# Exploring Supply Chain Collaboration in Thai Major Industries

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**Abstract**

Supply chain collaboration (SCC) is increasingly important in organizations, while successful collaboration buildings in Thai industrial supply chains are still limited. This study aims to explore major collaborative activities and major factors that have an influence on the occurrence of SCC in four major industries of Thailand which are Electronics and Computer Industry, Automotive Industry, Textile-Apparel Industry, and Construction Industry. The occurrence of SCC is determined, in terms of, various characteristics of the firms, which are type of industry, type of company, value of fixed assets, and number of employees. Research data was collected by two approaches; interview and questionnaire. Independent variables list were taken from the SCC factors that most frequently referred in previous studies. Samples of the research were 193 respondent companies from the four industries. Multivariate analysis such as Factors Analysis and Logistic Regression were employed for data analysis. The results showed that the major collaborative activity in the industries is the information sharing and the major factors that have an influence on the occurrences of SCC are top management support as well as trust and good relationship between supply chain partners. This study provides an empirical result that contributes to SCC building which can be used as a guidelines for development of supply chain management in Thailand and in other developing countries as well.

**Keywords**: Supply Chain Management, Collaboration, Partnering, Thai Industry, Factors Analysis, Logistic Regression

## Introduction

Due to the fast changing situation and high competition in the world market, all manufacturers have strived to improve their product quality, business processes and look for more cooperation with their partners. Supply Chain Collaboration (SCC) is increasingly important to organizations for improving their service level, reducing cost and leading time, as well as being more flexible and responsive to meet the change of market requirements.

Although Supply Chain Management (SCM) has been introduced into Thailand more than a decade ago, its successful implementation in Thai industrial sector is still limited. SCC is a driving force of SCM. Studies of SCC in Thai industrial sector can discover SCM problems and can serve as guidelines for SCM development.

The purpose of this study is to empirically determine the major collaborative activities and the major factors that have an influence on the occurrence of SCC in four major industries of Thailand. These industries were selected by considering the GDP, export value, employment, and technology-labor intensive. The technology intensive industry is including with Electronics Industry and Automotive Industry. The labor intensive industry is including with Textile-Apparel Industry and Construction Industry.

**Table 1** Major Export Items of Thailand (2009)

| Items | Export Ratio | Export Value (THB Billion) |
|---|---|---|
| Computers and Parts | 10.50% | 545,521.23 |
| Automobile and Parts | 7.28% | 378,374.77 |
| Gems and Jewelry | 6.42% | 333,719.63 |
| Electronic Circuits | 4.22% | 219,508.87 |
| Oil | 3.55% | 184,670.58 |
| Iron, Steel Products | 3.25% | 169,056.10 |
| Others | 64.78% | 3,366,270.17 |
| *Total* | *100.00%* | *5,197,121.35* |

Source: Ministry of Commerce (2010)

## Overview of Thai Industrial Sector and Four Major Industries

The industrial sector plays the important role in Thai economy as it is the top rank contributor of Thai GDP and the second rank contributor of labor employment (Bank of Thailand, 2010) which generates about 74% of the total Thai export value (The office of industrial economics, 2009).

The Electronics Industry has been Thailand top rank export revenue earner over the past five years (Office of the Permanent Secretary Ministry of Commerce (Thailand), 2010). The main exported products are

Hard Disk Drives (HDD) and Integrated Circuits (IC) which accounted for 40% and 23% of all electronic exports respectively (Thailand Board of Investment (BOI), 2008). Thailand is now the top HDD and components manufacturing base worldwide and also is a notable place of the IC and semiconductor industries in Southeast Asia. However, most of the manufacturers are foreign-owned or multinational companies, such as Seagate, Western Digital, Philips Electronics, Hitachi, Toshiba, etc.

The Automotive Industry is the third largest industry in Thailand that contributes the second rank of Thailand export value and annually employs an estimated total workforce of more than 300,000 persons (Ghazali et al., 2011). In 2010,this industry produced 1,645,304 vehicles, a 100% growth since 2005 (Thai Automotive Institute, 2011). Thailand is now one of the biggest automobile production bases in the world. Many world leading automobile producers; such as BMW, Daimler Chrysler, Ford, General Motors, Mitsubishi, Mazda, Toyota, Isuzu, Honda and Nissan, have their manufacturing bases in Thailand along with their numerous suppliers.

Textile-Apparel (T/A) industry in Thailand has for several decades been a priority sector that generates more than US$ 6,000 million of export revenue per year (Thailand Textile Institute (THTI), 2011). There are more than 4,000 textile-apparel firms in which one million workers are employed (Thailand Textile Institute (THTI), 2009). The T/A Industry is consisted of thousands of businesses along the supply chain, from up-stream industry to middle-stream industry then down-stream industry. Anyway, most of the T/A companies are still Small-Medium Enterprises (SMEs) or family-owned businesses.

Construction is the fundamental industry of Thailand. This sector contributed about 4% to the total Thai GDP and employed 335,150 employees in 2009 (Bank of Thailand, 2010). According to the 2009 construction survey carried out by the NSO (National Statistical Office (Thailand), 2009), the Gross Output Value of the construction industry was THB 394,126.9 million while the value added was THB 276,181.8 million. There were a total of 29,360 establishments; most of them were about 83.1% which were grouped as small sized between 1 – 20 employees. There were not more than 10 giant contractors (about 0.05%). Based on the type of construction industry under consideration, about 56.8% of the establishments were engaged in building construction.

**Supply Chain Collaboration**

Anderson & Narus (1996) explained that collaboration is the cooperation among independent, but related firms to share resources and capabilities to meet their customers' needs. Anthony (2000) defined the term 'collaboration' as two or more companies sharing the responsibility of exchanging common planning, management, execution, and performance measurement information. Soosay et al. (2008) concluded that "Collaboration can be best described as an inter-organizational relationship type in which the participating parties agree to invest resources, mutually achieve goals, share information, resources, rewards and responsibilities as well as jointly make decisions and solve problems". Collaboration in supply chain is called Supply Chain Collaboration (SCC). Supply chain members who had higher levels of SCC are able to achieve better operational performance and innovation activities (Simatupang, T. M. & Sridharan, 2005b). SCC helps a company coordinate and operate effectively, improve supply chain performance, reduce cost and inventory, and increase customer service level (Holweg et al., 2005; Soosay et al., 2008; Whipple, Judith M. & Russell, Dawn, 2007).

*1. Influencing Factors of SCC*

From review of the previous published articles (1993-2009) related to supply chain collaboration (Attaran & Attaran, 2007; Aviv, 2001; Bahinipati et al., 2009; Barratt, 2004; Barron, 2007; Betts & Tadisina, 2009; BoyacI & Gallego, 2002; Busi & Bititci, 2006; Chandra & Fisher, 1994; Chen & Chen, 2005; Chong et al., 2009; de Leeuw & Fransoo, 2009; Ganeshan, 1999; Gurnani, 2001; Haq & Kannan, 2006; Huiskonen & Pirttila, 2002; Huq et al., 2006; Hwarng et al., 2005; Jayaraman & Pirkul, 2001; Li et al., 1996; Lu, 1995; Mehrjerdi, 2009; Min et al., 2005b; Moses & Seshadri, 2000; Piplani & Fu, 2005; Pyke & Cohen, 1993; Simatupang, T. M. & Sridharan, 2004a, 2004b; Singh & Power, 2009; Soosay et al., 2008; Stank, T. et al., 1999; Stank, T. P. & Goldsby, 2000; Stock et al., 2000; Verwijmeren et al., 1996; Whipple, J. M. & Russell, D., 2007; Wu & Ouyang, 2003; Yang & Wee, 2002; Yao & Chiou, 2004; Zhao et al., 2002; Zou et al., 2004), we found 52 factors that have an effect on an establishment of collaboration among supply chain partners. We classified these factors into three groups which are Internal Factors (17 factors), Inter-Organizational Factors (28 factors), and External Factors (7 factors).

• *Internal factors (the factors within an organization)*: These factors affect the ability of an organization in establishing collaboration with others; for example, business processes, organization structures, information system, top management support, attitude (includes vision), commitment, understanding of SCM, firm's resources, etc.

• *Inter-organizational factors (the factors among organizations in the supply chain)*: These factors affect the collaboration among the organizations that are in the supply chain; for example, trust or reliability, business benefit, communication and coordination, willingness, leadership (includes guideline and advisory), partner's readiness, etc.

• *External factors (the factors from special entities or entities outside the supply chain)*: These factors are such as the customer specification or satisfaction, the pressure from a larger organization in the supply chain, the competition and uncertainty in global economy, social influence, and environmental uncertainty.

*2. Collaborative Activities and Dimensions of SCC*

There are various collaborative activities jointly performed among supply chain partners. The SCC activities which were most frequently mentioned in the reviewed literatures are such as Information Sharing, Joint Decision Making, Joint Planning, Joint Cost Consideration, Joint Delivery, Joint Performance Measurement, Joint Production, Joint Inventory, Joint Ordering, Skill, Knowledge Sharing, Cross Functional Activities, Joint Forecasting, and Joint Problem Solving.

According to Simatupang and Sridharan (Simatupang, T. M. & Sridharan, 2004b), there are five major elements of SCC: Information Sharing, Decision Synchronization, Incentive Alignment, Shared Supply Chain Process, and Collaborative Performance System. Min (Min et al., 2005a) classified the collaborative activities into five major categories. These are Information Sharing, Joint Planning, Joint Problem Solving, Joint Performance Measurement, and Leveraging Resource and Skill. (Fawcett et al., 2008) proposed that SCC includes Alignment Mechanism, Cross-Functional Process Change, Information System, People Empowerment, Alliance Design, and Performance Measurement.

In conclusion, we propose that the SCC activities can be grouped into four dimensions, called Dimensions of SCC, which are Information Sharing (IS), Decision Synchronization (DS), Joint Supply Chain Processes (JP), and Resource and Skill Sharing (RS).

• *Information Sharing (IS)* refers to the mechanism of capturing and disseminating information for monitoring, planning and controlling supply chain operations (Simatupang, T. & Sridharan, 2002; Simatupang, T. M. & Sridharan, 2005a), e.g., sharing of production schedule, ordering tracking, and on-hand inventory level monitoring, etc.

• *Decision Synchronization (DS)* are such as joint decision in planning, scheduling, problem-solving and controlling supply chain operations (Simatupang, T. M. & Sridharan, 2005a).

• *Joint Business Processes (JP)* includes the joint business operations among supply chain partners, e.g., planning, forecasting, sourcing, production, inventing, delivering, selling, and performance measuring, etc.

• *Resources and Skills Sharing (RS)* refers to sharing and mutually leveraging of collaborative partners' resources such as skill and knowledge sharing, joint research and development, and financial support.

**Materials and Methods**

In order to determine the major influencing factors of SCC, we created a conceptual framework (as shown in Figure 1) which contained with following hypotheses;

• *Hypothesis 1a*: The expected variables X1, X2, X3, ..., and X24 have an effect on occurrence of SCC

• *Hypothesis 1b*: The expected variables X1, X2, X3, ..., and X24 have an effect on occurrence of the dimensions of SCC (IS, DS, JP, and RS).
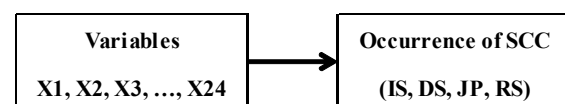


**Figure 1** Conceptual Framework of the Empirical Survey

The independent variables X1-X24 represent the factors that are expected to have an effect on the occurrence of SCC and the four dimensions of SCC (which are IS, DS, JP, and RS). These variables are selected from 52 factors which were found in literature review (as mentioned in the previous section). Variables X1-X10 are the top ten (of 17 factors) internal factors that are most frequently referred in the reviewed articles. Variables X11-X20 are also the top ten of 28 inter-organizational factors which are most frequently referred. Lastly, variables X21-X24 are the top three of 7 external factors adding with a factor that we expected that it may has an effect on the occurrence of SCC, which is Government Support. Details of each variable are described in Table 2.

**Table 2** Major Export Items of Thailand (2009)

| Category | Independent Variables | Description |
|---|---|---|
| **Internal Factors** | X1: SCM Understanding | Understanding and knowledge of supply chain management |
| | X2: Awareness | Awareness of importance of supply chain management |
| | X3: Policy | Policy and strategy of the company |
| | X4: Top Management | Top management vision and support |
| | X5: Commitment | Commitment to building collaboration with partners |
| | X6: Budget | Budget and cost of building collaboration |
| | X7: Human Resources | Ability or Potential of human resources |
| | X8: Information Technology | Information Technology (IT) system supporting collaboration |
| | X9: Structure | Firm's structure and management processes |
| | X10: Culture | Organizational culture and workers' attitude |
| **Inter-Organizational** | X11: Trust | Trust and Honesty between partners |
| **Factors** | X12: Good Relationship | Goodwill and intimate relationship between partners |
| | X13: Partner's Intention | Partners' intention and willingness to build collaboration |
| | X14: Communication | Communication efficiency |
| | X15: Coordination | Regularly and intimate coordination |
| | X16: Partner's Readiness | Partner's ability and readiness to build collaboration |
| | X17: Benefit | Business benefit due to collaboration |
| | X18: Risk | Risk of collaboration |
| | X19: Distance | Geographical distance between partners' working locations |
| | X20: Persuasion | Persuasion or lead for building collaboration |
| **External Factors** | X21: Customer Push | Customer's urge or pressure on the firm to build collaboration |
| | X22: Global Economy | Influence exerted by global economy and competition in markets |
| | X23: Government Support | Promotion and support from government organizations |
| | X24: Private Association Support | |

The occurrence of SCC is indicated by the existence of SCC activities formed between the supply chain partners that could occur in term of any SCC dimensions (IS, DS, JP or RS). We also compared intensity of the SCC occurrence in term of company's characteristics, which are type of industry, type of company, value of fixed assets, and number of employees.

The research data were collected by two approaches, interview and questionnaire. The questionnaire based on the reviewed literature and the conceptual model is separated into three parts. Part one asks about the general information and characteristics of the firms. Part two asks about the occurrence of SCC (have or not have SCC) and the collaborative activities between the firms and their partners. Part three, which comprises 24 items, examines the existence of each influencing factor of SCC occurrence, indicated by five levels of Likert's Scale; very low, low, medium, high, and very high. A validity test of the survey tool was conducted,

using Item-Objective Congruency Index (IOC) techniques (Sireci, 1998), by a panel of academicians and industry experts. The IOC from the testing was 0.76. The measurement items were refined and improved by the application of the feedback from the panel.

The samples were drawn from extensive databases such as Association of Thai Computer Manufacturing (ATCM), Thailand Electrical and Electronics Institute (EEI), Thailand Automotive Institute, Thailand Textile Institute (THTI), Thai Garment Manufacturers Association (TGMA), and website 'www.thaicontractors.com'. Two thousand questionnaires were sent to the companies' staff at management levels via mail, email, and online questionnaire website (survey monkey) and fourteen companies were sampling selected for in-depth interviews. All the interviewees are of the management levels.

The reliability of responded questionnaires was tested by Cronbach's Alpha Calculation (Gliem & Gliem, 2003); the alpha value should be more than 0.7. The collected data was calculated and interpreted by using statistical analysis (Joseph F. Hair Jr. et al., 2010; Vanichbuncha, 2005) including Descriptive Analysis, Pearson Chi-Square Test, Correlation Analysis, Analysis of Variance (ANOVA), Factor Analysis, and Logistic Regression.

## Results

There were 193 usable returned questionnaires from the representatives of the companies comprising managing directors or managers (49.7%), deputy or assistant managers (6.7%), engineers or officers (35.3%), and unspecified (8.3%). The Cronbach's Alpha Coefficient from Reliability Test of 24 questions asking about the level of factors with influence is 0.926 (more than 0.7) indicating that the replied questionnaires had a good level of internal consistency. Table 3 presents the characteristics of the samples.

**Table 3** Major Export Items of Thailand (2009)

| Characteristics | Number | Percent |
|---|---|---|
| **Type of industry** | | |
| Electronics and Computer Parts | 46 | 23.8 |
| Automobile and Auto Parts | 50 | 25.9 |
| Textile & Apparel | 42 | 21.8 |
| Construction | 55 | 28.5 |
| **Type of company** | | |
| Single Domestic Company | 95 | 49.2 |
| Domestic Group Company | 25 | 13.0 |
| Joint Venture | 22 | 11.4 |
| Foreign Company | 51 | 26.4 |
| **Value of Fixed Assets** | | |
| More than THB 200 million | 59 | 30.6 |
| THB 50 -200 million | 58 | 30.1 |
| Less than THB 50 million | 67 | 34.7 |
| Unknown | 9 | 4.7 |
| **Number of Employees** | | |
| More than 200 persons | 104 | 53.9 |
| 50-200 persons | 43 | 22.3 |
| Less than 50 persons | 45 | 23.3 |
| Unknown | 1 | 0.5 |

*1. Occurrence of SCC*

There were 80.2% of all the companies that had established SCC with their partners. The percentage of SCC in each dimension were as follows; IS = 76.8%, DS = 67.8%, JP = 65.0%, and RS = 67.2%. Table 5-8 present the percentage of the occurrence of SCC and collaborative activities in the four SCC dimensions (IS, DS, JP and RS) in terms of type of industry, type of company, value of fixed assets, and number of employees.

Investigation of the occurrence of SCC in the industries indicated that Automotive Industry had the highest percentage (84.0%), followed by Electronics & Computer Parts Industry (82.6%), Textile & Apparel Industry (81.0%) and Construction Industry (80.0%) respectively. However, the difference in the occurrence was not significant (at 0.05 level).

By comparing technology intensive industry (Automotive Industry and Electronics & Computer Parts Industry) with labor intensive industry (Textile-Apparel Industry and Construction Industry), the occurrence of SCC in technology intensive industry was slightly higher than that of labor intensive industry (83.3% and 80.4% respectively).

There was a slight difference in percentage of SCC among the four company types: domestic group companies had the highest percentage (92.0%), followed by joint venture companies (86.4%), single domestic companies (80.0%), and foreign companies (78.4%).

The size of a company was categorized by two characteristics, namely value of fixed assets and number of employees. Classified by the value of fixed assets of a company, a small-sized company had fixed assets valued less than Bht. 50 million, a medium-sized company had fixed assets valued between Bht. 50-200 million and a large-sized company had fixed assets valued more than Bht. 200 million. Focusing on the number of employees, a small-sized company had less than 50 employees, a medium-sized company had between 50-200 employees, and a large-sized company had more than 200 employees.

**Table 4** Percentage of the Occurrence of SCC Compared by Type of Industry

| Type of Industry | SCC | IS | DS | JP | RS |
|---|---|---|---|---|---|
| **Technology Intensive Industry** | *83.3* | *83.3* | *76.0* | *70.8* | *74.0* |
|   Automobile & Auto Parts | 84.0 | 84.0 | 72.0 | 66.0 | 78.0 |
|   Electronics & Computer Parts | 82.6 | 82.6 | 80.4 | 76.1 | 69.6 |
| **Labor Intensive Industry** | *80.4* | *74.2* | *64.9* | *63.9* | *64.9* |
|   Textile & Apparel | 81.0 | 78.6 | 69.0 | 71.4 | 59.5 |
|   Construction | 80.0 | 70.9 | 61.8 | 58.2 | 69.1 |
| Pearson Chi-Square | | | | | |
| (Comparing Technology with Labor Intensive) | | | | | |
| Value | 0.277 | 2.392 | 2.853 | 1.050 | 1.845 |
| df | 1 | 1 | 1 | 1 | 1 |
| Asymp. Sig. (2-sided) | 0.598 | 0.122 | 0.091 | 0.306 | 0.174 |
| Pearson Chi-Square | | | | | |
| (Comparison between the four industries) | | | | | |
| Value | 0.323 | 3.255 | 4.270 | 4.059 | 3.675 |
| df | 3 | 3 | 3 | 3 | 3 |
| Asymp. Sig. (2-sided) | 0.956 | 0.354 | 0.234 | 0.255 | 0.299 |

**Table 5** Percentage of the Occurrence of SCC Classified by Type of Company

| Type of Company | SCC | IS | DS | JP | RS |
|---|---|---|---|---|---|
| Domestic Group Company | 92.0 | 92.0 | 84.0 | 84.0 | 80.0 |
| Joint Venture | 86.4 | 86.4 | 72.7 | 81.8 | 81.8 |
| Single Domestic Company | 80.0 | 74.7 | 64.2 | 60.0 | 65.3 |
| Foreign Company | 78.4 | 76.5 | 74.5 | 66.7 | 66.7 |
| Pearson Chi-Square | | | | | |
| Value | 2.657 | 4.458 | 4.441 | 7.592 | 3.867 |
| df | 3 | 3 | 3 | 3 | 3 |
| Asymp. Sig. (2-sided) | 0.448 | 0.216 | 0.218 | 0.055 | 0.276 |

**Table 6** Percentage of the Occurrence of SCC Classified by Value of Fixed Assets

| Value of Fixed Asset | SCC | IS | DS | JP | RS |
|---|---|---|---|---|---|
| More than Bht.200 million (Large) | 83.1 | 83.1 | 79.7 | 72.9 | 76.3 |
| Bht.50 -200 million (Medium) | 84.5 | 82.8 | 74.1 | 75.9 | 77.6 |
| Less than Bht.50 million (Small) | 77.6 | 70.1 | 58.2 | 55.2 | 58.2 |
| Pearson Chi-Square | | | | | |
| Value | 1.109 | 4.077 | 7.545 | 7.217 | 7.144 |
| df | 2 | 2 | 2 | 2 | 2 |
| Asymp. Sig. (2-sided) | 0.574 | 0.130 | 0.023* | 0.027* | 0.028* |

* $p < 0.05$
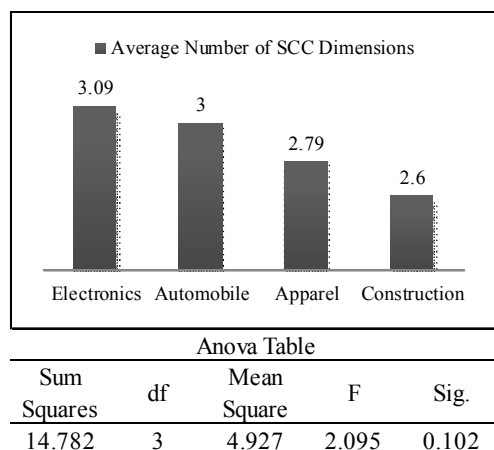
**Table 7** Percentage of the Occurrence of SCC Classified by Number of Employees

| Number of Employees | SCC | IS | DS | JP | RS |
|---|---|---|---|---|---|
| More than 200 persons (Large) | 81.7 | 81.7 | 76.9 | 71.2 | 75.0 |
| 50-200 persons (Medium) | 93.0 | 86.0 | 76.7 | 79.1 | 67.4 |
| Less than 50 persons (Small) | 71.1 | 64.4 | 51.1 | 46.7 | 60.0 |
| Pearson Chi-Square | | | | | |
| Value | 7.083 | 7.396 | 11.066 | 12.092 | 3.497 |
| df | 2 | 2 | 2 | 2 | 2 |
| Asymp. Sig. (2-sided) | 0.029* | 0.025* | 0.004* | 0.002* | 0.174 |

* $p < 0.05$

The results in Tables 7 and 8 showed that the occurrences of SCC in large-sized companies and in medium-sized companies did not differ much but they were quite higher than that in small-sized companies. In terms of, value of fixed assets, the occurrence of SCC and IS did not significantly differ while the occurrences of DS, JP and RS significantly differed. Furthermore, the occurrences of SCC, IS, DS, and JP significantly differed when compared in terms of, the number of employees. The larger company tended to have more SCC than the smaller one.

The intensity of SCC in a company was roughly measured by counting the number of SCC dimensions that occurred in each company; 1 = one dimension, 2 = two dimensions, 3 = three dimensions, and 4 = four dimensions. The average numbers of SCC dimensions of the companies compared by type of industry, type of company, value of fixed assets and number of employees are presented in Figures 2-5.



| Anova Table | | | | |
|---|---|---|---|---|
| Sum Squares | df | Mean Square | F | Sig. |
| 7.299 | 3 | 2.433 | 1.018 | 0.386 |

**Figure 3** Average Number of SCC Dimensions Compared by Type of Company



| Anova Table | | | | |
|---|---|---|---|---|
| Sum Squares | df | Mean Square | F | Sig. |
| 20.479 | 2 | 10.239 | 4.373 | 0.014* |
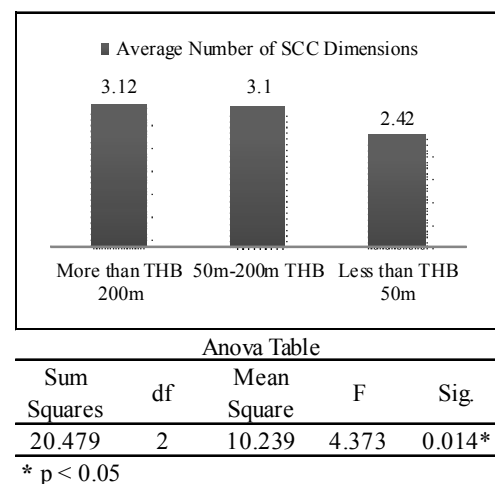
* $p < 0.05$

**Figure 4** Average Number of SCC Dimensions Compared by Value of Fixed Assets



| Anova Table | | | | |
|---|---|---|---|---|
| Sum Squares | df | Mean Square | F | Sig. |
| 14.782 | 3 | 4.927 | 2.095 | 0.102 |

**Figure 2** Average Number of SCC Dimensions Compared by Type of Industry
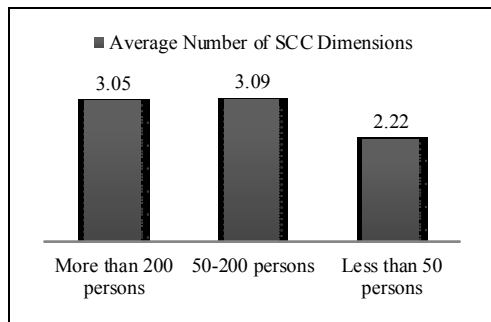
**Anova Table**

| Sum Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|
| 24.314 | 2 | 12.157 | 5.292 | 0.006* |

* p < 0.05

**Figure 5** Average Number of SCC Dimensions Compared by Value of Employees

The average number of SCC dimensions of each industry was not significantly different. However, the technology intensive industry tended to have more SCC than the labor intensive industry. Considering the different types of company, they were not significantly different as well. However, domestic group company had the highest average number of SCC dimensions followed by joint venture company, foreign company, and single domestic company.

Nevertheless, the average number of SCC dimensions compared by value of fixed assets and number of employees were significantly different. The result shows that large-sized and medium-sized companies had higher level of SCC than small-sized companies.

*2. SCC Factors*

The results of independent variables (X1-X24) indicated the levels of 24 SCC factors that really existed in each company, from very low (score = 1) to very high (score = 5). These variables were scored by the respondents' opinion. The average scores of the independent variables of all companies were ranked as shown in Table 9. The top three scores belong to Good Relationship, Trust, and Partner's Intention, while Risk, Private Association Support, and Government Support were the three lowest scores.

From Correlation Analysis (Joseph F. Hair Jr., et al., 2010), the Pearson's Correlation Coefficients showed that many independent variables were highly correlated (Multi-co linearity). Factor Analysis (Joseph F. Hair Jr. et al., 2010) was applied to get rid of Multi-co linearity and extract the composite independent factors. The factor analysis was taken using Principal Component Analysis (PCA) with Varimax

Rotation Method. The KMO (Kaiser-Mayer-Olkin) Coefficient of the variables was 0.897. This confirms that it was suitable to use the factor analysis.

**Table 8** The Average Level of SCC Factors Found in the Companies

| SCC Factors | Mean | SD. |
|---|---|---|
| X12-Good Relationship | 4.00 | 0.70 |
| X11-Trust | 3.89 | 0.74 |
| X13-Partner's Intention | 3.81 | 0.86 |
| X15-Close Coordination | 3.77 | 0.81 |
| X4-Top Management | 3.74 | 0.89 |
| X5-Commitment | 3.73 | 0.87 |
| X14-Communication Efficiency | 3.69 | 0.83 |
| X17-Benefit | 3.60 | 0.88 |
| X22-Global Economy | 3.56 | 0.94 |
| X3-Policy | 3.52 | 1.02 |
| X16-Partner's Readiness | 3.51 | 0.92 |
| X2-Awareness | 3.37 | 0.96 |
| X10-Organizational Culture | 3.35 | 0.96 |
| X7-Human Resource | 3.33 | 0.97 |
| X9-Structure | 3.28 | 0.93 |
| X8-Information Technology | 3.26 | 1.00 |
| X21-Customer Push | 3.22 | 1.01 |
| X1-SCM Understanding | 3.12 | 1.01 |
| X19-Distance | 3.12 | 0.98 |
| X6-Budget | 3.00 | 1.07 |
| X20-Persuasion | 2.90 | 1.05 |
| X18-Risk | 2.71 | 0.96 |
| X24-Private Association Support | 2.26 | 0.99 |
| X23-Government Support | 2.21 | 1.05 |

The variables were extracted into six composite factors (as shown in Table 10). Variables X11, X12, X13, X14 and X15 were combined into F1 that represented "Inter-Organizational Relation". Among X3, X4, X5, and X6 were grouped into F2 that represented "Top Management Support". F3 including X7, X8, X9, X10, X16, and X17 were the "Readiness and Benefits of Collaboration". F4 which was the "Awareness and Market Push" comprised X1, X2, X21, and X22. F5 represented the "External Support" from the government or private associations (X23 and X24). Finally, F6 which included X18, X19, and X20 were "Resistance and Persuasion" of building SCC.

**Table 9** Rotated Component Matrix of the Variables and the Composite Factors

| Composite Factors | Variables | Component and Factor Loadings | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| F1: | X11-Trust | 0.819 | 0.347 | 0.128 | 0.091 | 0.103 | -0.012 |
| | X12-Good Relationship | 0.809 | 0.273 | 0.126 | 0.163 | -0.025 | 0.053 |
| | X15-Close Coordination | 0.748 | 0.188 | 0.263 | 0.183 | 0.101 | -0.061 |
| | X13-Partner's Intention | 0.691 | 0.241 | 0.191 | 0.356 | 0.016 | -0.011 |
| | X14-Communication Efficiency | 0.648 | 0.147 | 0.475 | 0.080 | 0.135 | -0.025 |
| F2: | X4-Top Management | 0.258 | 0.836 | 0.175 | 0.245 | -0.035 | 0.027 |
| | X5-Commitment | 0.329 | 0.763 | 0.142 | 0.259 | 0.029 | 0.065 |
| | X3-Policy | 0.289 | 0.659 | 0.118 | 0.466 | 0.065 | -0.110 |
| | X6-Budget | 0.240 | 0.634 | 0.326 | 0.056 | 0.347 | -0.112 |
| F3: | X16-Partner's Readiness | 0.501 | 0.022 | 0.717 | 0.096 | 0.112 | 0.051 |
| | X8-Information Technology | 0.221 | 0.462 | 0.694 | 0.219 | 0.073 | 0.054 |
| | X7-Human Resource | 0.145 | 0.526 | 0.658 | 0.282 | 0.075 | -0.140 |
| | X9-Structure | 0.279 | 0.495 | 0.569 | 0.319 | 0.042 | 0.033 |
| | X10-Organizational Culture | 0.306 | 0.544 | 0.559 | 0.237 | -0.026 | 0.060 |
| | X17-Benefit | 0.525 | 0.099 | 0.534 | 0.335 | 0.091 | 0.083 |
| F4: | X1-SCM Understanding | 0.145 | 0.243 | 0.241 | 0.725 | 0.075 | -0.083 |
| | X2-Awareness | 0.116 | 0.359 | 0.206 | 0.719 | -0.053 | -0.250 |
| | X21-Customer Push | 0.387 | 0.227 | 0.102 | 0.598 | 0.260 | -0.033 |
| | X22-Global Economy | 0.269 | 0.173 | 0.165 | 0.554 | 0.068 | 0.203 |
| F5: | X24-Private Association Support | 0.086 | 0.007 | 0.004 | 0.094 | 0.910 | 0.118 |
| | X23-Government Support | 0.069 | 0.093 | 0.131 | 0.098 | 0.888 | 0.086 |
| F6: | X18-Risk | -0.125 | -0.129 | 0.147 | 0.016 | 0.119 | 0.785 |
| | X19-Distance | 0.086 | 0.074 | -0.110 | -0.147 | -0.003 | 0.765 |
| | X20-Persuasion | 0.060 | 0.036 | 0.025 | 0.527 | 0.225 | 0.556 |

The composite factors were taken to be tested the effect on the occurrence of SCC and its dimensions (IS, DS, JP, RS) by using Logistic Regression Analysis with Forward LR method (Joseph F. Hair Jr. et al., 2010). The result of the analysis between the composite factors and the occurrence of SCC was shown in Table 11. The Hosmer and Leme test showed that the model was suitable (Sig. = 0.237, > 0.05). F1 (Inter-Organizational Relation), F2 (Top Management Support), and F4 (Awareness and Market Push were significantly related (at the 0.05 level) to the occurrence of SCC. The Logistic Coefficients (B) showed that F2 was the most important factor affecting the occurrence of SCC (B = 0.807), followed by F1 (B = 0.763) and F4 (B = 0.542). Considering the component of F2, Top Management had the highest factor loading (0.836), followed by Commitment (0.763). This could be interpreted that the most important factor of the occurrence of SCC was Top Management's Vision, Support, and Commitment.

**Table 10** Variables in the Equation (SCC)

| | B | S.E. | Wald | df | Sig. | Exp.(B) |
|---|---|---|---|---|---|---|
| F1 | 0.763 | 0.269 | 8.059 | 1 | 0.005 | 2.145 |
| F2 | 0.807 | 0.261 | 9.597 | 1 | 0.002 | 2.242 |
| F4 | 0.542 | 0.246 | 4.845 | 1 | 0.028 | 1.719 |
| Constant | 1.957 | 0.302 | 41.907 | 1 | 0.000 | 7.081 |

By applying the same process as shown above, the effect of the composite factors on the occurrence of SCC dimensions: IS, DS, JP, and RS was determined. The results (as shown in Table 12-15) showed that F1 and F2 significantly affected every SCC dimension, F4 significantly affects IS, JP and RS while F5 significantly affected only DS. Besides, the Logistic Coefficients showed that the most important factors of IS, DS, JP, and RS were F4 (B = 0.913), F1 (B = 0.674), F2 (B = 0.667), and F2 (B = 0.582), respectively. As for the components of F1 and F4, Trust and Good Relationship were the highest loading of F1

(0.819 and 0.809) while SCM Understanding and Awareness were the highest loading of F4 (0.725 and 0.719).

**Table 11** Variables in the Equation (SCC)

|  | B | S.E. | Wald | df | Sig. | Exp.(B) |
|---|---|---|---|---|---|---|
| F1 | 0.869 | 0.269 | 10.411 | 1 | 0.001 | 2.384 |
| F2 | 0.785 | 0.258 | 9.258 | 1 | 0.002 | 2.191 |
| F4 | 0.913 | 0.270 | 11.452 | 1 | 0.001 | 2.493 |
| Constant | 1.864 | 0.301 | 38.295 | 1 | 0.000 | 6.452 |

**Table 12** Variables in the Equation (DS)

|  | B | S.E. | Wald | df | Sig. | Exp.(B) |
|---|---|---|---|---|---|---|
| F1 | 0.674 | 0.215 | 9.841 | 1 | 0.002 | 1.962 |
| F2 | 0.459 | 0.202 | 5.134 | 1 | 0.023 | 1.582 |
| F5 | 0.473 | 0.210 | 5.082 | 1 | 0.024 | 1.605 |
| Constant | 1.015 | 0.211 | 23.240 | 1 | 0.000 | 2.759 |

**Table 13** Variables in the Equation (JP)

|  | B | S.E. | Wald | df | Sig. | Exp.(B) |
|---|---|---|---|---|---|---|
| F1 | 0.442 | 0.209 | 4.474 | 1 | 0.034 | 1.555 |
| F2 | 0.667 | 0.204 | 10.712 | 1 | 0.001 | 1.949 |
| F4 | 0.610 | 0.209 | 8.564 | 1 | 0.003 | 1.841 |
| Constant | 0.875 | 0.206 | 18.021 | 1 | 0.000 | 2.399 |

**Table 14** Variables in the Equation (RS)

|  | B | S.E. | Wald | df | Sig. | Exp.(B) |
|---|---|---|---|---|---|---|
| F1 | 0.427 | 0.207 | 4.261 | 1 | 0.039 | 1.533 |
| F2 | 0.582 | 0.201 | 8.354 | 1 | 0.004 | 1.790 |
| F4 | 0.391 | 0.199 | 3.847 | 1 | 0.050 | 1.478 |
| Constant | 1.020 | 0.207 | 24.237 | 1 | 0.000 | 2.773 |

From the above, it was implied that Understanding of the Concept and Importance of SCM was the major driving force of Information Sharing, that Trust and Good Relationship between partners were the most important factors that govern Decision Synchronization, and that Top Management Support (including Vision and Commitment) was the most important factor that impacted on the building up of Joint Business Processes and Resource & Skills Sharing.

## Discussion and Conclusion

SCC is the major component of successful SCM. This paper describes the empirical study of SCC in Thai major industries, which are Computer Industry, Automotive Industry, Textile-Apparel Industry, and Construction Industry. It was found that 80.2% of all the surveyed companies established SCC with their partners and that the major collaborative activity has been Information Sharing. The occurrence of SCC in the Technology Intensive Industry was slightly higher than that in the Labor Intensive Industry.

Among the various types of company, Domestic Group Company had the highest percentage of the occurrence of SCC. The bigger company, with more fixed assets value and higher number of employees, tended to have more SCC than the smaller one.

While the most frequently referred SCC factor from literature review (mentioned above) is Trust followed by Information Technology and Business Benefits, the survey result shows that the most important factors which has an influence on the occurrence of SCC is Top Management's Vision followed by Support and Commitment. People in top management level of a company play the important role in SCC building, they are in charge of making policy, providing budget and controlling the direction of the company. Moreover, in order to successfully establish SCC with partners, they needed to have a right vision, an understanding of the importance of SCC and commitment to keep the SCC plan going. However, business benefit is the major driving force that pushes top managers (or business owners) to build collaboration with their supply chain partners. In addition, the survey result shows that Trust, Good Relationship and Intention are also the important factors of building up SCC.

The suggestion is that the company should take a proactive approach towards the building up of SCC with its partners rather than waiting for external supports.

Finally, this article only presents the observations on the occurrence of SCC, it does not measure the intensity or the success level of collaboration. In further studies, the SCC index might be created to obtain a more precise measurement of SCC levels then it will be clearly seen how much the association between SCC and the involving factors is.

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