Competition and Cooperation Intensity in a Network – A Case Study in Taiwan Simulator Industry

Ting-Hua Chien, Chung-Shan Institute of Science and Technology, Taiwan
Tzu-Ju Peng, Ph. D., Providence University, Taiwan

ABSTRACT

This study aims at exploring the competition, cooperation, and coopetition intensity in a network. Conducted by qualitative research, this study investigates a network which is composed of thirteen companies in the Taiwan simulator industry. Longitudinal data were collected from twenty-two bidding contracts during 1995-2002. The unit of analysis is the bidding contract. Drawing from network perspective, this study analyzes the competition matrix as well as cooperation matrix of these twenty-two bidding cases. According to the results, this study develops the equations of competition, cooperation and coopetition intensity to delineate the competitive and cooperative behaviors in a network.

INTRODUCTION

A competitive paradigm advocates that a business shall more efficiently acquire and use scarce resources than other competitors to create higher values. In view of the limitations of competitive strategies, the importance of cooperative strategies has been pointed out. In practice, firms have concurrently applied a syncretic model of competitive and cooperative strategies (Lado, Boyd and Hanlon, 1997). Prior studies have focused separately on competitive strategies or cooperative strategies, less attention has been paid to the coopetition strategies. Coopetition represents "competition and cooperation" as well as "cooperation with competitors". However, how do firms concurrently adopt a competitive strategy and a cooperative strategy? How do firms cooperate with their competitors? The main purpose of this study is to explore the competitive behaviors and cooperative behaviors of firms in a network. We particularly focused on the issue of coopetition intensity. Conducted by a qualitative research, this study investigates a network that is composed of thirteen companies in the Taiwan simulator industry. We collected longitudinal data of 22 bidding contracts during 1995-2002. In the network, companies compete each other for getting the bid, they then in turn cooperate by delivering sub-contract to competitors. Drawing from network analysis perspective, we depicted a competition matrix and a cooperation matrix to figure out the competition, cooperation, and coopetition intensity in a network.

THEORETICAL BACKGROUNDS

Competition, cooperation, and coopetition

Cooperation is the interaction process generated from relationships of acquiring common interest among individuals, groups and organizations (Smith and Wilson, 1995). Competition is an opponent behavior engaged by two or more individuals or groups to attain a certain objective. From the competitive aspect, a firm in such a turbulent environment shall strengthen its own competitiveness in order to survive (Hill, 1990). On the other hand, from cooperative aspect, a firm shall also establish and strengthen its core competitiveness through strategic alliances (Hamel, 1991). Lado, Boyd and Hanlon (1997) has proposed a syncretic model to explain rent-seeking strategic behavior. They argued that competition and cooperation have been previously viewed largely as opposite ends on a spectrum. However, success in today's business world often requires that firms adopt both competitive and cooperative strategies simultaneously. The best partner for a firm in a strategic alliance is the strong competitor. Thus, cooperation can enhance the competitiveness of a firm.

Interorganizational relationships constitute a social structure of coopetition, which manifests a strategy for cooperation as well as for competition. The issue of coopetition has been noticed by some scholars in the strategic management field (e.g., Brandenburger and Nalebuff, 1996; Lado, Boyd, and Hanlon, 1997; Tsai, 2002). Coopetition refers to a cooperative and competitive model adopted by a firm for developing market or reducing cost to improve firm's competitiveness and acquire market leading position. Levinson and Asahi (1995) stated that as alliance has turned to be cross-industrial and cross-national mode, in order to cope with uncertainty and complexity in the global environment, firms were forced to interact with each other cooperatively and competitively. Das and Teng (2000) defined competition as pursuing one's own interest at the expense of others. They argued that partners

are either direct or indirect, current or potential competitors. Although, they are in partnership of alliances, they compete to each other for resources, know-how and technologies from partners within the boundary of alliances and markets. Thus, the coexistence of cooperation and competition between partners is an important characteristic of strategic alliances (Das and Teng, 2000).

Intensity

Despite we have noticed the coexistence of competition and cooperation, how can we capture both competitive behaviors and cooperative behaviors in a network? In this study, we employed network analysis method to represent the competition, cooperation, and coopetition intensity in a network. From social network perspective, Tichy, Tuchman and Fombrun (1979) addressed that network intensity refers to the contact frequency of network members in a period of time. Whetten (1989) defined network intensity as the level of commitments of organizational resources to relationship, which can be observed from the amount and frequency of resource exchange. Kuklinsk and Knokei (1982) defined network intensity as the level of direct link of members with other people. Kilmann and Kilmann (1991) points out the network intensity shall be the concern level of individuals to missions or the number of signed contracts by both parties within a specified period. According to network analysis, intensity refers to the frequency of contact between network members during a period of time. Competition intensity is considered the frequency of competitive contact. As well, cooperation intensity refers to the frequency of cooperative contact between actors in a network.

METHODOLOGY

Sample and data collections

We selected the Taiwan simulator industry as our research setting. The simulators, the devices that can mix the spurious with the genuine, are tools for engineering design, test and analysis, and education and training. Combining high-speed computing with resolving capabilities for mathematic models of the current computers, the simulators can be applied to the physic-mathematic models in various fields. The applied scope covers military aircrafts, vessels, armored tanks, artillery, and computer war-gaming, etc. In addition, the simulators can be applied to civil use other than military use, such as aircraft simulator, ship piloting, car driving, and nuclear plant operating, etc. Moreover, dynamic-motion amusement machines of large-scale theme parks are the derived products of low-level simulators as well. For training requirements, military-applied market is always the major market segment in the simulator industry, especially this is the case happened in Taiwan.

In this study, we observed the competition and cooperation in a network in Taiwan simulator industry. The network is composed of thirteen companies, of which three companies (Company A, B, and C) are domestic companies and the others are foreign companies. In some cases, actors in the network compete to each other first for getting the bid, and then the winner transferred subcontracts to its competitors for completion the contracts. That is, the actors compete first and then cooperate. This is the major part from which we could observe the coexistence of competition and cooperation.

The network is led by the Company A, which is the largest domestic company and a technical research institution under MND (Ministry of National Defense) in Taiwan. Company A mainly focuses on R&D and manufacture of national defense weapon systems including simulators. Therefore, its development in simulator industry also deals mainly with the domestic armed force market as its target. Due to the mission, the deployment of internal professional resources in Company A is comprehensive and with high manpower quality. In addition, due to the stability of system operations and human resource management, Company A has possessed the leading position with best technological capability, managerial talent and network capital in the Taiwan simulator industry. Owing to its resource advantages, Company A always exerts competitive strategy in each bidding case.

Company B is an aviation business entity under the jurisdiction of MOEA (Ministry of Economic Affairs). The company focuses its business on R&D and production of aviator systems. In recent years, in order to strengthen its competitive advantages, it also performs diversification strategies towards medical engineering technology, education and training fields. In simulator market, Company B has currently positioned itself in domestic armed force market. Due to its synergy from aviator system, Company B possessed highly professional and technical standards. As well, the deployment of internal resources such as technological capacity, managerial talent and network capability are strong enough to adopt competition strategies in domestic simulator market. Company C is a private-owned company, which focuses its core business on communication and computer industry. It spans into the armed force-related but lower level computer training system to meet the armed-force demand in computer network and geological information system. Since it focuses on communication industry, its competitive advantages

pertaining to simulator is weaker than those of Company A and B. Therefore, Company C employed cooperative strategy rather than competitive strategy in the simulator industry.

The unit of analysis in this study is each bidding contract. Longitudinal data were collected from 1995 through 2002. During this period, totally 22 bidding contracts were observed. In the network from which we investigated, each of the thirteen companies has involved at least one shot of competition for the bidding cases. Each bid offered at least NT$ three millions contract on simulator production or maintenance. In this study, we conducted in-depth face-to-face interviews with semi-structural questionnaire to gather the qualitative data. We interviewed six managers who are in charge of the bidding contracts in simulator division.

Measurements

Derived from network analysis perspective, intensity refers to the frequency of contact between network actors during a period of time. Thus, competition intensity indicates the frequency of competitive interactions between network actors. Cooperation intensity refers to the frequency of cooperative interactions between network actors. As well, coopetition intensity is measured by both the competitive and cooperative frequency between network actors. In accordance with the above definition, this study induces quantitative equations of competition, cooperation, and coopetition intensity as follows.

$$\text{Competition Intensity} = \frac{\text{Actual competitive frequency of bidding cases}}{\text{Total number of possible competitive cases}} \quad (1)$$

$$\text{Cooperation Intensity} = \frac{\text{Actual cooperative frequency of cases}}{\text{Total number of possible cooperative cases}} \quad (2)$$

In this study, we collected 22 bidding cases. This figure indicates the "total number of possible competitive cases" as well as the "total number of possible cooperative cases". Coopetition intensity can be calculated as equation (2) divided by equation (1).

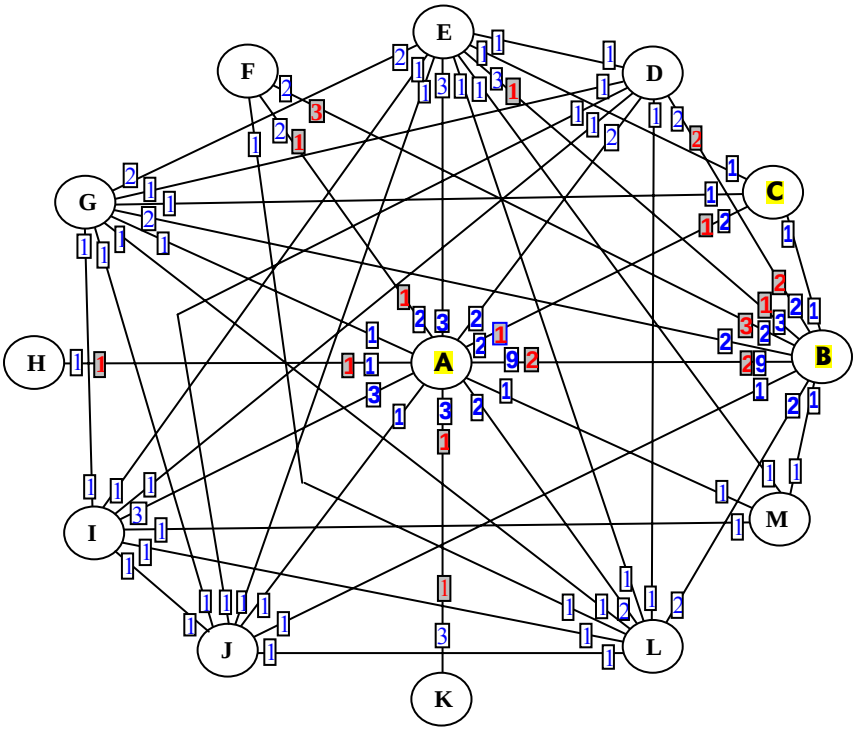
$$\text{Coopetition Intensity} = \frac{\text{Actual competitive frequency of bidding cases}}{\text{Actual cooperative frequency of cases}} \quad (3)$$

RESULTS AND DISCUSSIONS

Network with competition and cooperation

Figure 1 shows the network with competitive and cooperative frequencies among these thirteen companies in 22 bidding contracts during 1995-2002. In the network, company A, B, and C are domestic companies in Taiwan, the others are foreign companies. As we can see from the network, coexistence of competition and cooperation did happen, particularly the interactions among three domestic companies. However, some of the dyadic relationship represent only competition but not cooperation, such as dyad A and D, A and G, A and I, A and J, A and K. The competition frequency as well as the cooperation frequency did vary with different dyads. For example, dyad A and B shows 9 competition frequencies and 2 cooperation frequencies, dyad A and C shows 2 competition frequencies and 1 cooperation frequency.

Figure 1. Network with competition and cooperation



Note: The figure with dark-colored background stands for cooperative frequency. The figure with blank background stands for competition frequency. Take an example of the dyad between A and B, 9 competition frequencies and 2 cooperation frequencies happened in total 22 cases.

Competition/cooperation frequency and intensity

According to Figure 1, the frequency matrix of competition and cooperation is shown in Table 1. Based on equation (1) and equation (2), the competition intensity and cooperation intensity were calculated from frequency matrix divided by 22 cases. The intensity matrix is shown in Table 2.

Table 1. Frequency Matrix of Competition and Cooperation

	A	B	C	D	E	F	G	H	I	J	K	L	M
A		**9**	**2**	**2**	**3**	**2**	**1**	**1**	**3**	**1**	**3**	**2**	**1**
B	2		**1**	**2**	**3**	**2**	**2**	**0**	**1**	**1**	**0**	**2**	**1**
C	1	0		**1**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**1**	**1**
D	0	2	0		**0**	**0**	**1**	**0**	**1**	**1**	**0**	**1**	**0**
E	0	1	0	0		**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
F	1	3	0	0	0		**0**	**0**	**0**	**0**	**0**	**1**	**0**
G	0	0	0	0	0	0		**0**	**1**	**1**	**0**	**1**	**0**
H	1	0	0	0	0	0	0		**0**	**0**	**0**	**0**	**0**
I	0	0	0	0	0	0	0	0		**1**	**0**	**1**	**1**
J	0	0	0	0	0	0	0	0	0		**0**	**1**	**0**
K	1	0	0	0	0	0	0	0	0	0		**0**	**0**
L	0	0	0	0	0	0	0	0	0	0	0		**0**
M	0	0	0	0	0	0	0	0	0	0	0	0	

Note: The right half matrix with bold and dark-colored figure shows the competition frequency. The left half matrix shows the cooperation frequency.

Table 2. Intensity Matrix of Competition and Cooperation

	A	B	C	D	E	F	G	H	I	J	K	L	M
A		**0.41**	**0.10**	**0.10**	**0.14**	**0.10**	**0.05**	**0.05**	**0.14**	**0.05**	**0.14**	**0.10**	**0.05**
B	0.10		**0.05**	**0.10**	**0.14**	**0.10**	**0.10**	**0**	**0.05**	**0.05**	**0**	**0.10**	**0.05**
C	0.05	0		**0.05**	**0.05**	**0**	**0.10**	**0**	**0.05**	**0.05**	**0**	**0.05**	**0.05**
D	0	0.10	0		**0**	**0**	**0.05**	**0**	**0.05**	**0.05**	**0**	**0.05**	**0**
E	0	0.05	0	0		**0**	**0.05**	**0**	**0**	**0**	**0**	**0**	**0**
F	0.05	0.14	0	0	0		**0**	**0**	**0**	**0**	**0**	**0.05**	**0**
G	0	0	0	0	0	0		**0**	**0.05**	**0.05**	**0**	**0.05**	**0**
H	0.05	0	0	0	0	0	0		**0**	**0**	**0**	**0**	**0**
I	0	0	0	0	0	0	0	0		**0.05**	**0**	**0.05**	**0.05**
J	0	0	0	0	0	0	0	0	0		**0**	**0.05**	**0**
K	0.05	0	0	0	0	0	0	0	0	0		**0**	**0**
L	0	0	0	0	0	0	0	0	0	0	0		**0**
M	0	0	0	0	0	0	0	0	0	0	0	0	

Note: The right half matrix with bold and dark-colored figure shows the competition intensity. The left half matrix shows the cooperation intensity.

As shown in Table 1 and Table 2, the competition intensity between A and B is respectively 0.41, which is higher than that between dyad A and C (0.10) and B and C (0.05), demonstrating that competition between the leading domestic company A and the second domestic company B is the strongest. This is probably resulted from that both Company A and B possessed similar competitive advantages of technological capability, managerial talent, and network capital. With better advantages, they performed much more competitive strategy than cooperative strategy. This finding is consistent with Chen's (1996) argument that firms with symmetric resources may have similar strategies.

In terms of cooperative strategy, the company B represented much more cooperative frequency (8 of 22) than the company A did (6 of 22), showing that company B preferred cooperation other than competition. This is probably due to the difference of ownership between A and B. Despite two companies are state-owned, the company A belongs to the Ministry of National Defense but the company B belongs to the Ministry of Economic Affairs. The former may have more restrictions on interorganizational collaborative contracts whereas the latter has more flexibility. As Johanson and Mattsson (1987) point out, network is composed of positions and links, firms with different positions in a network adopt various strategies. The actor with relatively strong position attempts to initiate more competitive strategies. In this study, the company A possessed central position in the network that in turn enhance company A with more power to employ competitive strategy.

Moreover, the competition intensity and cooperation intensity between B and C are respectively 0.05 and 0, indicating that, so far, only competition but not collaboration exists between B and C. According to the findings, we proposed the following equations (4), (5) and (6) which were transformed from matrix to generally express the competition, cooperation, and coopetition intensity in a network.

$$\text{Competition Intensity} = \frac{\sum_{i=1}^{K}\sum_{j=1}^{K} COM_{ij}\ ,\ (i<j)}{N} \qquad (4)$$

COM: competition frequency
N: Total number of possible competition cases among actors

$$\text{Cooperation Intensity} = \frac{\sum_{i=1}^{K}\sum_{j=1}^{K} COOP_{ij}\ ,\ (i>j)}{N} \qquad (5)$$

COOP: cooperation frequency
N: Total number of possible cooperation cases among actors

$$\text{Coopetition Intensity} = \sum_{i=1}^{K} \sum_{j=1}^{K} \frac{COM_{ij}\ ,\ (i < j)}{COOP_{ji}\ ,\ (i > j)} \qquad (6)$$

CONCLUSIONS

This study focused on the competition and cooperation between actors in a network. Conducted by a qualitative research in Taiwan simulator industry, we observed 22 bidding cases which encompass both the competitive behaviors and cooperative behaviors. Actors in a network compete first for getting the bid and then cooperate by delivering subcontract to competitors. We found that competition and cooperation did coexist in a network, and that the competitive frequency as well as the cooperative frequency did vary with different dyads. Drawing from network analysis perspective, we depicted competition frequency and cooperation in a matrix. Moreover, in accordance with the results in the matrix, we proposed the equations of competition intensity, cooperation intensity, and coopetition intensity to generally express the interactions among actors in a network.

The frequency matrix and intensity equations proposed in this study are expected to be useful for capturing the organizational behaviors in alliances and networks. Yet some limitations left revealing the need for future research. For example, this study did not examine the antecedent factors that affect the coopetition intensity, such as resource symmetry between actors, position in networks, and strategic similarity between actors. Nor we did not examine the correlation between coopetition intensity and performance. Also, the concept of coopetition intensity could be examined in various network settings other than simulator industry. Meanwhile, quantitative research is preferable as long as we can overcome the limitation on archival data collection. Hopefully, at the era of coopetition, this study contributes to complete understanding about competition and cooperation in alliances and networks.

ACKNOWLEDGEMENT

The authors are grateful for the financial support from the National Science Council in Taiwan (NSC-90-2416-H-126-005).

REFERENCES

Brandenburger, A. M. and Nalebuff, B. J. (1996). *Co-opetition*. New York: Doubleday.

Chen, M. J. (1996). Competitor Analysis and Inter-Firm Rivalry: Toward a Theoretical Integration. *Academy of management Review*, 21: 100-134.

Das, T. K. and Teng, B. (2000). Instabilities of Strategic Alliances: An Internal Tensions Perspective. *Organization Science*, 11(1): 77-101.

Hamel G. (1991). Competition for Competence and Inter-partner Leaning within International Strategic Alliance. *Strategic Management Journal*, 12: 83-103.

Hill, C. W. (1990). Cooperation, Opportunism, and The Invisible Hand: Implications for Transaction Cost Theory. *Academy of Management Review*, 15: 500-513.

Kilmann, R. H. and Kilmann, I. (1991). *Creating The Perfectly Competitive Organization, Making Organizations Competitive: Enhancing Networks and Relationships Across Traditional Boundaries,* Jessey-Bass Publishers.

Knoke, D. and Kuklinski J. H. (1982). *Network Analysis*, Beverly Hills: Sage Publications.

Lado, A. A., Boyd, N. G. and Hanlon, S. G. (1997). Competition, Cooperation and the Search for Economic Rents: A Syncretic Model. *Academy of Management Review*, 22: 110-141.

Levinson, N. and Asahi, M. (1995). Cross-national Alliances and Inter-organizational Learning. *Organizational Dynamics*, 24: 50-63.

Smith, F. L. and Wilson, R. L. (1995). The Predictive Validity If The Karnani and Wernerfelt Model of Multipoint Competition. *Strategic Management Journal*, 16: 143-160.

Tichy N. M., Tushman, M. L. and Fombrun, C. (1979). Social Network Analysis for Organizations. *Academy of Management Review*, 4(4): 507-519.

Tsai, W. (2002). Social Structure of "Coopetition" within a Multiunit Organization: Coordination, Competition, and Intra-organizational Knowledge Sharing. *Organization Science*, 13(2): 179-190.

Whetten, D.A. (1989). What Constitutes a Theoretical Contribution?" *Academy of Management Review*, 14: 490-495.