mentioned that a lot of existing theories or articles are using the concept of network organization and take it as granted. When talking about the reasons for the emerging of network organization, here are some agreed reasons: the trend of globalization, increasing specialization and uncertainty, in search of complementary resources (especially knowledge), in search of lower costs, enhancing flexibility, efficiency, or capacity, etc (Child, 2005, pp: 147). Yes, these are all reasons for the emerging of innovation networks. However, what is the theoretical foundation that supports the existing of network organization and these reasons? Basically, this question can be answered from economic, sociological, organizational, and technological views.

From the economic views, i.e. transaction cost theory and coordination cost concept, the emerging of network organization and innovation network is based on intermediate transaction cost and high coordination cost, but also, a long-term network organization built on trust will in turn lower transaction costs. From the sociological view, one essential concept to understand network organization is the social capital, which explains why network organization emerges, and the relationship between an actor’s performance and its network location. From the organizational and managerial views, there are resource-based view, knowledge-based view, dynamic capabilities, orchestration capabilities, resource dependency theory, and institutional theory that are related to network organization. Resource-based view and knowledge-based view explain that critical resources or knowledge may exist beyond a firm’s boundary, thus network relationships are need to tap into the critical resources. Dynamic capability and orchestration capability explain how to properly behave in a network organization and how to successfully managing resources to generate sustained competitive advantages both within a firm and a network. Institutional theory explains the regulative, normative and culture-cognitive factors that influence the formation and orchestration of a network organization. From a Science and technology studies’ view, technology and organization mutually shape each other, thus the formation of network organization meets the need of the development of innovation, and technology itself will in turn improve the performance of network organization.

According to literatures mentioned before, one thing interesting is that the emerging of network organization for innovation also links different theories together. Traditionally, economics focuses on market and single firm’s optimal choices; organization theories focus only within an organization (especially a firm)’s boundary; strategic management researchers study and make strategies for single firms; business researchers tend to take business environment as exogenous; innovation scholars focus on single firm’s performance or innovative heroes. However, the emerging of network organization has already moved economists from two poles, i.e. market and hierarchy, to network form which lies in between. Since network organization makes an existing firm’s boundary blurred, organization researchers now move beyond traditional boundary and try to understand network as a quasi-organization. Moreover, a firm is inevitably embedded in different networks even though it is unaware of, and a business environment itself is constructed by massive overlapped networks. Thus, it is possible for a firm to engage in different network organizations and to co-construct a business environment together with other network actors. In terms of innovation, every stream of innovation theories tends to discuss innovation on a network level now. In the next few sections, some underlying theories of network organization will be discussed.

## 3.1 Transaction Cost and Coordination Cost

Economists care about costs and benefits. Transaction cost theory explains why there is firm (or organization) within market based on the concept “transaction cost” which constructed by searching, negotiating, contracting, monitoring and enforcement costs. Initially, transaction cost theory (Coase, 1937; Williamson, 1981) successfully explained that organizations came out to reduce transaction costs, and this in turn supported the trend of vertical integration from 1930s to 1970s (See TNCs such as Royal Dutch Shell, Ford, Carnegie Steel). From the 1980s, a “turbulent time” came, and many U.S. companies have been forced to rethink their competitiveness and their existing inflexible organization structures (Miles and Snow, 1986). Thus, Williamson (1991) advances transaction cost theory to adapt the emerging of “hybrid forms”, but in his paper, it seems that a hybrid form doesn’t have many advantages compared to hierarchy. Williamson (1991) mentioned that innovation needed a weaker property rights and a weaker contract than hierarchy, but he thought hybrids such as joint ventures would tend to be temporary. Also, Williamson (1991) noticed the existence of bilateral dependency, but he thought that long-term contracts are supported by “added contractual safeguards and administrative apparatus” which will increase transaction cost rather than trust that will reduce transaction cost. As a result, transaction cost theory will still be powerful to explain short-term network organization, but when it comes to long-term, the basic assumptions, i.e. bounded rationality and opportunism, will be challenged.

As a complementary to transaction cost, some scholars develop a concept called “coordination cost” (Jones and Hill, 1988; Rawley, 2010) to cope with the interdependencies of organizations, i.e. pooled, sequential, reciprocal, and team interdependencies (Thompson, 1967; Van de Ven, 1976). The more uncertainty and complexity of an innovation project, and the richer the information links between value activities, the more powerful coordination mechanisms are needed and thus the coordination cost will be higher. Hämäläinen and Schienstock (2000) argue that when coordination cost is high, it is better to employ network organization as a coordination structure, while market needs no coordination cost and hierarchical organization coordinated simply by commands needs intermediate coordination cost. The coordination cost thinking can be seen as a development of transaction cost and has a different prediction to the choices among network, hierarchy and market, but it still conceptualizes organization and value-adding activities from the economic side.

## 3.2 Social Capital

Since costs (both transaction cost and coordination cost) are not the only determinant of organization structures, here we introduce another way to understand the emerging of network organization. People may discover that some of them 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. Besides, another explanation is that they are better connected than others, and the networks of relationships constitute a valuable resource. 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 and Ghoshal, 1998). Napapiet and Ghoshal (1998) identify three dimensions of social capital – structural, relational, and cognitive. 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). As a result, go across structural holes and construct network with other firms is good for innovation. Secondly, the relational dimension indicates that trust and trustworthiness are rooted in relationships. Thus, actors that are regarded as trustworthy are more likely to get others’ support. The relational social capital in the Eastern Asia context is called “guanxi”, which is very important to the success of business. The third one is cognitive dimension which refer to the shared paradigm that facilitates collective goals and legitimate behaviors. In conclude, the emerging of network organization facilitates the generation of social capital, and social capital requires a network organization to embed in.

In the social capital theory, an actor’s advantageous location in a network will generate a certain kind of capital which is also a kind of precious resources, so here we come to a third theoretical foundation to understand network organization: resource-based view of the firm (RBV) and knowledge-based view of the firm (KBV). RBV links theories talking about sustained competitive capabilities, Both RBV and KBV are aiming at explaining how firms can gain competitive advantages.

## 3.3 Resource-based view and knowledge-based view

Wernerfelt (1984) analyzed firms from the resource side rather than from the product side for the first time, i.e. firms can be conceptualized as bundles of resources, and proposed four basic propositions of the resource-based view. Firm resources can be categorized into three types: physical capital resources; human capital resources; and organizational capital resources. Organizational capital resources include a firm's formal reporting structure, its formal and informal planning, controlling, and coordinating systems, as well as informal relations among groups within a firm and between a firm and those in its environment (Barney, 1991). Resources are heterogeneously distributed across firms, and when firms have resources that are valuable, rare, inimitable and nonsubstitutable (VRIN), they can achieve sustained competitive advantage (Barney, 1991). From here we can see that firm will need complementary resources from other organizations, such as knowledge, labor forces, special materials, low cost management, etc., thus networks among different firms are formed. Besides resource-based view of the firm, there is knowledge-based view of the firm. The KBV conceptualizes firm as an institution of integrating knowledge since knowledge is the most strategically important firm's resource (Grant, 1996). Generally speaking, KBV is one case of RBV (Eisenhardt, et al., 2001). In terms of innovation, massive external linkages provide firm with complementary knowledge and opportunities to generate new knowledge.

Dyer and Singh (1998) argue that people overlook the fact that a firm's (dis)advantages is often linked to the (dis)advantages of the network of relationships in which the firm is embedded. If the network relationship is VRIN, then it will contribute to a firm’s sustained competitive advantage as well. In line with this logic, Dyer and Singh (1998) suggest that a firm's critical resources may span firm boundaries and may be embedded in interfirm resources and routines (networks). They argue that an increasingly important unit of analysis for understanding competitive advantage is the relationship between firms, and they identify four sources of interorganizational competitive advantage: (1) relation-specific assets, (2) knowledge sharing routines, (3) complementary resources/capabilities, and (4) effective governance.

Through the construction of network organization, a firm may need to alter their resource base to generate new resources of competitive advantage. This also needs a specialized capability, i.e. dynamic capabilities (Eisenhardt and Martin, 2000; Teece, et al., 1997). In a high-velocity market with increasing uncertainty, dynamic capabilities are the drivers behind competitive advantages. As a result, network relationships are important resources to a firm, and more important, when to construct, reveal resources with other network actors, interact, and quit a network organization requires dynamic capabilities. Moreover, since innovation networks can be viewed as loosely coupled systems of autonomous firms, some scholars propose another capability related to the interorganizational competitive advantages, i.e. orchestration capability. This capability refers to 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). The orchestration is a combination of knowledge mobility, innovation appropriability, and network stability.

## 3.4 Resource Dependency Theory

Resource dependency theory (RDT) also shares the basic understanding of resource-based view of the firm, but tries to explain how organizations manage their relationships with other organizations, and focuses more on organizational power rather than competitive advantage of a firm. RDT (Pfeffer and Salancik, 1978) proposes that the power of an organization depends upon the resource dependency relationships it has with other organizations. Thus, if one firm processes a kind of key resources that the focal firm highly depends upon, it has power over the focal firm. There are three critical factors determining the dependence of one organizational unit upon another and therefore their relative power, i.e. resource importance, alternatives, and discretion (Medcof, 2001). Moreover, it is possible for each supplier’s power to vary with the importance of the resources it supplies and the extent to which alternative suppliers are available. Thus the RDT avoids zero-sum view of power and it becomes possible for two actors both to hold power over each other – through an increase in their interdependence (Scott and Davis, 2007, pp: 234). When applying RDT to the management of TNC’s intra- and inter-organizational innovation networks, it is reasonable for us to understand why many globally distributed R&D units have relatively autonomy upon head quarter, as well as why some firms outsource almost everything but still remain to be orchestrators of innovation network.

## 3.5 Institutional Theory

Since a firm is embedded in networks of economic and social relations, its performance is directly conditioned by actors within a network, and its behavior is indirectly conditioned by the totality of networks as a context (Chesbrough et al., 2006, pp: 205-219; Håkansson and Snehota, 2006).

When summarizing motivations for internationalization of R&D and the influencing factors of managing global innovation networks, scholars may refer to favorable policies, open and friendly culture, attractive infrastructure, good education systems, and stable business environment (See Gassmann and Han, 2004). Actually, many of these motivations and factors can be understood from the institutional theory, which focuses on the deeper aspects of social structure and provides powerful explanation for both individual and organizational action (Dacin, et al., 2002; Scott, 1987; Scott and Davis, 2007, pp: 258-277). 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 composed by 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 and Trompenaar’s national culture theories, as well as Louis’ and Schein’s corporate culture theories, can be considered as supporting theories of culture-cognitive dimension of institutional theory.

Transnational corporations operating in different countries with varying institutional environments will face diverse pressures. Pressures from host and home countries’ institutional environments have fundamental influences on a TNC’s strategies and organizational structure. 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, et al., 1992, 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.

## 3.6 Science and Technology Studies

Science and Technology Studies (STS) is the study of how social, political and cultural values affect scientific research and technological innovation, and vice versa. STS holds a social constructivist view and regard innovation technology as a social construction and also the influencing factor of society and values. Based on this assumption, it is possible for us to understand why many scholars regard the development of information and communication technology (ICT) as one driving force of network organization (Freeman, 1991; Mils and Snow, 1986).

Twenty years ago, Huber indicated that information technology fitted within the domain of organization theory and that it would have significant effect on organizational design, intelligence, and decision making (Huber, 1991). Thus, since ICT enhances the efficiency and quality of intra- and inter- organizational communications, it provides an infrastructure for globally distributed members to effectively share knowledge and latest information, which also ensures the generation of network organization. On the other hand, the emerging to network organization with the characteristics of flexibility, mutual benefits, and shared views, will encourage innovation and provide innovation with a better environment.

# Key Components of a Network Organization

Until now, we have identified different levels of network, established a network perspective, distinguished a network organization from networks, and discussed the theoretical foundation of network organization. We have touched the definition of network organization, but haven’t discussed in detail the key components of a network organization. Håkansson and Johanson (2002) propose a model to understand business networks, and the model is consisted by actors, resources and activities. As mentioned before, a network organization is a social combination of actors and relationships with the aim of achieving certain goals and guided by certain rules. Here, the author accepts Håkansson and Johanson’s model, and develops five key components of a network organization, i.e. actors, resources (complementarity and similarity), commonality, activities (protocols), and infrastructure.

Without actors, there will be no organization. In a network organization for innovation, actors are basically innovators and the network can be called as “networks of innovators” (see Bianchi and Bellini, 1991; DeBresson and Amesse, 1991; Freeman, 1991; Powell and Grodal, 2005). Here we don’t consider physical objects as actors, but only consider actors such as individuals, groups of individuals (such as user communities), units of firms, firms or other organizations (such as NGO, government, university, intermediary); groups of firms or organizations (such as guild, federation, small networks). Actors are the most important part in a network organization: resources are embedded in either individual or organizational actors, and will generate different relationships among actors; an actor in a network organization is no longer “rational” and “opportunistic”, but shares common goals with others and at least willing to free reveal some of its resources; all actors’ activities should be guided by an agreed protocol; all actors’ activities rely on certain infrastructure.

According to RBV and KBV, one reason for the formation of innovation networks is searching for valuable resources especially knowledge. Many literatures emphasize searching for complementary resources and few talks the advantages of homogenous resource base. However, here the author thinks similar resources are also needed. Similar knowledge provides a base for mutual understanding and the possibility to generate synergies. Examples are industry federations or clusters. Also, resources from different actors are networked as well, e.g. knowledge network. As knowledge is the most strategically important firm's resource (Grant, 1996), network organization provides a context where knowledge network among actors is embedded in, and also make it possible for actors to access not only explicit knowledge but also tacit knowledge of other actors. Thus in terms of network organization, the competitive capability is also embedded in the network level rather than single firm level. On the other hand, according to RDT, resources will also generate different relationships and will also determine the content of network organization. Thus, if actors share similar knowledge, there will be clusters, consortia or federations among them; if one actor processes critical resource which the other one needs, there will be captive relationship between them; if actors share highly specialized knowledge, there will be a modular network organization; if both actors processes complementary resources, there will be relational or reciprocal interdependence between them.

Actors should share some commonality, which means that different actors should have a common goal though they may also have their own agenda. As mentioned before, without a common goal, there will be a network rather than network organization. Besides a common goal, a network organization may also need activities to combine, develop, exchange, or create resources by utilizing other resources (Ford, 2002, pp: 147). All activities are guided by certain protocols (rules) otherwise they will not be accepted by other actors. The last component of a network organization is the infrastructure. Here, infrastructure can be physical, such as meeting rooms, offices, buildings, and highways; and can also be virtual, such as internet, information systems, video conference and telephones. Virtual organization such as Dell is a network organization that is supported by ICT technology.

As a conclusion, all five components are critical to identify a network organization, but without commonality and shared protocol, there still could be innovation networks. In the next section, the author will discuss the power and roles of a firm based on three levels of networks.

# Discussion and Conclusion

## 5.1 Hierarchy, Authority, and Power in a Network Organization

It is always confusing that whether an innovation network or a network organization should have hierarchy or authority inside, and also who has power in a network organization. In this section, these questions will be answered.

Hierarchy is not a bad thing, it determines who reports to who, reduces the uncertainty and complexity, and enhances the efficiency and formality of communication within an organization. Though hierarchy is criticized for lacking innovation incentives, it exists widely in many kinds of network organizations, such as a focal firm’s innovation network, a modular network, value chains and TNC’s internal network. Also, since a network organization is always regulated by certain rules, hierarchy is needed. Traditionally, hierarchy is related to words such as boss, status and authority, but within a network organization the actor who listens to reports will not be a boss who assigns commands but a coordinator integrates resources. Moreover, authority in a network organization is based on profession rather than command, thus there may be little command and only “expert authority”. This expert authority will in turn generate power, which is based on the possession of expertise and scarce resources. According to RDT, it is possible for an organization to have relatively little power in relations to its suppliers, but considerable power in relation to its buyers.

In conclusion, in a network organization, we can always expect some extent of hierarchy, but authority is not always needed. Also, since wherever there are resources, there will be power, thus there will always be power in a network organization.

## 5.2 Management, Orchestration, Coordination, Participation and Adaptation

We may have heard the above words many times, but what are the differences between them and how do they refer to different networks? In organizational and managerial papers, “control” and “management” are always referring to the organizing of functional or divisional hierarchical firms. In terms of TNC’s global R&D, it is still possible to “manage” it as long as R&D subsidiaries’ powers are relatively limited. Orchestration means to arrange different elements to achieve a desired overall effect and better performance, which is applicable to TNC’s internal innovation network. Coordination is the act of making different people or entities work together for a goal, which can be used in interorganizational networks. When a firm has some specialty but not able to influence the whole network organization, it can “participate”. At last, when a firm is hard to participate or influence in networks surrounded, the only choice is to be an adaptive system in the complex network environment (Boisot and Child, 1999).

The fundamental factor that determines the ability and role of a firm within a network is the power of the firm. As mentioned before, power is determined by resources, so different levels of power will influence the ability of a firm. In a TNC’s intraorganizational network with relatively high or intermediate hierarchy, its head quarter will have strong power and will be able to manage or orchestrate different units. When move beyond a TNC’s boundary, its power will be weakened by other network actors, thus the TNC can not give commands to others but coordinate the network organization. If a firm has weak power then it can only participate in a network organization. Moreover, if a firm’s power is too low to influence the network environment, the better choice is to adapt. The power of a firm is also influenced by the complexity of task and uncertainty of environment, i.e. the more complex the innovation task is and the more uncertain the environment is, the less power one focal firm may possess, and less possible for the focal firm to manage the whole network organization. Based on these understanding, here the author summarizes this paper with a conceptual model that illustrates a focal firm’s role in different levels of network.

Intraorganizational network

Interorganizational network

Network as environment

Roles of firm: manager → orchestrator → coordinator → participator → adapter

Strong

h

Weak

Power of focal firm

Hierarchy

High

h

Intermediate

h

Low

h

Little

h

## 5.3 Conclusion

Figure 1. Focal firm’s role in different levels of network.

In conclusion, this paper made an attempt to clarify what a network organization is based on an inductive research on relative literatures, and focuses on innovation network of transnational corporations. There are four levels to understand innovation network, i.e. interpersonal, intraorganizational, interorganizational networks and network as a context. The last level also provides us with a network perspective to look into organizations and business environment. Thus, the relationship among network, market and hierarchy in this paper is: market and hierarchy are extreme cases of network and can be analyzed and measured by those concepts from network. As a concept; “network” exists in economics, sociology, organizational and managerial studies and innovation theories. Thus, research on a network organization should refer to its rich theoretical foundation. This paper ends with a conceptual model that explains a focal firm’s role in different levels of network. Also, this model provides a possibility to further research on the strategies or management of innovation in network organization. However, due to the limitation of ability, there remain many deficiencies of this paper. For example, the definition of the network perspective remains ambiguous; there are only a few words about the TNC; the relationships between different theories are under developed; and also the model now lacks empirical support.

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