Is joining consortia the best way to lead a good performance?

Is joining consortia the best way to lead a good performance? – An observation of Taiwan Bike Industry
Ting-Lin LEE and In-Chen TU,
Department of Asia-Pacific Industrial and Business Management,
National University of Kaohsiung, Taiwan
700, Kaohsiung University Road, Kaohsiung, Taiwan, linda_lee@nuk.edu.tw

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Is joining consortia the best way to lead a good performance? –An aspect of Social Network Analysis

Abstract:

The article uses visually social network analysis (SNA) to present networking activities of Taiwan’s bike and components firms interacting in domestic market. The study uses data from questionnaires of sixty-five bike and component firms to explore the influence of organizational learning, relationship quality and network position on organizational performance. Results show that relationship quality positively affects organizational learning and organizational performance. However, the outcome shows that organizational performance is partially supported by network position. It was further revealed that TCN’s closeness centrality is the best explanation on organizational performance, because A-TEAM was coordinated by Giant and Merida. They share core value and related information, knowledge and market. It is worth noted that non-A-TEAM member (say IDEAL, coded GB_01) also had a higher in-degree and closeness centrality, and a better performance as well. Here is a key point to be re-thinking: is joining consortia the best way to lead a good performance? The answer is not fully supported by the case of Taiwan’s bike industry.

Keywords: social network, organizational learning, relationship quality, network position, organizational performance.
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1. Introduction

On the subject of Taiwan’s traditional industries, the public will think of contract manufacturers (CM) of well-known international factories. Among others, bike industry plays a crucial role which can truly stand for Taiwan. In 2007, the export volume approaches to around 4.75 million sets whose growth rate rises almost to 17%. Moreover, the export value amounts to \$10.54 billion, all its growth rate closes to 25.63%. It cannot be denied that CM of bike and related components is a marvelous industry, which creates high value-added profits and at one time has great effects upon Taiwan’s economic development.

However, industrial environment has changed a lot; SMEs which insist on staying in Taiwan are facing overwhelming challenges from China and Southeast Asian countries where production costs are much lower than Taiwan. In this scene, Giant and Merida (the representative two success firms in Taiwan’s bike industry) proposed establishing A-TEAM (Taiwan Bike Association) in 2003 to possess firmly industrial foundation and strong link of global supply chain.

In the past, one mode of technology transfer, as Fransman (1985) proposed, comes from the foreigners: learning by exporting. Those American buyers were not only providing technology transfer but also actively assisting the local producers to monitor the process of production and marketing in developed countries. However, not many literatures use a visually whole framework to explore the interaction of Taiwan’s bike firms. Therefore, the study will employ social network analysis (SNA) to discover the pattern of network, to detect which firms are the key actors, and to trace the direction of the flow of information among those surveyed firms whether it will indirectly do good to the follow-up accumulated learning.

Business social networks, which we use as the research main theme, suit the study for several reasons, yet accessing information and knowledge that foster organizational learning becomes a critical benefit. There are three questions seemed to be helpful in sketching out the learning and innovation phenomenon in Taiwan’s bike industry. First, what types of networking and cooperative relationships exist among bicycle and components firms in Taiwan? Will network position affect organizational performance? Second, after joining A-TEAM, does the follow-up learning atmosphere pervade in this industry? And will it obviously benefit each firm’s organizational performance?

2. Bike Industry in Taiwan

2.1 The Development of Bike Industry
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Trace back to the period of Japanese colony, there are very few bicycles in Taiwan society; even the common components are imported from Japan. Time went by; Taiwan manufacturers change the status of excessively depending on Japan to locally implement in-house R&D for producing critical components and bicycles (Hsu, 2007). Besides, the industry was active to march forward the remarkable way of Original Design Manufacturing (ODM) and Own Brand Manufacturing (OBM). The development history of Taiwan’s bike industry can be divided into five main stages: 1) the phase of Japanese colony(1930s-50s), most of bicycle and common components were imported from Japan; 2) import substitution and subsequent stagnation(1950s-70s), for the sake of reducing the dependence on foreign exchange and of protecting the domestic bike industry, the government banned the importation of whole bikes(Yan & Hu, 2008) and subsequently the rising of motorcycles assembling led to stagnation of the bike industry; 3) The export drive and industrial consolidation(1970s), thanks to the coming of oil crisis, the American market brought lots of business, and the Taiwan government established a set of safety standards at the same time to strengthen the constitution of bike industry; 4) Industrial growth and upgrading(1980s), after undergoing the improvement of quality, being devoted to raise product image, and broadening the foreign market, not only did the export volume overtake Japan, but also Taiwan became the number one exporter around the world (Wei, 2006); 5) Innovative capability and global marketing(1990s onwards), For choosing toward high quality and value-added bikes, domestic manufacturers and key components (derailleur), with the support of government, devoted to innovate new material (carbon-fiber) and high level structure of bicycles. In order to maintain competitive advantages and to raise industry level collectively, the slogan “Order to Taiwan, produce in China, and distribute globally” became a better strategy existing in bike industry.

![Figure 1 Average export price for Taiwan’s bikes, 1970-2005](image)

2.2 The present situations of Taiwan’s bike industry

Foreign buyers, in addition to providing technology transfer, even actively benefit the local bike firms in management, for example, Schwinn represents an important episode for Giant to jump into the international production chain. At that time, Schwinn transfers technicians and efficiency production process to Giant to work out related production problems, which upgrades Giant’s productivity and raises its total sales volume toward American market (Wei, 2006). In other word,
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the large-scale market and customers’ demand in USA offer good opportunities for Taiwan manufacturers to accumulate wealth and learning capabilities of improving modern management techniques. Furthermore, Taiwan’s components firms, such as KMC, Merida and Kenda, also indirectly obtain the advanced production technologies through strategic alliance with Japanese components firms, such as Shimano and Bridgestone…etc (Yan & Hu, 2008).

In the past, the bike industry doesn’t have concerted standards, therefore, facing two unheard-of crises in 1950s and 1970s. Thanks to Mr. Hsu, the former director of the Taiwan Bike Industry Association, and King Liu, Giant’s leader, used to visit Japan’s bike manufacturers many times and brought back some valuable data about Japan’s components specifications (Hsu, 2007). Then, Mr. Hsu zealously persuaded Taiwan’s component firms to unify their specifications and help to set up the fundamental standards for Taiwan’s bike industry to improve the integral quality and to firmly grab export market. It is worth noting that the bike industry at present is highly fragmented and specialized division of labor by varied components. It mainly originates from the characteristics of bike that can be deconstructed into a series of components and assembled in some specific way. The flexibility of standardizing component interfaces across product architecture will lead to reduce entry barriers within the industry and more regular incremental and modular innovation on the basis of enhanced learning opportunities at the component level (Galvin & Morkel, 2001), but less architectural and radical innovations.

Bike industry tends to be typically labor-intensive business among traditional industries and the specialized capabilities lead to close links between components and bike firms. Taiwan’s bike industry has developed complete components suppliers within a close network which are composed of many components suppliers and assemblers. Moreover, the advantages of geographical concentration not only reduce the transportation cost, but also benefit to the manufacturers to exchange and diffusion of new knowledge. In this vein, components suppliers and assemblers constitute a relationship of competitive and cooperative which construct a firm and solid network. Moreover, in order to interact with foreign OEM buyers simultaneously, they built up a unique bike cooperation system in such a way that assemblers and components suppliers formed a relationship of parallel-connected. Local suppliers and assemblers separately concentrates on specialized technologies in their specific area on the purpose of lowering the defect rate and minimizing production cost. Later on, unlike the IT industry, bike industry was not actively supported by government, but somewhat helpful in the industry (Chu, 1997).

2.3 The Characteristics of A-TEAM

In 2003, Giant invited its domestic component, Merida, with Taiwan’s 11 bike components companies to found the A-Team, with the anticipating of increasing the general competitiveness of Taiwan’s bike industry and enlarging the difference of producing level from China and other countries from Southeast Asia. The main aim of the association is positioned to raise industry level collectively and to provide high-end and innovative key components and bicycles. Besides,
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A-TEAM aims to enlarge the scale of the international marketplace; instead to compete merely with each other in Taiwan’s market. A practical way of operating for A-TEAM is to share themselves valuable manufacturing process to others 23 members. Moreover, A-TEAM realized to take advantage of the collective resources to jointly develop new and high-quality bike components and bike-model-upgrading plans, and to shorten the design and delivery time (Lin and Chang, 2006). Members of A-Team, with the consistent distribution and cooperative selling, dedicated to build brand and boost more opportunities to connect with foreign OEM buyers. Briefly speaking, Taiwan’s bike industry is positioned to become the global innovation and supply center of premium-quality cycling products, providing top-flight service and facilities to the bike industry and the world's bike consumers.

In order to achieve process improvement, Giant introduces Toyota Production System (TPS) and Total Quality Management (TQM) to A-TEAM members to reach the goals of ‘zero inventory’ and ‘just-in-time’ delivery. In view of facilitating firms’ continuous innovation, Taiwan Creative Bike Design Competition was launched and has been successfully held on an annual basis ever since. As previous stated, it is assured that learning atmosphere pervade in the industry. Taiwan’s bike industry has successfully transformed itself to be a part of ODM and OBM.

Once joining A-TEAM, firms must live up to specific rules. Firstly, firms should set chief manufacture or R&D department in Taiwan. Besides, firms highly commit to the market of Specialty Bike Retailer (SBR) or are devoted to consistently capital investment in R&D. Secondly, all members are energetic to take part in activities of A-TEAM and its core value. No matter where components are sold in domestic or international market, the total sale revenues need to achieve forty million dollars. Thirdly, firms should consider not only how to raise the competition of bike industry in Taiwan, but also how to strengthen the niches of A-TEAM’s future development. The specific rules of A-TEAM truly bring members the benefits on one side, but it might constraints firms themselves autonomous development on the other side.

3. Literature review and hypotheses development

3.1 Relationship Quality and Organizational Learning

Anterior research has recommended that organizational units not only possess professed knowledge but also hold the opportunity to learn from other units (Huber, 1991). Furthermore, better relationships enable organizations to imitate technologies possessed by cooperative partners and to develop and tailor offerings to more specific requirements (Hakansson & Ford, 2002). All the time, both buyer and seller would like to adapt to their own process or product technologies to accommodate each other (Ford, 1980). Therefore, it appears that the better relationship quality a firm maintains, the better organizational learning it will be.

_Hypothesis 1: Relationship quality positively relates to organizational learning._

3.2 Relationship Quality and Organizational Performance
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Crosby et al. (1990) indicated that relationship quality affects organizational performance. Factually, once two parties in a cooperative model, they are capable of accomplishing lower costs by working together to lower both buyer’s and seller’s operating costs (Wilson, 1995). Besides, most remarkably studies indicate that the organizational level of relationship quality indeed influences customer loyalty (Rauyruen & Miller, 2007). Accordingly, it seems reasonable to assume:

*Hypothesis 2: Relationship quality positively relates to organizational performance.*

3.3 Organizational Learning and Organizational Performance

Some scholars observed that company with the capability to learn new information about technology, markets, customers, and the business environment may possess bright performance (Huber, 1991; Levitt, 1988). Indeed, organizations that have a quick learning capability possess a greater strategic capability to maintain a position of competitive advantage and has better long-term performance (Senge, 1990). Therefore, it follows from what has been said that performance discrimination among organizations may be attributed to the differences in organizational learning.

*Hypothesis 3: Organizational learning positively associates with organizational performance.*

3.4 Network position and Organizational Performance

Network position is a statement of social structure and has leading role in networks (Tsai, 2001). Position can improve actor’s capability to develop creative or innovative value to accomplish particular goals. Similarly, the strategic network perspective affirms that the embeddedness of firms in networks of external relationships with other organizations keeps implied meaning for organization performance (Gulati and Nohria, 2000). Accordingly, it seems reasonable to assume:

*Hypothesis 4: Network position positively relates to organizational performance.*

4. Methods
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The questionnaire is divided into four sections. First section is about organizational learning measured by knowledge acquisition, distribution, interpretation, and organizational memory; the second section is to measure the extent of firms’ relationship quality which includes trust, satisfaction, and commitment within the industry; three types of relationship, buyer/supplier, competitor, and others, are arranged in the third section with a list of representative firms; the final section, respondents are requested to answer a number of dimensions of financial performance over the past five years. Organizational performance excepted, the rest of questionnaire were asked from a scale ranging from 1 to 7, where 1 refers to the lowest score in the measure and 7 the highest.

The research focuses on building a model of business network analysis, particularly related to Taiwan Bike Exporters’ Association (TBEA). We set 65 bike and component firms from TBEA as the sample which includes 19 bike firms, 46 component firms in total. There are three network structure in this study: one is the members within A-TEAM association (TCN) which totally contains 23 bike and component firms; the overall collaborative communication network within the bike industry (CCNI) which mainly focus on their collaborative/vertical relationships; and the complete communication network (CCN) which contains all actors and relationships, such as administration office, research institutes and other supporting units. The analytic network is composed of three kinds of communication relationships, including buyer/supplier, competitor, and others.

Data collection was propitiously conducted by December 2007. After one follow-up mailing, fax, or e-mail, 51 surveys were returned in total, with 49 having completed data available for subsequent analysis, yielding the response rate of 75.4 %. Someone might argue the sample is too small to have representation. Nevertheless, research on the so-called Small World Theory argues that ties of acquaintanceship link us to nearly every human being on the earth in six or seven steps, so the network finally contains the world population. (Nooy, 2005). Additionally, the research continued to interview five practitioners of components and bike firms for justifying our findings.

Correlation analysis was used to describe relationships among three independent variable and organizational performance; and regression analysis is aimed to test the four hypotheses. Network software, UCINET 6.182, was used to analyze firms’ network indicators, including degree, closeness, and betweenness centrality. Due to different stress on varied network, those indicators separately give us insight on how and what degree they communicate with each other. The effects of network position on organizational performance might be detected.

5. Empirical Analysis and Hypothesis Test

Statistical analyses were conducted to make sure that nonresponsive bias is absent. First, when comparing the responding and non-responding firms in the light of company capital and number of employees, we find no significant differences between them based on the independent sample t-test.
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(p=0.34 and 0.69, respectively). Cronbach $\alpha$ coefficient was to measure internal consistency reliability, and check if the items belonging to each section are reliable within the acceptable interval. Table 1 shows Cronbach $\alpha$ of three measures is high, that is, the measurement is highly reliable.

Table 1 Reliability of research constructs

<table>
<thead>
<tr>
<th>section</th>
<th>Number of items</th>
<th>Cronbach $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Learning</td>
<td>12</td>
<td>0.83</td>
</tr>
<tr>
<td>Relationship Quality</td>
<td>10</td>
<td>0.88</td>
</tr>
<tr>
<td>Organizational Performance</td>
<td>6</td>
<td>0.82</td>
</tr>
</tbody>
</table>

5.1 Hypothesis Prove

In this section we mainly discuss our hypothesis 1 to 4, and conduct testing. In order to carry out simple regression analysis, SPSS 15.0 was applied in this section. Table 2 illustrating the relations among those variable of our hypothesis.

Table 2 Correlation matrixes of variables

<table>
<thead>
<tr>
<th></th>
<th>Organizational Learning</th>
<th>Relationship Quality</th>
<th>Network position</th>
<th>Organizational Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Learning</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship Quality</td>
<td>0.714(**)</td>
<td>1</td>
<td>0.736(**</td>
<td></td>
</tr>
<tr>
<td>Network position</td>
<td>0.482(*)</td>
<td>0.481(**)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Organizational Performance</td>
<td>0.453(**)</td>
<td>0.621(**)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

5.1.1 Hypotheses proof of Relationship Quality on Organizational Learning and Organizational Performance

After carrying out the simple regression model (F-ratio is 48.837 and P-value is 0.000), the influence of a firm’s relationship quality on organizational learning and organizational performance is shown in Table 3. The results of the regression analysis show that there is respectively a significant and positive correlation between relationship quality and organizational learning ($\beta$=0.714, $t$=6.988, P-value=0.00 <0.05, Adjusted R square= 0.499). A firm obtains business partners’ high trust, commitment, and satisfaction, no matter what kinds of cooperative relationships; they will have chances to access more manufacturing technology and new trends in market. It shows that the better relationship quality represents, the higher organizational learning appears.
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Table 3 Result of examination influence of relationship quality to organizational learning/organizational performance

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients (B)</th>
<th>Standardized Coefficients (β)</th>
<th>t</th>
<th>Sig.</th>
<th>R²</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship quality</td>
<td>1.255</td>
<td>.714</td>
<td>6.988</td>
<td>.000</td>
<td>0.51</td>
<td>0.499</td>
</tr>
</tbody>
</table>

Dependent Variable: Organizational learning

| Relationship quality | .259 | .481 | 3.766 | .000 | 0.232 | 0.215 |

Dependent Variable: Organizational performance

Note: *p<0.1, **p<0.05, ***p<0.01

The results of the regression analysis show that there is a significant and positive correlation between relationship quality and organizational performance (β=0.481, t=3.766, P-value=0.00<0.05, Adjusted R square=0.215). Many academics and practitioners argued relationship quality as a powerful influence on customer loyalty. Accordingly, there is fairly general agreement that the better relationship quality represents, the better organizational performance appears.

5.1.2 Hypothesis Proof of Organizational Learning on Organizational Performance

After carrying out the simple regression model (F-ratio is 12.138 and P-value is 0.001), we subsequently examine the relationship between organizational learning and organizational performance. The results shown in Table 4 indicate that it is respectively a significant and positive correlated between organizational learning and organizational performance (β=0.453, t=3.484, P-value=0.001<0.05, Adjusted R square=0.188). The higher organizational learning represents, the better organizational performance appears. Moreover competitive firms usually possess several keys, whose items include consecutively learning new information about technology, markets, customers, and the business environment. In other words, organizations, with aggressive learning motivations, have a greater capability which enables them to maintain competitive advantage and to better long-term performance.

Table 4 Result of examination influence of organizational learning to organizational performance

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients (B)</th>
<th>Standardized Coefficients (β)</th>
<th>t</th>
<th>Sig.</th>
<th>R²</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational learning</td>
<td>0.139</td>
<td>0.453</td>
<td>3.484</td>
<td>.001</td>
<td>0.205</td>
<td>0.188</td>
</tr>
</tbody>
</table>

Note: *p<0.1, **p<0.05, ***p<0.01

Dependent Variable: Organizational performance

5.1.3 Hypothesis Proof of Relationship Quality and Organizational Learning on Organizational Performance

In order to avoid the phenomenon of co-linearity among independent variables,
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multiple-regression was adapted to examine if relationship quality and organizational learning have a significant effect on organizational performance. The result was shown in Table 5 (F-ratio is 8.894 and P-value is 0.01)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>205.039</td>
<td>2</td>
<td>102.520</td>
<td>8.894</td>
<td>.001(a)</td>
</tr>
<tr>
<td>Residual</td>
<td>530.226</td>
<td>46</td>
<td>11.527</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>735.265</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *p<0.1, **p<0.05, ***p<0.01

According to Table 6, the results show that it is significant and positive relation between relationship quality and organizational learning on organizational performance at the same time.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients (B)</th>
<th>Standardized Coefficients (β)</th>
<th>t</th>
<th>Sig.</th>
<th>Adjusted R²</th>
<th>Adjusted R²*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational learning</td>
<td>.109</td>
<td>.292</td>
<td>1.733</td>
<td>.090</td>
<td>0.279</td>
<td>0.248</td>
</tr>
<tr>
<td>Relationship quality</td>
<td>.154</td>
<td>.286</td>
<td>1.702</td>
<td>.096</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *p<0.1, **p<0.05, ***p<0.01
Dependent Variable: Organizational performance

5.1.4 Hypothesis Proof of Network Position on Organizational Performance

In the following hypothesis 4 is tested by three aspects. First, after carrying out the regression model, the results of Table 8 indicates that direct ties among three types of networks do not have significantly positive effect on organizational performance. Merely CCN’s direct ties have best explanation on organizational performance. In other words, the more direct ties a firm keeps, the more knowledge sharing and spillover the firm with their business partners obtain. However, due to the network characteristics of bike industry, the data that belongs to direct ties can’t positively relate to organizational performance. It seems unreasonable to suppose that one firm holds the more direct ties, it inevitably brings better organizational performance.

Second, all the betweenness centrality among three types of networks does not have significantly positive effect on organizational performance. Merely CCN’s betweenness centrality has best explanation on organizational performance. One explanation for betweenness centrality, as Nooy (2005) put it, is that the higher degree of betweenness centrality a firm controls, the chains of contacts will facilitate the spread of information in the network. However, due to the network characteristics of Taiwan’s bike industry, the higher information flows are hold by most assemblers which possesses the capabilities of controlling information or banning the emergent amazement.
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Hence, the statement that betweenness centrality has a positive relationship with organizational performance can’t be widely accepted.

Third, all closeness centrality among three types of networks have significantly positive effect on organizational performance. TCN’s closeness centrality has better explanation on organizational performance. In other words, the closer one firm to other business partners is, the easier information may be acquired in a short time, the higher the closeness centrality one firm will be. Therefore, one can safely state that closeness centrality has a positive relationship with organizational performance (refer to Table 7).

Table 7 Regression analysis between direct ties/betweenness/closeness centrality and organizational performance

<table>
<thead>
<tr>
<th>Type of centrality</th>
<th>Type of Network</th>
<th>Unstandardized Coefficient (B)</th>
<th>Standardized Coefficient (β)</th>
<th>t</th>
<th>Sig.</th>
<th>R²</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Ties</td>
<td>TCN</td>
<td>0.418</td>
<td>0.018</td>
<td>0.079</td>
<td>0.938</td>
<td>0.000</td>
<td>-0.052</td>
</tr>
<tr>
<td></td>
<td>CCNI</td>
<td>-1.636</td>
<td>-0.041</td>
<td>-0.18</td>
<td>0.859</td>
<td>0.002</td>
<td>-0.051</td>
</tr>
<tr>
<td></td>
<td>CCN</td>
<td>29.475</td>
<td>0.635</td>
<td>3.579</td>
<td>0.002***</td>
<td>0.403</td>
<td>0.371</td>
</tr>
<tr>
<td>Betweenness</td>
<td>TCN</td>
<td>12.724</td>
<td>0.223</td>
<td>1.565</td>
<td>0.124</td>
<td>0.05</td>
<td>0.029</td>
</tr>
<tr>
<td></td>
<td>CCNI</td>
<td>23.562</td>
<td>0.127</td>
<td>0.88</td>
<td>0.383</td>
<td>0.016</td>
<td>-0.005</td>
</tr>
<tr>
<td></td>
<td>CCN</td>
<td>28.464</td>
<td>0.401</td>
<td>2.997</td>
<td>0.004***</td>
<td>0.16</td>
<td>0.143</td>
</tr>
<tr>
<td>Closeness</td>
<td>TCN</td>
<td>29.475</td>
<td>0.635</td>
<td>3.579</td>
<td>0.002***</td>
<td>0.403</td>
<td>0.371</td>
</tr>
<tr>
<td></td>
<td>CCNI</td>
<td>28.464</td>
<td>0.401</td>
<td>2.997</td>
<td>0.004***</td>
<td>0.16</td>
<td>0.143</td>
</tr>
<tr>
<td></td>
<td>CCN</td>
<td>21.722</td>
<td>0.318</td>
<td>2.297</td>
<td>0.026**</td>
<td>0.101</td>
<td>0.082</td>
</tr>
</tbody>
</table>

Note: *p<0.1, **p<0.05, ***p<0.01

Note: A-TEAM communication network (TCN)
Overall collaborative communication network within the bike industry (CCNI)
Complete communication network (CCN)

5.2 Network Analysis

When a firm builds a position in a network, it establishes relationships to other firms who already are embedded in the network. Perspectives of social network of TCN and CCNI are worth deeply analysis in this section.

5.2.1 A-TEAM Communication Network (TCN)

Figure 3 visualize the TCN, where dark blue nodes (AB_01 and AB_02) mean bike firms; light blue nodes (AC_01~AC_21) mean components firms. The size of nodes is respectively weighted by in-degree centrality in Figure 3; by betweenness in Figure 4; by closeness in Figure5.

Figure 3 distinctly reveals that the firm AB_01 is the biggest one key player in TCN and the
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Firm AB_02 represents the second one. Nearly all collaborative relationships for the other firms in TCN are linked to either AB_01 or AB_02 which are the most powerful firms to mobilize social resources. Similarly firms AB_01 and AB_02 are also the key players in Figure 4 which means the higher betweenness centrality is, the more controllable ability one key player has. To put it briefly, the stronger ties one key player obtains, the more sources of information it gains at its disposal; the faster information the key player attain, the more capabilities of transmitting industrial news the key player keeps. In Figure 5 which refers to the extent to which an actor can reach a large number of other actors in a small number of steps. Table 8 reveals that nearly every firm is capable of reaching other firms in three steps (distances); moreover the three firms (AB_01, AC_09, and AC_13) reach others in two steps. Table 8 also indicates those in-degree and closeness centralities are the most obvious indicators. Results reveal that the ranking of each indicator in each firm is very similar. Therefore, we might infer that bike and components firms’ relationship are quite close, which might have a positive impact on communication efficiency and business performance. TCN is composed of A-TEAM members, this kind of network lead to a close relationship and might benefit the performance collectively. This has been proved above. Therefore, it might be proposed that an individual firm with not much resource and capabilities is better to join consortia to get some assistance or needed resources from other members. All in all,

1 For saving space, the distance table will not show in the CCNI.
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![Figure 5 Visualization of TCN's Closeness Centrality](image)

Table 8 Network indicators of TCN

<table>
<thead>
<tr>
<th></th>
<th>In-Degree</th>
<th>Betweenness</th>
<th>Closeness (N=23)</th>
<th>Distance Weight Reach</th>
<th>Distance 1, (N=23)</th>
<th>Distance 1 + 2, (N=23)</th>
<th>Distance 1 + 2 + 3, (N=23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB_01</td>
<td>78.57</td>
<td>44.78</td>
<td>91.30</td>
<td>95.45</td>
<td>0.9048</td>
<td>1.0000</td>
<td>1.0000</td>
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<tr>
<td>AB_02</td>
<td>71.43</td>
<td>28.64</td>
<td>80.77</td>
<td>90.15</td>
<td>0.8095</td>
<td>0.9524</td>
<td>1.0000</td>
</tr>
<tr>
<td>AC_01</td>
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<td>0.05</td>
<td>52.50</td>
<td>58.33</td>
<td>0.1429</td>
<td>0.9524</td>
<td>1.0000</td>
</tr>
<tr>
<td>AC_02</td>
<td>4.55</td>
<td>0.05</td>
<td>52.50</td>
<td>58.33</td>
<td>0.1429</td>
<td>0.9524</td>
<td>1.0000</td>
</tr>
<tr>
<td>AC_03</td>
<td>8.44</td>
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<td>53.85</td>
<td>60.61</td>
<td>0.1905</td>
<td>0.9524</td>
<td>1.0000</td>
</tr>
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<td>0.05</td>
<td>51.22</td>
<td>56.06</td>
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<td>0.9524</td>
<td>1.0000</td>
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<tr>
<td>AC_05</td>
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<td>0.05</td>
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<td>56.06</td>
<td>0.0952</td>
<td>0.9524</td>
<td>1.0000</td>
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<tr>
<td>AC_06</td>
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<td>0.00</td>
<td>51.22</td>
<td>56.06</td>
<td>0.0952</td>
<td>0.9524</td>
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<td>AC_07</td>
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<tr>
<td>AC_08</td>
<td>12.34</td>
<td>0.48</td>
<td>55.26</td>
<td>62.88</td>
<td>0.2381</td>
<td>0.9524</td>
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<tr>
<td>AC_09</td>
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<td>61.36</td>
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<td>1.0000</td>
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<td>0.9524</td>
<td>1.0000</td>
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<td>AC_11</td>
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<td>1.0000</td>
</tr>
<tr>
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<td>AC_13</td>
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<td>1.0000</td>
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<td>1.0000</td>
</tr>
<tr>
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<tr>
<td>AC_17</td>
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<td>51.22</td>
<td>56.06</td>
<td>0.0952</td>
<td>0.9524</td>
<td>1.0000</td>
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<td>0.05</td>
<td>53.85</td>
<td>60.61</td>
<td>0.1905</td>
<td>0.9524</td>
<td>1.0000</td>
</tr>
<tr>
<td>AC_19</td>
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<td>0.05</td>
<td>51.22</td>
<td>56.06</td>
<td>0.0952</td>
<td>0.9524</td>
<td>1.0000</td>
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<tr>
<td>AC_20</td>
<td>1.30</td>
<td>0.24</td>
<td>37.50</td>
<td>44.70</td>
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<td>0.2381</td>
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</tr>
<tr>
<td>AC_21</td>
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<td>0.00</td>
<td></td>
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<tr>
<td>Average</td>
<td>9.18</td>
<td>3.76</td>
<td>55.14</td>
<td>61.02</td>
<td>0.2078</td>
<td>0.9264</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Network Centralization

| | 72.55 | 42.88 | 77.67 |

5.2.2 Overall Collaborative Communication Network (CCNI)

In addition to the 23 firms within A-TEAM, there are another 42 firms which constitute the CCNI. Total 65 representative firms construct the industry cluster of bike. Figure 5-4 visualize the CCNI, where red nodes (GB_01~GB_17) mean the general bike firms and pink nodes (GC_01~GC_25) mean the general component firms. Both of them are outside the A-TEAM.
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Firm AB_01 and AB_02, with the very strong power to mobilize social resources, are still two key players in CCNI. Apart from the A-TEAM bike firms, GB_01 is the key player. Taking the whole components firms for viewing, AC_08 and AC_13 are the first layer of degree centrality according to the data of normalized in-degree centrality (Figure 6). From the view point of betweenness centrality, taking the whole bike firms for example, it reveals that firms AB_01, GB_05, GB_02 and AB_02 are the key players. Apart from the overlap components firms in TCN, the first layer of betweenness centrality is GC_11, GC_01, GC_5 and GC_02 (Figure 7). Regarding the closeness centrality, AB_01, AB_02, GB_01 are also the key players. It is worth noted that non-A-TEAM member (say IDEAL, coded GB_01) also had a higher in-degree and closeness centrality, and a better performance as well; and its characteristics of centrality are even more distinct than A-TEAM member. It is worth thinking that joining A-TEAM seems unable to guarantee a good position, especially for centrality of in-degree and closeness in this case, and then lead to a good performance. It could be infer that an individual firm with competitive advantage prefers to choose not joining consortia, like A-TEAM in this case, instead going solo. Apart from the overlap components firms in TCN, the first level of closeness centrality is GC_02 and GC_17 which was placed in the central network position (Figure 8).

In the network of CCNI, nearly every firm is able to reach other firms in four steps (distances), moreover half of total 65 firms have the capability of contacting others in three steps. Comparing to the TCNs, it can be found that the relationships of bike and components firms in CCNI are not closer than TCNs. Here we assume whether network position has a positive impact on communication efficiency and business performance. It deserved to further test.
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Figure 8 Visualization of CCNI's Closeness Centrality

5.3 Summary

The primary aims of this section are to investigate the influence of relationship quality and organizational learning on performance among bike and components firms from a social network theory perspective. The findings of this study were summarized in Table 9. Among these four hypotheses, three are fully supported (hypothesis 1, 2, and 3), one is partially supported (hypotheses 4).

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1:</td>
<td>Supported</td>
</tr>
<tr>
<td>H2:</td>
<td>Supported</td>
</tr>
<tr>
<td>H3:</td>
<td>Supported</td>
</tr>
<tr>
<td>H4:</td>
<td>Partially Supported</td>
</tr>
</tbody>
</table>

6. Discussion and conclusions

6.1 Findings and Discussion

According to the analyses results, all hypotheses are all proved. It can be found that Giant and Merida are in the critical network positions. The bike-industry cluster concentrated in the central part of Taiwan, therefore, the degree of dependence on a particular supplier or buyer is not particular high.

1. The Key Player

No matter what network firms belong to, two key players keep relationships with other
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components firms and nearly form the whole industrial cluster. In other words, if a firm possesses higher networking capacity, which means the close interaction with other partners and standing on the position near the network anchor, it would significantly influence its network position because the sub-construct of networking capacity is connected with other partnership or level of communication. The two key players have been approved that the closer business partnership firms maintain, the higher network capability they will be. Similarly, firms’ network positions within TCN are also the top class in CCNI. Except for some firms (GC_01, GC_02, GC_11, and GC_17) which are not intended to take participate in A-TEAM, almost 21 critical components firms are asked to invest lots of time, money, efforts in pushing industrial growth. Therefore, as for components firms, in addition to formal contracts, once firms gather friendships of business partners through informally cooperative network, it will be good news for business partners of possessing the same ideals.

2. Network Characteristic

Taiwan’s bike industry is not similar to Japan’s automobile industry which is the Keiretsu System. A common perception of the Keiretsu System is that relatively exclusive interfirm relationships facilitate closely interfirm ties, which benefit both assemblers and suppliers (Nobeoka, Dyer, & Madhok, 2002). Hence, those components firms are irresponsible for supporting specific bike firms. That is, it will not have big conflicts to hinder components firms from selling to different segments (mass markets or specialty bike retailers) and to provide foreign and domestic assemblers better products/services.

3. Joining A-TEAM facilitate Collective Knowledge Transfers

The claim that relationship quality is an important facilitator in organizational learning was supported by the findings. It is consistent with Nobeoka et al. (2002) argue that buyer which possesses close interactions with supplier is an important source of valuable re-deployable knowledge. With positive motivations from interorganizational trust and commitment, firms in bike industry are willing to facilitate knowledge transfers and participate in the knowledge-sharing activities. It implies that the above statement becomes easier as a result of better assembler-supplier relationships. Recently, Giant and Merida assist A-TEAM members to enhance theirs business partners’ capabilities of management and exploration; therefore, one of specific firms’ factories will be chosen to visit by other A-TEAM members every year. In the end of visit activities, not only does the firm’s factory be checked and monitored, but also the firm is capable of accepting others’ brainstorming and suggestions. Besides, possessing a better relationship quality with Giant and Merida, components firms might indirectly receive more OEM/ODM or OBM orders from foreign assemblers.
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4. Knowledge sharing comes from competitive interaction

Organizational learning has a positively effect on organizational performance. Empirical analysis in bike industry indicates that one driving force pushes the prosperity of Taiwan’s bike industry: accumulated learning by exporting. Even now components and bike firms generally obtain market and technology knowledge from the long-term interactions with multiple customers and competitors. The A-TEAM’s e-paper or cycle press also plays a crucial role in disseminating each firm’s growth dynamics and in exchanging industrial news. Moreover, in view of facilitating firms’ continuous innovation, Taiwan Creative Bike Design Competition was launched and has been successfully held on an annual basis ever since. Similarly, International Cycle Show and cycle race held in Taiwan are benefits to promote the slogan of “think bike, think Taiwan” in domestic and foreign markets. In addition to the source of foreign external knowledge, the knowledge came from domestic internal is also an important resource. Most internal knowledge comes from the individual efforts In Taiwan’s bike industry. Knowledge sharing among employees is often viewed as the most crucial process for knowledge accumulation within firms and will facilitate the formation of organizational knowledge. By doing this, it can avoid inefficient reinvention and then maintain competitive advantage.

5. Geographic proximity contributes to collective benchmarking

Closeness centrality has a positively effect on organizational performance. It is undoubted that the closer a vertex is to all other vertices, the easier information may be acquired, the higher its centrality is (Nooy, 2005). Due to bike manufacturers mostly concentrate in the central of Taiwan, the distance between any two firms of A-TEAM is so close that they can connect each other in three steps; even the farthest distance between any two supporting firms can be reached in four steps. Geographic proximity easily brings up the interaction of information and knowledge, which in turn contributes to collective benchmarking.

6. Open but Overlapped Network Structure

The research outcome shows that organizational performance was partially supported by network position. The analysis results of direct ties are inconsistent with Nooy’s (2005) argue that it is easy to access a pivotal position if possess multiple sources, and even easily obtain information as well. The reason is that most components firms’ partners are not all domestic assemblers; on the contrary, 50% sale volume is achieved by famously foreign assemblers. As previous studies state, the social structure of bike-industry is more open network rather than closed network (Wen and Amsden, 2003). Any components firms can simultaneously freely offer several assemblers, thus, the degree of dependence on a particular supplier or buyer is not particular high. Moreover, the industrial structure is overlapped by several assemblers’ networks.

6.2 Conclusion
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This study provides a detailed social network structure for explicating the whole scenery of Taiwan bike industry and illustrates that central network assuredly will be good for firms to become learning organization in the future. Bodies of literatures have claimed that the higher industrial central network has, the more information or knowledge firms acquire, the more commercial margins they will obtain.

1. Managerial Implications

This study also has several managerial implications based on the empirical study. First, the study results show that central network is indeed beneficial for firms to promote external knowledge acquisition and sharing. Second, frequent interactions with each other present that the relationship quality between any two firms are better in bike industry. It is noted that firms within the A-TEAM show much more competitive in products and operational management than non-A-TEAM ones. In reality, nearly 87 percent of members within A-TEAM are component firms which provide components to multiple competing bike manufacturers; in the same way, bike-makers also get components from multiple suppliers. Therefore, non-A-Team firms intend not to join A-TEAM, as previously state that joining A-TEAM seems unable to guarantee a good position, and then lead to a good performance. It could be infer that an individual firm with competitive advantage, such as IDEA and HODAKA, prefers to choose going solo. Besides, it often makes some misunderstanding that that A-TEAM merely belongs to Giant and Merida’s production network, say “keiretsu group”, and that a exclusive relationships between assemblers and suppliers in Taiwan bike industry. Due to the above wrong viewpoint, it is deserved that Giant and Merida do their best not only to allure foreign bike brand, such as COLNAGO, SCOTT, SPECIALIZED, TREK, and National Bike Dealers Association (NBDA) to provide value assistants and suggestion, but also promote the pertinent and positive association of A-TEAM within the bike industry.

2. Limitations and Future Research

Although cases in Taiwan provide a good opportunity for testing the phenomena of extending large-scale business and industry learning in a different network, the generalization of the study is limited. Therefore, the questionnaire should be simultaneously sent to foreign bike firms in the future research. Moreover, three network indicators that are considered critical to network position are examined, but other network model such as discrete core-periphery may also affect the outcomes of industrial exploration. This study is worthy to take a longitudinal survey in the future. Merely conducting cross-sectional surveys will be difficult to draw the issue of how capabilities are created over a run of several years. On the other hand, “state changes” over a longer period of time can add more understanding of how to leverage and extend learning capabilities and to maintain businesses’ relationship quality for company’s competitive advantage.

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