Identifying firms' positions in business networks

ABSTRACT

Lately, business practices and researches have been focused on understanding a firm's position, especially in network environment, where the essence of network manifests the complexity. Therefore, it is hard to identify positions, because all firms with multiple interrelations were characterized by multilayer network organizations and multilateral interactions. This study proposes a quantitative method to measure a firm's position in business networks. Based on the relations and power of business networks, the graph theory is applied to configure the firms' positioning. Then, the advantageous and disadvantageous positions of each firm can be ranked, compared and revealed. Furthermore, managerial interpretation can identify the firm's direct or indirect competitions and the firm's network relationship type in the business network.

Keywords Business network, Position, Power

INTRODUCTION

In recent years, significant study works have moved from a linear sequence "value chain" concept to a "business network" concept when analyzing relationships between firms. A network relationship is as well emphasized, expanding to the focus of dyadic relationships used in the past (Huemer 2006; Ketchen & Hult 2007; Mills et al. 2004; Ritter, Wilkinson & Johnston 2004; Svahn & Westerlund 2007). Managers want to explore their firm's current position in terms of a broader behavioral framework. Identifying position allows the firm to understand the competitive environment. Sun Tzu (500 BC) wrote as (Giles 1910, p 9):

> If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle.

Therefore, it is necessary to identify the firm's position and relative relationships within its business network. To identify a firm's position, one should explore the focal firm itself, suppliers, buyers or all members in the business network. But, *what is the business network?* Exploring the network perspective (Gadde et al. 2003; Håkansson & Snehota 1989; Håkansson & Ford 2002; Ritter & Gemünden 2003) and analyzing supply chain structure (Lambert et al. 1998) can provide a clear concept of business networks. For this study, the business network is defined as a set of two or more connected business relationships

(Anderson et al. 1995), in which each relationship are built the firm's power strength relative to other parties.

After defining the business network, the next concern is *what determinants influence a firm's position in the business network*? The firms play several roles (e.g., supplier, buyer or competitor) which carry different advantages and occupy different positions. Regarding the relative advantage/disadvantage and networking nature, two most referred factors, power and network relationships, are considered in this study.

- *Power*. Power is closely related to a firm's position. Resource Dependency Theory (RDT), which is derived from the Resource-Based View (RBV), proposes that interorganizational power influences a firm's position and advantage. Certain firm resources may affect the power and relational behavior between other firms. If firm A is relatively dependent upon resources of another firm B, then other firm B will have a power advantage (David & Barney 1984; Kim et al. 2004; Medcof 2001; Pfeffer & Salancik 1978; Pfeffer 1982). In general, when a firm has a greater power advantage, it occupies a more dominant position relative to other firms, and can improve its financial position through price and service limit determination.
- *Network relationships*. Competitive advantage refers to a firm's occupying a better position relative to its competitors; competitive advantage allows a firm to earn high rates of return. In order to evaluate a firm's competitive position, it must assess its external environment and competition conditions. Five competitive forces have been proposed to be considered as part of the industry structure (Porter 1980). The five forces (i.e. supplier power, buyer power, competitive rivalry, threat of substitution, and threat of new entry) point out a firm's position and its competitive advantage, as constrained by its outsider environment, forming a business network of them, firm and the entities which interact with it. Therefore, a business network consists of multilayered network members, complex relationships and multilateral interactions. The network context focuses on network relationships and its interactions, indicating that such a network forms, and relationships therein influence, a firm's position and its competitive advantage in the business network.

Our attention now focuses the issue *how one evaluates the firm's position via its power and network relationships*. While a considerable number of researches have been conducted to analyze these issues qualitatively, relatively few quantitative researches have been done today. We present a quantitative approach by using graph theory – a *business network position evaluating method*. The method is designed to adopt the concepts of power and network relationships as a basic ingredient measurement of a firm's position, combining with a dominance digraph to present a quantitative evaluation of a firm's position in business networks. Moving beyond qualitative analysis, quantitative analysis can assess the ranking value of a firm's position in business networks, thus offering another tool to analyze a firm's

position.

BUSINESS NETWORKS

As mentioned above, the focus of business practices move from dyadic business relationships to business networks (Ford & McDowell 1999; Håkansson & Snehota 1989; Ritter et al. 2004). These authors argue business networks include two or more connected business relationships; the behavior of network members is conditioned by a limited number of counterparts; the relationships as well as behaviors affect the nature of a firm's activities and access to resources; and the vertical and horizontal relationships are interrelated, forming intricate networks of organizations (Möller & Halinen 1999). Among them, the research on network perspective significantly contributes to exploring the context of business networks. Once the network perspective is discussed, the business network structure of this study is proposed.

The nature of business networks: Network perspective

From European-based industrial network perspective, the Industrial Marketing and Purchasing (IMP) group used the A-R-A model to illustrate the nature of business networks source. The A-R-A model describes a business network as having three main elements: actors, resources, and activities. Gadde and Håkansson (1992, p 178) characterized the *network perspective* as followed:

> An actor will affect either the performance of one or more activities and/or the use of resources. The actors involved in carrying out these activities, or controlling the resources, will consider not only the chance *per se* but also how the change (or potential change) might affect their positions *vis-à-vis* other actors.

Håkansson and Snehota (1989) also stated that "no business is an island". The business interactions are influenced by the organization's counterparts or members of the network (e.g., relative power influence). By interactions mutual relationships can be built, the resources of other parties can be accessed and the links between activities of the parties are established. Wilkinson and Young (2002) extended the network perspective to include five groups of characteristics "the relationships and interactions in which a firm is involved; a firm's relationship partners; connected relations and their interactions; a firm's network position; and the network as a whole". Furthermore, network perspective is also the underpinning of marketing (Mattsson & Johanson 2006). In short, the network perspective offers a panorama and a proper understanding of inter-firm interactions, relationships, behaviors, resources, and performance in a business network.

The structure of business networks

Business practices trend toward more network than dyadic relationships. Supporting this, the importance of supply chain management has been greatly emphasized, especially regarding the structure of the chain (Lambert et al. 1998; Wathne & Heide 2004). Since the emergence of a global division of labor and professional integration, the typical structure has become more complicated and trended toward a network system. Lamming et al. (2000) suggested the "network" concept of analyzing the supply chain as opposed to the traditional supply chain, which had assumed a linear sequence and unilateral chain structure. Anderson et al. (1994, p 1) also suggested the network structure as a central concern of the focal firm: "we formulate business network constructs from the perspective of a focal firm and its partner in a focal relation that is connected with other relationships".

In order to represent the business network in graph, we propose the structure of business networks in three network levels: the upstream network level, the focal firm level, and the downstream network level. The major members of the focal firm level are the focal firm and its competitors, whereas the firms in the upstream network level include the focal firm's suppliers and the suppliers of its suppliers. Similarly, the focal firm's customers and the customers of its customers comprise the downstream network level. The structure of business networks is shown in Figure 1. The interrelations refer to the mutual power influences between firms. Therefore, we define the interrelations as the firm's power strength relative to other parties, with the direction of the arrows. For example, in Figure 1, $S_{11} \rightarrow F_1$ means S_{11} has power over F_1.

"Take in Figure 1"

BUSINESS NETWORK RELATIONSHIPS

In general, organizations are influenced by their counterparts through power or transactions, forming complex interrelations and relationships in business networks (Brennan et al. 2003). Therefore, how the relationships influence each other by power is worth exploring. For that reason, we first explore the stem of power and power measurements. Next, we develop the network relationships, based on the power influence of the focal company on its related network's members.

Power measures

In our study, power is viewed as a major analytical factor in determining a firm's position. In this section, we explore power in detail, including types, characteristics and measurements, as

well as interorganizational relationships with respect to firm power. Power has been explored from a multi-disciplinary perspective within economics, sociology, psychology, politics, marketing and other disciplines. Emerson (1962, p 32) proposed a definition of power from the political viewpoint, stating that "the power of actor A over actor B is the amount of resistance on the part of B which can be potentially overcome by A". From a RDT view, organizations dependent on others' essential resources may attempt to minimize that dependence or, alternatively, increase the dependence of others on them as much as possible. Power is thus a property within social relationships that resides in the dependency of one social actor upon another (Pfeffer 1982), and stems from the shared need or freedom to obtain resources. Buyers and suppliers generate different power influences by the transactions of mutual resources (Ramsay 1994). The power of an organization depends upon its dependency relationships with regard to resources: if an organization is highly dependent upon another organization for an important resource, and then that other organization will have power over the focal organization. In a business environment, a firm's relative dependence on the chain in acquiring resources affects each member's power (Crook & Combs 2007). Cox et al. (2002, p 3) integrated RDT and transaction cost analysis to characterize power as:

> The ability of a firm (or an entrepreneur) to own and control critical assets in markets and supply chains that allow it to sustain its ability to appropriate and accumulate value for itself by constantly leveraging its customers, competitors and suppliers. We contend that the successful exploitation and protection of these sources of power will enable a firm to be sustainable successful. Success is represented by the firm's ability to earn rents.

Power can be measured in different ways. In general, means of power measurement can be classified as either quantitative or qualitative. Qualitative methods draw on interviews, direct/indirect approach (Bigné et al. 2004) and conceptual inference techniques to survey the relationships among power influences (e.g., positive or negative effect), power base (e.g., reward, coercion, expert, referent, legitimacy), power sources (from buyers) and targets (for sellers) (Benton & Maloni 2005; Cool & Henderson 1998; French & Raven 2001; Hardy 1996; Hart & Saunders 1997; Lusch & Brown 1982; Maloni & Benton 2000; Provan et al. 1980). Several studies have suggested classifying power into three categories: perceived power, potential power and enacted power. Perceived power measures how much power one party has over another, while potential power represents the capability to control and measure by net dependence. In contrast to potential power, enacted power specifies actual performances of control and evaluates that power in terms of the extent to which a desired outcome is obtained. Hart and Saunders (1997) also conducted similar studies to measure potential power and enacted power to further deal with both supplier- and buyer-side issues. Lusch and Brown (1982) categorized power as economic or non-economic and suggested that power influence is positively related to coercive power and negatively related to

non-economic power. Maloni and Benton (2000) studied the relation between power influences and supply chain performance. In their findings, the mediated power (e.g. coercive, reward, and legal legitimate bases) had a positive effect upon relationship's strength, while non-mediated power (e.g. expert, referent, and legitimate bases) had a negative effect upon relationship's strength. Relationship strength had a positive effect on supply chain performance.

In contrast to qualitative methods, by drawing on economics, finance, and trade information quantitative methods of measuring power offer a more objective points of view (Dickson 1983; Grant 1997; Krajewski et al. 2005; Ramsay 1994; 1996). Ramsay (1996) measured the potential power at the market level, organizational level, divisional level and individual product level. Potential power at the organizational level could be calculated using the organizational expenditure/revenue ratio (all products with the specified supplier)/(all buyers of all products within all divisions in all markets). These ratios indicate a firm's power strength relative to other parties in different levels. Grant (1997) proposed cooperative measurements as follows: (1) industry concentration ratios; (2) aggregate concentration ratios; (3) numbers of corporate interlocks as a percentage of the number of corporations; (4) after-tax corporate profits as a percentage of personal or national income; (5) the ratio of the marginal product of labor to the real wage; (6) the percentage of total government revenue derived from corporate income taxes; and (7) the percentage of the labor force that is unionized. The aggregate concentration ratios are the most popular firms' power measurement.

In conclusion, power is multi-dimensional, and thus, it is not easy to use a single measurement to achieve complete representation (Grant 1997; Hardy 1996; Maloni & Benton 2000). Hence, a variety of power measurements that can be derived from different methodologies and viewpoints, and the characterization of power measurements differ in different settings. Thus, the appropriate measurement depends on the type of analysis needed for different issues in question. In applying our position measuring method, we suggest these power measurements all be translated onto a quantitative scale. For the consistency of examples calculation in this study, the quantitative measure of power is chosen as the organizational expenditure/revenue ratio (Ramsay, 1996), in which the ratio has a quantitative value between 0 and 1.

Type of business network relationships

In order to further explore a firm's relationships in a business network, several studies have classified various circumstances into different types. Focusing on each specific type helps us to understand the firm, its environment, interrelationships among firms and the firm's position. Bensaou (1999) utilized the nature of specific investments to categorize the supplier-buyer relationships into four types, including captive buyer, market exchange,

strategic partnership and captive supplier. Power could be also used to explore mutual relationships among firms (Cox 2001; 2004; Cox et al. 2002; Ritter et al. 2004). Cox (2001, 2004) adopted the relative strength of the power between buyer and supplier and categorized the relationships into four types: buyer dominance, independence, interdependence and supplier dominance.

In this paper, we also consider relative strength of power to evaluate a firm's relationships. We evaluate the power of the focal firm relative to its upstream and downstream network. Therefore, two dimensions are used to classify their relationships in the business network. The first dimension is the focal firm's power (high or low) relative to its upstream network and the second dimension is the focal firm's power (high or low) relative to its downstream network. Therefore, four possible outcomes can be identified; we named them as:

- upstream network dominance
- focal firm dominance
- focal firm obedience
- downstream network dominance.

Upstream network dominance occurs when the upstream network firm's power is stronger relative to the focal firm and the focal firm's power is stronger relative to the downstream. That is suppliers can dominate the focal firm, and the focal firm can dominate its customer at least to a degree. Under this situation, these upstream network firms will be at a dominant position in the whole business network; for instance, these upstream suppliers may be in a high concentration or consolidation industry, and competitors are few. As for the focal firm dominance condition, the focal firm has a stronger power over both the upstream and downstream networks. In other words, the focal firm should be able to influence the decisions of the whole business network. In contrast to focal firm dominance, focal firm obedience happens in the case that both the upstream and downstream network have power over the focal firm. At this situation, suppliers may own critical resources. Meanwhile, the downstream firms may be major players in the channels, or they may carry a brand name in the market. Finally, in the case of downstream network dominance, downstream firms have power over the focal firm and the focal firm also has power over its upstream firms. That means that the downstream firms exert major influence on the whole network. A huge retailer, for example, may dominate upstream because of buying power. The four types of business network relationships are represented in Figure 2.

"Take in Figure 2"

Based on the exploration of these network structures above, we construct the following conceptual framework as:

"Take in Figure 3"

MEASURING FIRM POSITION

In Figure 1, we depict the business network structure which reveals the relations, constraints, and relative power influences among these firms in the network. Based on the structure, we develop a business network position evaluating method to measure the positions of firms in business networks.

Business network position evaluating method

According to the power measurements described above, we can apply the dominance digraph theorem used in graph theory (Harary et al. 1965; Sullivan & Mizrahi 2008) to determine a firm's position in the business network. Graph theory can handle network properties nicely; we integrate graph theory with power measurements to measure a firm's position.

In general, graph theory employs square matrices to represent a network. The properties of a matrix can be represented with a directed graph, namely, a dominance digraph (Harary et al. 1965; Sullivan & Mizrahi 2008). The notation "A → B" means that A has stronger power over B. The entity of the matrix in row *i* and in column *j* indicates the degree of power that the *i*-th node has over *j*-th node on a quantitative scale. The sum of the entries in a row indicates the node dominance position in one stage. For example, if we consider only four firms S_{21}, S_{11}, S_{12} and F_1 in Figure 1, in which: S_{21} has power over S_{11} and S_{12} then we denote the value 1 in row 1 and column 2 of the matrix, and the value 1 in row 1 and column 3 of the matrix. S_{11} power over S_{12} and F_1, and S_{12} has power over F_1 also have same work. Therefore, the network (S_{21}, S_{11}, S_{12} and F_1) can be represented by a matrix (*M*) as

$$M = \begin{array}{c} \\ S_{21} \\ S_{11} \\ S_{12} \\ F_1 \end{array} \begin{array}{c} \begin{array}{cccc} S_{21} & S_{11} & S_{12} & F_1 \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

. The sum of *M* in a row is $\begin{bmatrix} 2 \\ 2 \\ 1 \\ 0 \end{bmatrix}$, which indicates the number of nodes to be dominated. The results show that S_{21}(=2) dominates two nodes (S_{11} and S_{12}), S_{11}(=2) dominates two nodes (S_{12} and F_1), S_{12}(=1) only dominates one node F_1, and F_1(=0) does not dominate any node. Now, we only consider the direct dominance relation in one stage (e.g., S_{21} → S_{11} or S_{11} → F_1). If S_{21} has power over S_{11} and S_{11} has power over F_1, then S_{21} has power over not only S_{11} but also F_1 (i.e., S_{21} → S_{11} → F_1). In this situation (two-stage dominance), the square of matrix *M* covers the indirect relations of two stages. The sum of *M* and M^2 in a row includes the nodes that dominate both in one stage and in two stages.

$M + M^2 = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 2 & 2 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$. The result is $\begin{bmatrix} 5 \\ 3 \\ 1 \\ 0 \end{bmatrix}$. We can find the order of dominance is: $S_{21} \rightarrow S_{11} \rightarrow S_{12} \rightarrow F_1$. The *n*-stage dominance (M^n) may be derived by following the same way. By summarizing the matrix in every stage (i.e., $M + M^2 + M^3 + \ldots$), we can obtain each firm's position in terms of power. At the end, the firm with the greatest value of the row sum has the greatest power over every other firm, and it is recognized as the most dominant position in the business network.

Now, the *business network position evaluating method* is illustrated formally as follows:

Business network position evaluating method

Let $BN(S_{ti}, F_j, B_{tk})$ be a square matrix that represents each firm linkage and its individual power strength in the business network. The sum of the entries in each row of the matrix $BN(S_{ti}, F_j, B_{tk}) + BN(S_{ti}, F_j, B_{tk})^2 + \ldots$ indicates how these firms are positioned relative to each other and the extent to which they dominate every stage, where

$$\text{Position} = BN(S_{ti}, F_j, B_{tk}) + BN(S_{ti}, F_j, B_{tk})^2 + \ldots$$
$$= \sum_{s=1}^{\infty} BN(S_{ti}, F_j, B_{tk})^s$$
$$= BN(S_{ti}, F_j, B_{tk}) \cdot \left(I - BN(S_{ti}, F_j, B_{tk})\right)^{-1}.$$

Notation:

S_{ti} : the i^{th} supplier in the t^{th}-tier upstream network level

F_j : the j^{th} firm in the focal firm level

B_{tk} : the k^{th} buyer in the t^{th}-tier downstream network level

t: the t^{th} network level

i: the i^{th} supplier

k: the k^{th} buyer

I: identity matrix

Once we obtain the cumulative weights of power, a firm's position in the business network strength can be identified; at the same time, we can observe all the firms in the network having a quantitative position value. The quantity helps demonstrate the business network from a whole network picture. A more detailed application and discussion will be shown in next section.

Examples

In this section, an example in which we analyze a firm's position in the business network

through the business network position evaluating method is presented in detail. In this example, we draw on the finance quantitative method to measure power, in which the powers are measured by using the percentage of the buyers derived from their suppliers' sales amount. Therefore, the value of power measurement is from 0 (low) to 1 (high) as shown in Figure 4. There are 8 upstream network firms (S_{11},S_{12},…,S_{18}), 9 downstream network firms (B_{11},B_{12},…,B_{19}) and 5 firms (F_1,F_2,…,F_5) at the focal firm level.

"Take in Figure 4"

Next, the business network is represented by the matrix $BN(S_{ti}, F_j, B_{tk})$ as follows:

$$BN(S_{ti}, F_j, B_{tk}) = \begin{array}{c} \\ S_{11} \\ S_{12} \\ S_{13} \\ S_{14} \\ S_{15} \\ S_{16} \\ S_{17} \\ S_{18} \\ F_1 \\ F_2 \\ F_3 \\ F_4 \\ F_5 \\ B_{11} \\ B_{12} \\ B_{13} \\ B_{14} \\ B_{15} \\ B_{16} \\ B_{17} \\ B_{18} \\ B_{19} \end{array} \begin{bmatrix} S_{11} & S_{12} & S_{13} & S_{14} & S_{15} & S_{16} & S_{17} & S_{18} & F_1 & F_2 & F_3 & F_4 & F_5 & B_{11} & B_{12} & B_{13} & B_{14} & B_{15} & B_{16} & B_{17} & B_{18} & B_{19} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.1 & 0.3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.4 & 0.5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.5 & 0 & 0.2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.5 & 0.7 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0.1 & 0.3 & 0 & 0 & 0 & 0.4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.1 & 0 & 0.6 & 0.1 & 0 & 0 & 0 & 0 \\ 0 & 0.4 & 0.5 & 0 & 0 & 0 & 0.3 & 0 & 0 & 0 & 0 & 0 & 0 & 0.3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.3 & 0 & 0 & 0.4 & 0.1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.4 & 0 & 0 & 0 & 0 & 0 & 0.2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.4 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.7 & 0 & 0 & 0.8 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.9 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.2 & 0 & 0.9 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.6 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

By using the business network position evaluating method, we find results as follows:

$$Position = \sum_{s=1}^{\infty} BN(S_{ti}, F_j, B_{tk})^s = [\ 1.67 \quad 0.31 \quad 1.46 \quad 3.17 \quad 2.65 \quad 1.53 \quad 0.64 \quad 0.00 \quad 4.11 \quad 2.54 \quad 2.06 \quad 0.60 \quad 1.08 \quad 0.00 \quad 4.15 \quad 3.19 \quad 1.77 \quad 1.60 \quad 0.35 \quad 1.60 \quad 2.49 \quad 0.96\ ]^T.$$

The results reveals each firm's position (e.g., S_{11}=1.67, S_{12}=0.31, ..., B_{19}=0.96). These values of position are calculated based on the relative power and network relationships; that is, the positions can be viewed as the cumulative weights of power steamily from the other network members. In addition, the values of position allow us to analyze their relative position as well. All firm positions are depicted in Figure 5; firm positions are included in parenthesis below the firm label.

"Take in Figure 5"

Results: findings and discussions

The positions of each firm can be quantified by our approach; therefore the data can be ranked and compared. With regard to the results, we may re-explain it from a general network picture as follows:

1. *Firms in advantageous/disadvantageous positions*. The findings in Figure 5 clearly indicate that suppliers S_{14} (3.17) and S_{15} (2.65) have an advantageous position at the upstream network level; S_{14} and S_{15} are the most powerful suppliers at this level. The same observation applies to B_{12} (4.15) as well, for it is in a position of competitive advantage at the downstream network level. At the focal firm level, F_1 (4.11) occupies the most powerful position. In contrast to the firms occupying an advantageous position, S_{18}, F_4 and B_{11} occupy the weakest position at each level. This analysis clearly shows a firm's position relative to others.
2. *The discrepancy between a power relation and a position advantages*. In general, if a firm has power over other firms, it also has a position of competitive advantage relative to these other firms. The results for most firms in our example fall in line with this generalization; however, some exceptions existed. A closer look at these ties in Figure 5 ($S_{11} \rightarrow F_2$ (i.e., S_{11} power over F_2); $S_{12} \rightarrow F_3$; $S_{14} \rightarrow F_1$; $S_{16} \rightarrow F_3$; $F_1 \rightarrow B_{12}$; $F_3 \rightarrow B_{13}$; $B_{14} \rightarrow F_2$; $B_{16} \rightarrow F_2$). Shows that these ties have a power advantage but occupy weak positions relative to their counterparts (e.g., F_3 has power strength over B_{13} with 0.3, but the F_3 position 2.06 is lower than B_{13} position 3.19.). The explanation of this discrepancy likely lies in the nature of each firm's mutual interactions with different firms and across various network levels. A firm's position is determined not only by the result of direct forces stemming from its first tier supplier(s) and/or buyer(s), but also from indirect forces exerted by the influence of firms on the second or other tier levels. These results are hard to find if we only consider dyadic or direct relationships; therefore, this is why we must consider a firm's position within the entire network structure. Another explanation for the discrepancy can spring from a relational view (Dyer and Singh, 1998), which involves considering cooperative strategies as sources of interorganizational competitive advantage. The authors also suggest using the network as the unit of analysis, with competitive advantage and relational rents associated with inter-firm linkages in the network.
3. *Identifying a firm's relationship in business networks*. The study identifies a firm in the business network relationship by evaluating the focal firm position relative to the upstream and downstream network levels. Here, we concentrate on a single focal firm to all of its upstream counterparties and downstream counterparties rather than a mere dyadic relation for each single supplier or buyer. This viewpoint would help managers

view all its suppliers and customers from a complete picture. These types are determined by two dimensions: the focal firm power's ranking relative to the upstream and the downstream, respectively. For example, F_3's position (2.06) in the downstream set (0.00 4.15 3.19 1.77 1.60 0.35 1.60 2.49 0.96) is 4th out of 10 firms (including F_3 itself) (= 6/10 = 60%) and its rank in the upstream set is 3rd out of 9 (= 6/9 = 67%). Therefore, the F_3's ranking in order is the 60th percentile and the 67th percentile on the upstream and downstream dimensions. Now, we can annotate all of the focal level firms with percentages: firm (% of ranking to downstream , % of ranking to upstream). The results are as follows: F_1(80% , 89%), F_2(70% , 67%), F_3(60% , 67%), F_4(20% , 22%) and F_5(30% , 33%). We can also represent the results of these firms diagrammatically, as in Figure 6. This figure reveals all of these firms' locations and their taxonomies in the business network. F_1, F_2 and F_3 are in the focal firm dominance group, whereas F_4 and F_5 are in the focal firm obedience group. Firms in the same group face similar power circumstances and competitive environment. (e.g., F_1, F_2 and F_3 have a stronger power over both their suppliers and customers.) Hence, it is helpful to identify a firm in business network relationship by analyzing the diagram.

"Take in Figure 6"

Case study: FC Company

This case study investigates the position of the case (focal firm) to its main tier 1 upstream suppliers and downstream customers. Due to these companies' request, fabricated company names are used to ensure anonymity. FC represents the focal firm that we aim to analyze; S refers to the upstream firms of the focal firm; and C refers to the downstream firms of the focal firm. FC designs and manufactures optical communication components. Their products are used in data communication, signal integration and consumer electronics application. Table 1 offers the profile of all companies in this case.

"Take in Table 1"

First, we evaluate the power strength between the focal firm and its upstream and downstream. In this case, we investigate the top five upstream suppliers of and top five downstream buyers from FC. We evaluate the relative power by using the percentage of the buyers (downstream) derived from the focal firm's sales, the percentage of the suppliers (upstream) derived from the focal firm's purchases (Ramsay 1996) and the opinion from interviews with FC's top managers (e.g., VP, sale director and purchasing director).

"Take in Figure 7"

Next, after the Figure 7 is transformed to matrix $BN(S_i, FC, B_j)$ and calculated by the business network position evaluating method, we can finally obtain the position: [0.57 0 0 0 0 0.26 0.42 0.37 0.34 0.06 0.06]^T. All positions are included in parenthesis below the firm label in Figure 7. According to the results, we re-explain the position with quantitative characteristics as:

1. From the advantageous/disadvantageous positions analysis, S_1 is the most dominant in this business network; most downstream companies are in advantageous positions, and most upstream companies are in disadvantageous positions. As FC (=0.26) is in the intermediate position (i.e., 5th out of 11).
2. From the viewpoint of the discrepancy between power and position, although the power of B_4 and B_5 are higher than that of FC, but FC still owns an advantageous position because of other network members' interactions.
3. In terms of business network relationships, FC's rank in the upstream set is 4th out of 6 and in the downstream set is 2nd out of 6; we can annotate this (i.e., 4th out of 6 refers to the 33rd percentile of the downstream, and 2nd out of 6 denotes a 66th percentile ranking in the upstream) as FC(33%, 66%). Therefore, the relationship type of FC is downstream network dominance.

In the past, the FC mangers can only compare the relative position of itself and another. The above results not only consistent with the general perspectives made by the top managers previously but also offer them to analyze their position and each member's position in this business network. Furthermore, this analysis can lead FC's top managers to understand its business network environment and take further strategic actions.

CONCLUSIONS AND MANAGERIAL IMPLICATIONS

A firm's position within its business environment is critical and of interest to managers. Managers are held accountable for recognizing a firm's position in its business environment. Consequently, how a firm's position is identified has become more important. In this paper, we first consider business networks from network perspective as opposed to a dyadic relation or a sequential chain concept. Second, we develop an understanding of a firm's competitive position by drawing on power and network relationships. We then summarize qualitative and quantitative methods of measuring the strength of power between the focal firm and its counterparts. Accordingly, we propose the business network position evaluating method to measure a firm's position in the network. As a result, we show that firm position can be

determined by systematic methodology and therefore be represented by quantitative value.

This study offers a quantitative approach for studying business network structures, relationships, power and firm position. There are several managerial implications and findings stemming from this work, as follows:

1. By quantitative analysis of firm position, it is possible to identify the ranking of all firms, allowing us to understand: which suppliers dominate the supplier market, which buyers occupy important positions in the buyer market, what is the relative position advantage between the focal firm and its competitors, suppliers and buyers, and which firms are the most influential in the business network. This study enables us to assess the strength of a firm's position and order in ways that facilitate qualitative analysis.
2. Industry structure analysis includes analyzing the number, size and power relation distribution of firms in an industry in order to understand the degree of industrial competition. Our study complements industry structure analysis by providing a much more detailed examination of firm position.
3. In our research, we draw on a firm's power relative to upstream and downstream firms to divide a business network into four types, which we denote as the *business network strategic groups*. Each different strategic group has different attributes; however, each firm within the same group has similar characteristics (McGee & Howard 1986; Nohria & Garcia-Pont 1991; Peteraf & Shanley 1997; Porter 1981). Our systematic analysis clarifies how to determine a firm according to the business network strategic groups as well as how to position a firm in the business network. As the former example revealed, F_4 and F_5 are in the same strategic group, meaning that other focal level firms (F_1, F_2, F_3, F_4, and F_5) compete with F_4, but only F_5 constitutes a strong and direct rival to F_4. Hence, if we view this from the standpoint of the focal firm F_4, we would not treat all competitors on the focal firm level equally rather than focusing on firms occupying the same strategic group (e.g., F_4 and F_5; F_1, F_2, and F_3). Further research is necessary to investigate strategies and management of a firm in the context of these business network strategic groups.
4. In general, a firm's position could be evaluated in terms of direct network members such as first tier suppliers, customers and competitors. Intuitively, if a firm has power over another, it occupies a position of competitive advantage relative to another. However, this result ignores indirect or multi-tier effects. Under bounded rationality, it is difficult to consider indirect influences, such as suppliers of suppliers or customers of customers. Even so, our study accounts for not only direct power influences but also indirect power influences across various network levels.

As Easton (1992, p 20) noted that "Positions are balanced as between the past and the future. History determines the current position but the future offers opportunities for changes". This study has taken a first step in the direction of identifying and quantifying a firm's current

position in a business network, and it underpins the status of the present and historical environments like other firm position studies. Based on our study, there are several questions that future research can address; that includes—how a firm manages or strategizes under different business network strategic groups; how a firm identifies its opportunities and threats on its current position; how a firm can engage in strategic repositioning and how a firm can draw on its current position to form a synergy with other members within the network; extending the business members which include such as investors, stakeholders, etc.

REFERENCES

Anderson, JC, Håkansson, H & Johanson, J 1994, 'Dyadic business relationships within a business network context', *The Journal of Marketing*, vol. 58, no. 4, pp. 1-15.

Bensaou, M 1999, 'Portfolios of buyer-supplier relationships', *Sloan Management Review*, vol. 40, no. 4, pp. 35-44.

Benton, WC & Maloni, M 2005, 'The influence of power driven buyer/seller relationships on supply chain satisfaction', *Journal of Operations Management*, vol. 23, no. 1, pp. 1-21.

Bigné, JE, Blesa, A, Küster, I & Andreu, L 2004, 'Market orientation: an antecedent to the industrial manufacturer's power', *European Journal of Marketing*, vol. 38, no. 1/2, pp. 175-193.

Brennan, DR, Turnbull, PW & Wilson, DT 2003, 'Dyadic adaptation in business-to-business markets', *European Journal of Marketing*, vol. 37, no.11/12, pp. 1636-1665.

Cool, K & Henderson, J 1998, 'Power and firm profitability in supply chains: French manufacturing industry in 1993', *Strategic Management Journal*, vol. 19, no. 10, pp. 909-926.

Cox, A 2001, 'Understanding buyer and supplier power a framework for procurement and supply competence', *The Journal of Supply Chain Management*, vol. 37, no. 2, pp. 8-15.

Cox, A 2004, 'The art of the possible: Relationship management in power regimes and supply chains', *Supply Chain Management: An International Journal*, vol. 9, no. 5, pp. 346-356.

Cox, A, Ireland, P, Lonsdale, C, Sanderson, J & Watson, G 2002, *Supply Chains, Markets and Power: Mapping buyer and supplier power regimes*, Routledge, London.

Crook, TR & Combs, JG 2007, 'Sources and consequences of bargaining power in supply chains', *Journal of Operations Management*, vol. 25, no. 2, pp. 546-555.

David, U & Barney, JB 1984, 'Perspectives in Organizations: Resource dependence, efficiency, and population', *Academy of Management*, vol. 9, no. 3, pp. 471-481.

Dickson, PR 1983, 'Distributor portfolio analysis and the channel dependence matrix: New techniques for understanding and managing the channel', *Journal of Marketing*, vol. 47, no. 3, pp. 35-55.

Dyer, J & Singh, H 1998, 'The relational view: Cooperative strategies and sources of interorganizational competitive advantage', *Academy of Management Review*, vol. 23, no. 4, pp. 660-679.

Easton, G 1992, 'Industrial network: a review', in Axelsson, B & Easton, G (ed.), *Industrial networks: A new view of reality*, Routledge, London, pp. 3-27.

Emerson, RM 1962, 'Power-dependence relations', *American Sociological Review*, vol. 27, pp. 31-40.

Ford, D & McDowell, R 1999, 'Managing business relationships by analyzing the effects and value of different actions', *Industrial Marketing Management*, vol. 28, no. 5, pp. 429-442.

French, JR & Raven, B 2001, 'The Bases of Social Power', in Asherman, IG & Asherman, SV (ed.), *The Negotiation Sourcebook*, Human Resource Development Press, MA, pp. 61-73.

Gadde, LE, Huemer, L & Håkansson, H 2003, 'Strategizing in industrial networks', *Industrial Marketing Management*, vol. 32, no. 5, pp. 357-364.

Gadde, L-E & Håkansson, H 1992, 'Analysing change and stability in distribution channels - a network approach', in Axelsson, B & Easton, G (ed.), *Industrial networks: A new view of reality*, Routledge, London, pp. 166-179.

Grant, RR 1997, 'Measuring corporate power: Assessing the options', *Journal of Economic*, vol. 31, no. 2, pp. 453-460.

Håkansson, H & Ford, D 2002, 'How should companies interact in business networks', *Journal of Business Research*, vol. 55, no. 2, pp. 133-139.

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

Harary, F, Norman, RZ & Cartwright, D 1965, *Structural models: an Introduction to the theory of directed graphs*. John Wiley & Sons, New York.

Hardy, C 1996, 'Understanding power: Bringing about strategic change', *British Journal of Management*, vol. 7, pp. 3-16.

Hart, P & Saunders, C 1997, 'Power and trust: Critical factors in the adoption and use of electronic data interchange', *Organization Science*, vol. 8, no.1, pp. 23-42.

Huemer, L 2006, 'Supply management: Value creation, coordination and positioning in supply relationships', *Long Range Planning*, vol. 39, no. 2, pp. 133-153.

Ketchen, DJ & Hult, TM 2007, 'Bridging organizational theory and supply chain management: The case of best value supply chains', *Journal of Operations Management*, vol. 25, no. 2, pp. 573-580.

Kim, H, Hoskisson, RE & Wan, WP 2004, 'Power dependence, diversification strategy, and performance in keiretsu member firms', *Strategic Management Journal*, vol. 25, no. 7, pp. 613-636.

Krajewski, L, Wei, JC & Tang, LL 2005, 'Responding to schedule changes in build-to-order

supply chains', *Journal of Operations Management*, vol. 23, no. 5, pp. 452-469.

Lambert, DM, Cooper, MC & Pagh, JD 1998, 'Supply chain management: Implementation issues and research opportunities', *The International Journal of Logistics Management*, vol. 9, no. 2, pp. 1-20.

Lamming, R, Johnsen, T, Zheng, J & Harland, C 2000, 'An initial classification of supply networks', *International Journal of Operations & Production Management*, vol. 20, no. 6, pp. 675-691.

Lusch, RF & Brown, JR 1982, 'A modified model of power in the marketing channel', *Journal of Marketing Research*, vol. 19, no. 3, pp. 312-323.

Maloni, M & Benton, WC 2000, 'Power influences in the supply chain', *Journal of Business Logistics*, vol. 21, no. 1, pp. 49-74.

Mattsson, L-G & Johanson, J 2006, 'Discovering market networks', *European Journal of Marketing*, vol. 40, no. 3/4, pp. 259-274

McGee, J & Howard, T 1986, 'Strategic groups: Theory, research and taxonomy', *Strategic Management Journal*, vol. 7, no. 2, pp. 141-160.

Medcof, JW 2001, 'Resource-based strategy and managerial power in networks of internationally dispersed technology units', *Strategic Management Journal*, vol. 22, no. 11, pp. 999-1012.

Mills, J, Schmitz, J & Frizelle, G 2004, 'A strategic review of supply networks', *International Journal of Operations & Production Management*, vol. 24, no. 10, pp. 1012-1036.

Möller, M & Halinen, A 1999, 'Business relationships and networks: Managerial challenge of network era', *Industrial Marketing Management*, vol. 28, no. 5, pp. 413-427.

Nohria, N & Garcia-Pont, C 1991, 'Global strategic linkages and industry structure', *Strategic Management Journal*, vol. 12, no. S1, pp. 105-124.

Peteraf, M & Shanley, M 1997, 'Getting to know you: A theory of strategic group identity', *Strategic Management Journal*, Summer Special Issue 18, pp. 165-186.

Pfeffer, J 1982, *Organizations and Organization Theory*, Pitman, Boston, MA.

Pfeffer, J & Salancik, GR 1978, *The External Control of Organizations: A Resource Dependence Perspective*, Harper & Row, New York.

Porter, ME 1981, 'The contributions of industrial organization to strategic management', *Academy of Management Review*, vol. 6, no. 4, pp. 609-20.

Porter, ME 1980, *Competitive strategy: techniques for analyzing industries and competitors*, Free Press, New York.

Provan, KG, Beyer, JM & Kruytbosch C 1980, 'Environmental linkages and power in resource-dependence relations between organizations', *Administrative Science Quarterly*, vol. 25, no. 2, 200-225.

Ramsay, J 1994, 'Purchasing power', *European Journal of Purchasing and Supply Management*, vol. 1, no. 3, pp. 125-138.

Ramsay, J 1996, 'Power measurement', *European Journal of Purchasing and Supply*, vol. 2, no. 2-3, pp. 129-143.

Ritter, T & Gemünden, HG 2003, 'Interorganizational relationships and networks: An overview', *Journal of Business Research*, vol. 56, no. 9, 691-697.

Ritter, T, Wilkinson, IF & Johnston, WJ 2004, 'Managing in complex business networks', *Industrial Marketing Management*, vol. 33, no. 3, pp. 175-183.

Sullivan, M & Mizrahi, A 2008, *Finite Mathematics: An Applied Approach*, John Wiley & Sons, New York.

Svahn, S & Westerlund, M 2007, 'The modes of supply net management: A capability view', *Supply Chain Management: An International Journal*, vol. 12, no. 5, pp. 369-376.

Wathne, KH & Heide, JB 2004, 'Relationship governance in a supply chain network', *Journal of Marketing*, vol. 68, no. 1, pp. 73-89.

Wilkinson, I & Young, L 2002, 'On cooperating: Firms, relations, networks', *Journal of Business Research*, vol. 55, no. 2, pp. 123-132.

TABLE

Table 1 Case study: the company profiles ($ million)

Company	Profile	Mkt. Share %	Reg. capital	# Emp.	Country
B_1	Optical components supplier	33	50	800	China
B_2	Communication component and consumer applications supplier	29	120	450	China
B_3	Fiber optical devices manufacturer	27	6	400	China
B_4	OEM/ODM manufacturer of networking products	5	800	6000	Taiwan
B_5	Optical communication products supplier	5	4	80	USA
FC	Optical communication components manufacturer	—	20	200	Taiwan
S_1	Specialty materials, optical components and systems provider	45	3000	18000	Germany
S_2	Optical, analog and mixed-signal products and data communications components provider	10	127	450	Canada
S_3	Analog and mixed signal ICs of optical fiber communications provider	8	80	50	UK
S_4	Soc IC and LCD driver IC provider.	5	40	280	Taiwan
S_5	Fiber optic cables and electrical cables provider	3	10	100	USA

Note:

Mkt. share %: % of FC's purchases from suppliers or % of buyer's market share from FC; Reg. capital: registered capital; # Emp.: number of employees.

Data sources: Mkt. Share % from the internal finance report; Profile, Reg. capital, # Emp., and Country from companies' websites.

FIGURE

Figure 1 The structure of business networks

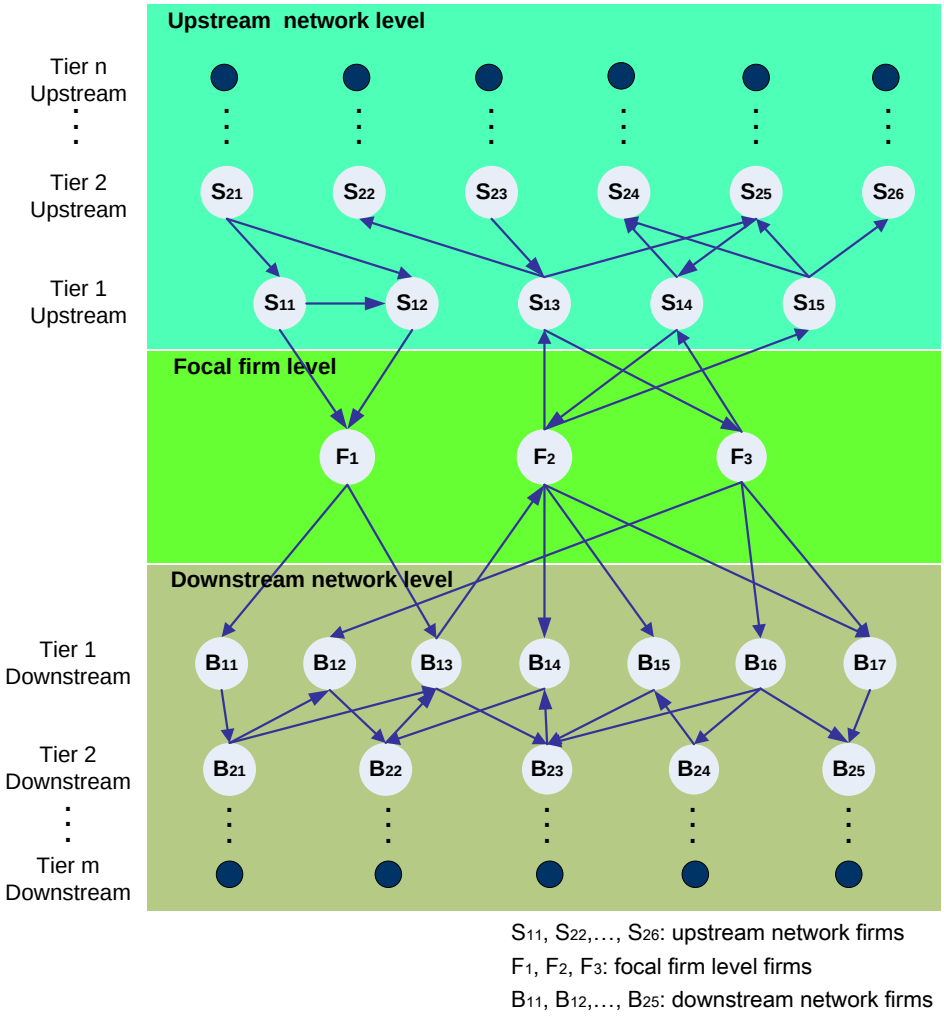


Figure 2 Types of business network relationships

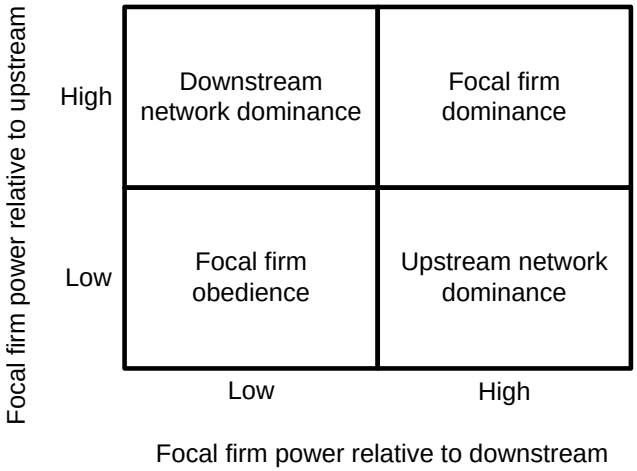


Figure 3 The conceptual framework of this study

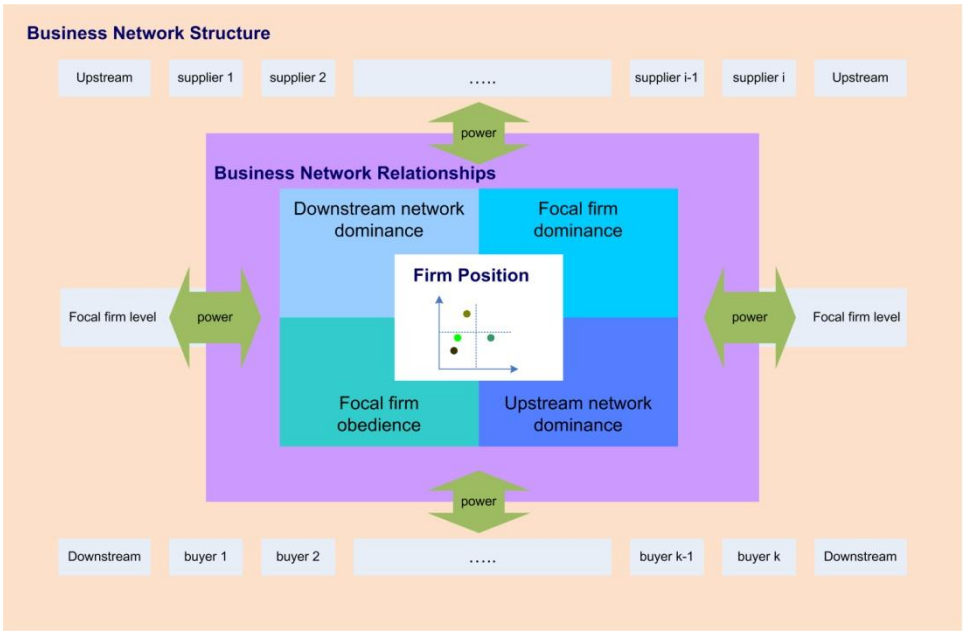
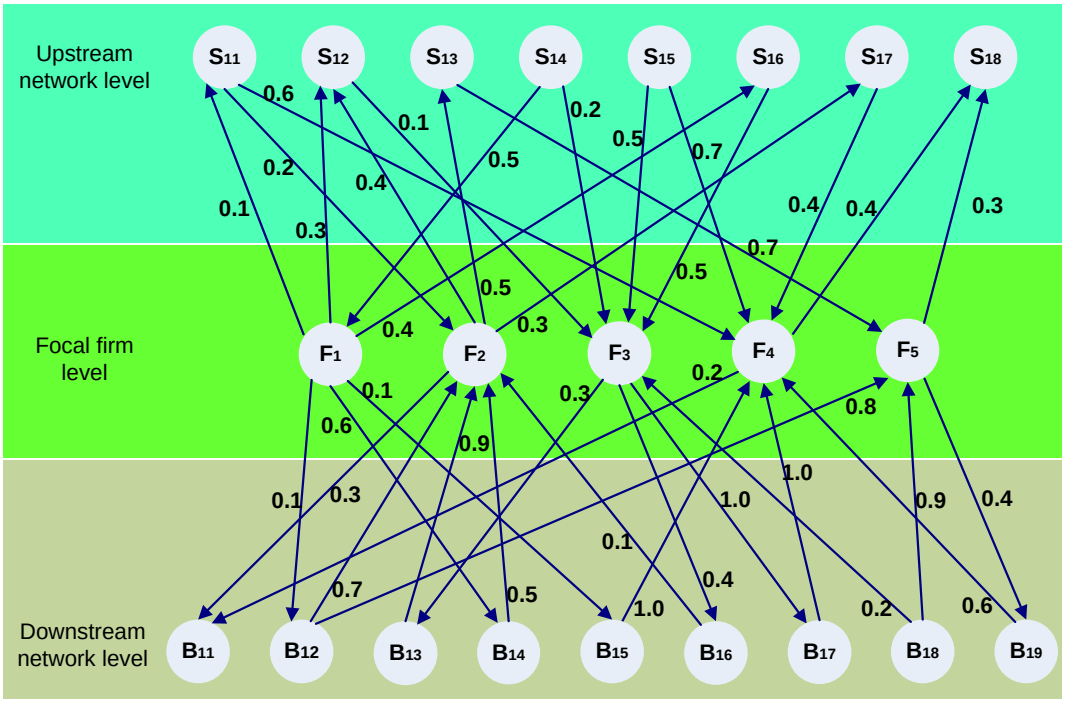


Figure 4 Example of business networks



S_{11}, S_{22},…, S_{26}: upstream network firms
F_1, F_2,..., F_5: focal firm level firms
B_{11}, B_{12},…, B_{19}: downstream network firms

Figure 5 Example of business networks with positions

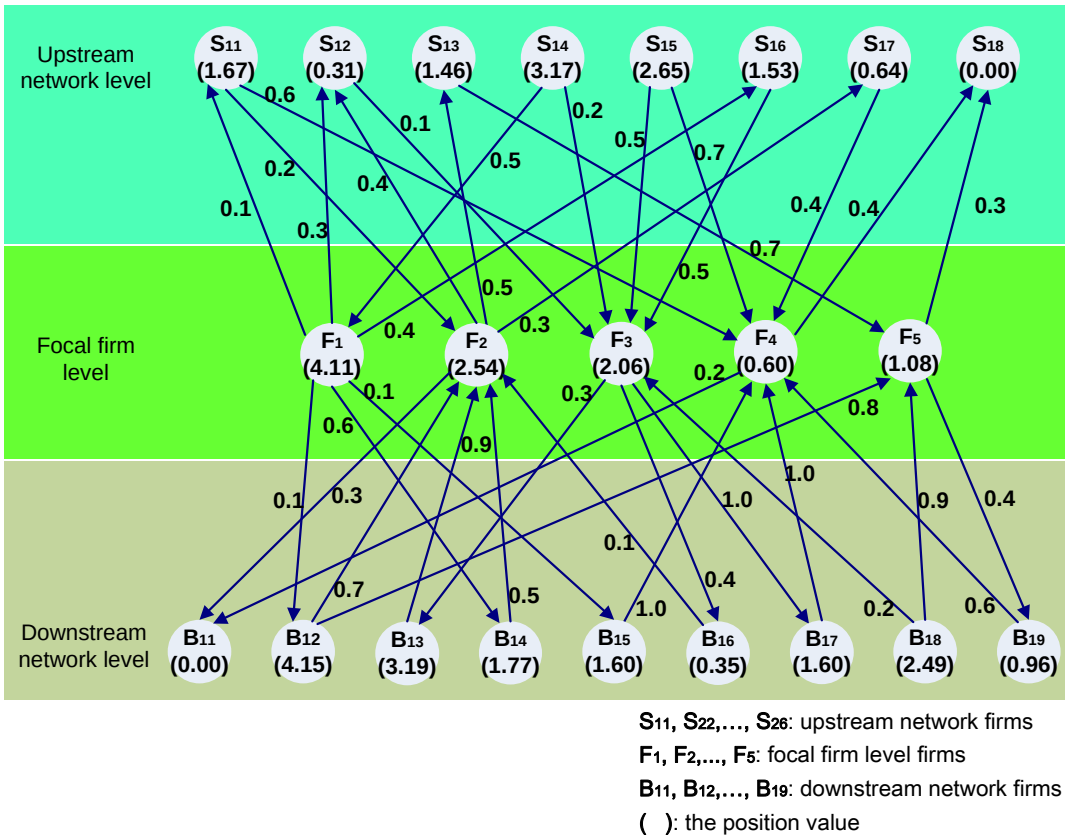


Figure 6 Example of the firm positions and business network relationships

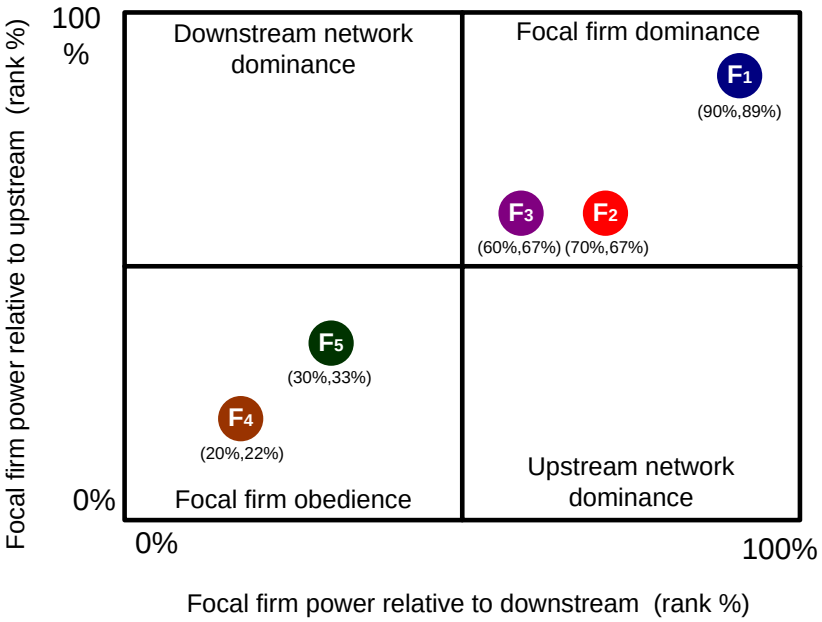
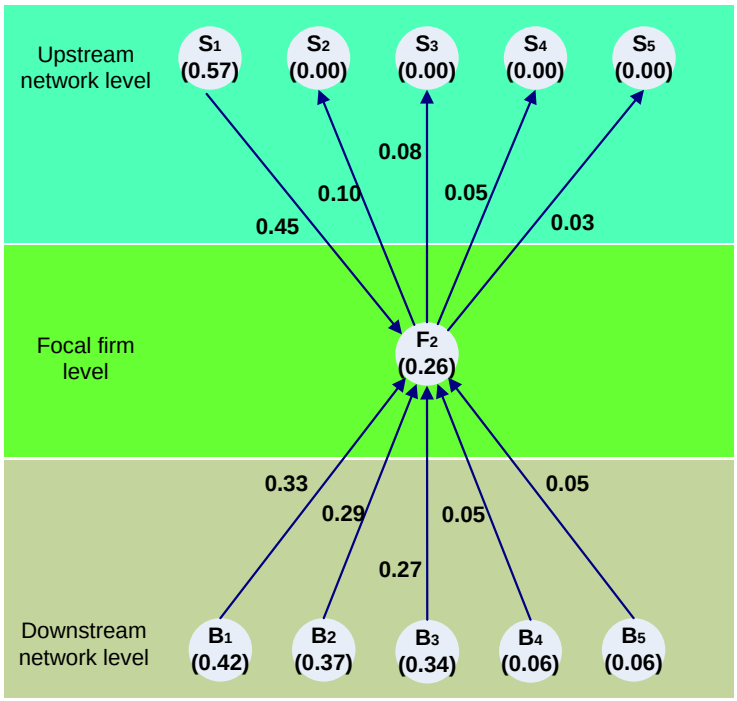


Figure 7 Case study of business networks with positions



S1, S2,…, S5: upstream network firms
FC: focal firm
B1, B12,…, B5: downstream network firms
( ): the position value