The Impact of Alignment between Supply Chain Strategy and IS Strategy on SCM Performance

Jau-Wen Wang
Institute of Management, National Kaohsiung First University of Science and Technology,
Department of Information Management, Fortune Institute of Technology,
Kaohsiung , Taiwan, ROC

Chien-Chih Huang
Department of Information Management, National Sun Yat-sen University, 70 Lien-Hai Road,
Kaohsiung 804, Taiwan, ROC

Yenming J. Chen
Institute of Management, National Kaohsiung First University of Science and Technology,
Kaohsiung 811, Taiwan, ROC

Abstract

Supply chain (SC) strategy and information system (IS) strategy to implement Supply Chain Management (SCM) processes have been individually regarded as the vital and imperative ways to improve SCM performance. Yet what kinds of IS strategies to be implemented under what condition of manufacturing strategies in a supply chain remain to be unseen in empirical researches. The purpose of this study is to provide a theoretical understanding of the alignment between SC strategy and IS strategy and then investigates its impact on SCM performance. 151 manufacturers were surveyed and were mapped into three predefined SC strategies (Caretakers, Marketeers, and Innovators) and three predefined IS strategies (IS for efficiency, flexibility and comprehensiveness). A profile deviation approach was used to compute the alignment between these two strategies. The results indicated that the alignment between SC strategy and IS strategy has a positive effect on SCM performance. Suggestions to future research are discussed in the conclusion.

Key words: Supply Chain (SC) Strategy, Information System (IS) Strategy, Alignment, Supply Chain Management (SCM) performance

1. INTRODUCTION

In recent years, manufacturing industry has paid much attention on supply chain management (SCM). Manufacturing firms face the problem of how to provide efficient and cost-effective response to gain advantages in the changing environment. Uncertainties including complicated production processes, random yields, and high quality requirements and so on all affect their supply chain performance. Efficient SCM provides better resources utilization, reductions in inventory, transaction, and manufacturing costs, and improvement in product development, competitiveness, and profitability for the manufacturing firms (Langfield-Smith and Smith, 2005). Reports of savings achieved by best-in-class companies as a result of effective SCM amount to 5–6% of sales (SimulationDynamics, 2003).

Numerous studies have been conducted to help design a role model or strategy to effectively operate complex supply chain for manufacturing firms. For example, Li and O'Brien (2001) based on a mathematical model applying quantitative analysis to match types of products to supply chains. Furthermore, Rudberg and Olhager (2003) established a typology that integrates manufacturing

networks and supply chains as a foundation for future research. SC strategies for manufacturing firms determine the capability of a manufacturing system and specify how it will operate to meet supply chain objectives. It is the foundation for manufacturing firms to meet the overall business objectives and gain competitiveness in the supply chain.

Moreover, with the growing of information technology (IT), manufacturing firms are attempting to find ways to include the implementation of IT in by changing their SC strategy and operations methods. For example, the interorganizational information systems (IOISs) or IT-enabled SCM or SCM systems (SCMS) such as electronic data processing (EDI), providing inter-company data processing and data communication, could lead to better efficiency and effectiveness for the manufacturing firms in a supply chain (Kobayashi, Tamaki and Komoda, 2003; Dehning, Richardson and Zmud, 2006).

However, managing supply chain is a complicated task. Technologies are easily to be cloned and business models can be emulated by competitors. Successful manufacturing firms understand that the right SC strategies accompanies with the right information technology (IT) strategy are necessary to meet the specific needs of customers to 'sustain' competitive advantage. Whereas, empirical research on the topic of alignment between manufacturing SC strategy and IS strategy is extremely sparse, if not non-existent — although ideal alignment between business strategy and IS strategy have been empirically investigated to play an important role in business performance (Sabherwal and Chan, 2001; Bergeron, Raymond and Rivard, 2004). Ignoring the important concept of 'alignment', SCM research respectively investigated the influence of SC strategies and IS strategies on performance. As a result, failures in supply chain management which mismatches between these two strategies are still in common, and therefore, the performance of SCM is not as good as expected.

Therefore, the main objective of this paper is to understand the alignment between IS strategies and SC strategies of manufacturing firms and investigate its impact on SCM performance. Furthermore, this study seeks to provide deeper insights into the SC strategies appropriate for IS strategies by adopting a predefined classification of these two strategies. As for Manufacturing SC strategies, this study adopts the most commonly cited taxonomy that are classified into three types — Marketeers, Caretakers, and Innovators (Miller and Roth, 1994). As for IS strategies, this study adopts Sabherwal and Chan's (2001) three classifications — IS for efficiency, flexibility and comprehensiveness. Finally, by doing so, this study examines the performance implications of alignment separately for these strategy types to assess whether alignment affects performance for all strategies or only for some of them.

2. THEORETICAL BACKGROUND

2.1 Manufacturing Strategies in Supply Chain

Manufacturers within a supply chain may have very different competitive positions in their sector, and thus may have quite different generic competitive strategies. According to Miller and Roth (1994), manufacturing strategy is classified into two core elements, including "manufacturing task" and "manufacturing choice". The former element refers to the terms of the capabilities the manufacturing unit must have in order for the firm to compete given its overall business and marketing strategy, such as quality, cost/efficiency, delivery/responsiveness and flexibility. The latter element refers to structure decision (e.g., facilities, technology, vertical integration, capacity) and manufacturing infrastructure (e.g., organization, quality management, workforces policies, IS architecture). The demand that manufacturing choices and manufacturing tasks be linked follows from the presumption that there is an appropriate alignment between them.

Following Miller and Roth's (1994) taxonomy which has since become one of the most influential frameworks in the manufacturing strategy literature (Goh et al, 1997), this study proposes that there are three manufacturing strategies — Caretakers, Marketeers and Innovators. First of all, the Caretakers's strategy is uniquely preoccupied with low price over all other potential competitive capabilities (Frohlich and Dixon, 2001). It puts low relative emphasis on the development of competitive capabilities. The capabilities of conformance quality, delivery dependability and delivery speed are relative important within this cluster, suggesting that firms should offer low-price with consistent quality product in their industry, meet the delivery schedule

and make fast delivery (Miller and Roth 1994). Second, the Marketeers' strategy is oriented towards reliability in the manufacturing process — especially in quality and delivery. Furthermore, this strategy has some price perception similar to Caretakers' strategy, such as low price. Therefore, it counterparts on several key market oriented competitive capabilities, such as conformance quality, delivery dependability, and performance quality, suggesting that firms may offer products with broader product line by concerning product life cycle, and potential economies of scope (Zahra and Covin 1993). Finally, the Innovators' strategy is characterized by an emphasis on quality and an avoidance of price competition. Furthermore, Miller and Roth (1994) showed that Innovators have similar characteristics to Marketeers. It puts relative emphasis on ability to make changes in design and to introduce new product quickly. Service, delivery dependability and design flexibility are important capabilities for such strategy. Table 1 provides the SC strategy profiles for the three strategic types using three-point scale of high(H), medium(M), and low(L).

Table 1 SC strategy Profiles of Caretakers，Marketeers and Innvoators

SC strategy Attributes	Caretakers	Marketeers	Innovators
Price	H	M	L
Flexibility	L	H	M
Quality	H	H	H
Delivery	M	H	M
Service	L	M	H

Derived from Frohlich and Dixon (2001)

2.2 IS Strategy Alignment

Several studies have noted that the importance of the efficient use of information systems (IS) in integrating suppliers with partnering firms in supply chain (Gunasekaran and Ngai, 2004；Talluri 2000). IS integrates the flow and information of the supply chain; meantime, it supports communication across the supply chain and collaboration between supply chain partners (Handfield and Nichols,1999; Christopher, 2000). The efficient use of IS throughout supply chain helps achieve agility in the supply chain such as flexible manufacturing systems to make an agile manufacturing (Christopher, 2000; White et al., 2005).

Borrowing from Sabherwal and Chan's research (2001), this study posits that IS strategy can be categorized into three profiles ― IS strategy for efficiency, IS strategy for flexibility and IS strategy for comprehensiveness. "IS for efficiency" refers to use IT for monitoring and controlling the day-to-day operations, and expected to facilitate operational efficiency, supporting function of information sharing and communication to link with customers and suppliers, and providing basis for decision making. "IS for flexibility" is characterized to use IS for observing marketing information and changes of market, and providing basis for decision making. "IS for comprehensiveness "refers to employ IS for observing marketing information and market changes, supporting function of information sharing and communication to link with customer and suppliers, and providing basis for decision making. The ideal profiles of IS strategy attributes Caretakers, Marketers, and Innovator for Caretakers, Marketers, and Innovator are given in Table 2.

Table 2 IS strategy profiles of Caretakers, Marketeers, and Innovators

	Caretakers	Marketeers	Innovators
IS strategy attributes	IS for Efficiency	IS for Comprehensiveness	IS for Flexibility
Operational support systems	H	M	L

Market information systems	L	H	H
Interorganizational systems	H	H	M
Strategic decision support systems	H	H	H

Derived from Sabherwal and Chan (2001)

Recently, some researchers adopted the notion of 'strategy alignment' on the organizational performance, proposing performance is affected by the consequence of fit between two or more factors such IS strategy and business strategy (Bergeron and Raymond, 1995; Sabherwal and Chan, 2001). In the context of SCM, IS also has been considered as aids in the evolution of SCM since the rapid development of SCM software (King 1996; Semich 1994). IS coupled with supply chain management may led to superior logistics management aiding in successive SCM adoption (Tan 2001). For example, EDI integrated stocking, logistics, materials acquisition, and other function may improve customer responsiveness (Mische 1992). Many members of supply chain acquire the requisite information systems (IS) such as IOIS in order to align with the network leader who dominates a supply chain network (Sanders, 2005). However, there still lacks clear indications and empirical studies of how to align between IS strategies and supply chain strategies, especially for the manufacturing firms.

2.3 SCM Performance

Some frameworks of supply chain management (SCM) performance measurement or metrics have been proposed and validated. For instance, Otto and Kotzab (2003) proposed a scale with six perspectives, including systems dynamics, operations research, logistics, marketing, organization and strategy, to measure the SC performance. Each perspective follows a particular set of goals, which consequently leads to a particular set of performance metrics. Chan (2003) proposed a framework for the SC performance measurement consisting of quantitative measures and qualitative measures: resource utilization, flexibility, visibility, trust, and innovativeness. AHP process is then used for making decisions based on the priority of performance measures. However, several companies intend to identify critical success factor (CSFs) to know what is required to enhance performance and develop key performance indicators (KPIs) for the total supply chain (Langfield-Smith and Smith, 2005). Therefore, this study adopts Brewer and Speh's (2000) balanced scorecard (BSC) approach which is applied to supply-chain performance measurement (Brewer and Speh, 2000) to deal with manufacturing SC performance evaluation. Table 3 shows the four perspectives of the SCM performance framework-Customer Benefits links to the Customer perspective, Financial Benefits links to the financial perspective, and SCM Improvement links to the Innovation and Learning perspective.

Table 3 Measures for a SCM Balanced Scorecard

Perspective	Goals	Measures
Financial	1. Profit margin 2. Cash flow 3. Revenue growth 4. Return on assets	1. Profit margin by supply chain partner 2. Cash-to-cash cycle 3. Customer growth and profitability 4. Return on supply chain assets
Customer	1. Customer view of product/service 2. Customer view of timeliness 3. Customer view of flexibility 4. Customer value	1. Number of customer contract points Relative customer order response time 3. Customer perception of flexible response 4. Customer value ratio
Internal business process	1. Waste reduction 2. Time compression 3. Flexible response 4. Unit cost reduction	1. Supply chain cost of ownership 2. Supply chain cycle efficiency 3. Number of choice/average response time 4. % of supply chain target costs achieved
Innovation and learning	1. Product/process innovation 2. Partnership management 3. Information flows 4. Threats and substitutes	1. Product finalization point 2. Product category commitment ratio 3. Number of share data sets/total data sets 4. Performance trajectories of competing technologies

Source: Adapted from Brewer and Speh (2000), p.86.

3. RESEARCH MODEL AND HYPOTHESIS

Based on strategic alignment perspective, this study integrates two types of strategies — SC strategy and IS strategy — to examine their effect on SCM performance and develops four hypotheses. The profile of alignment between three IS strategies with the three SC strategies is showed in Table 4. The expected relationship between alignment and SCM performance leads to the following hypotheses for the three SC strategy types. Figure 1 summarizes the research model in this paper with reference to prior studies.

Table 4 Levels of Alignment Between Various SC and IS Strategies

	Caretakers	Marketeers	Innovators
IS for Efficiency	H	L	L
IS for Flexibility	L	L	H
IS for Comprehensiveness	L	H	L

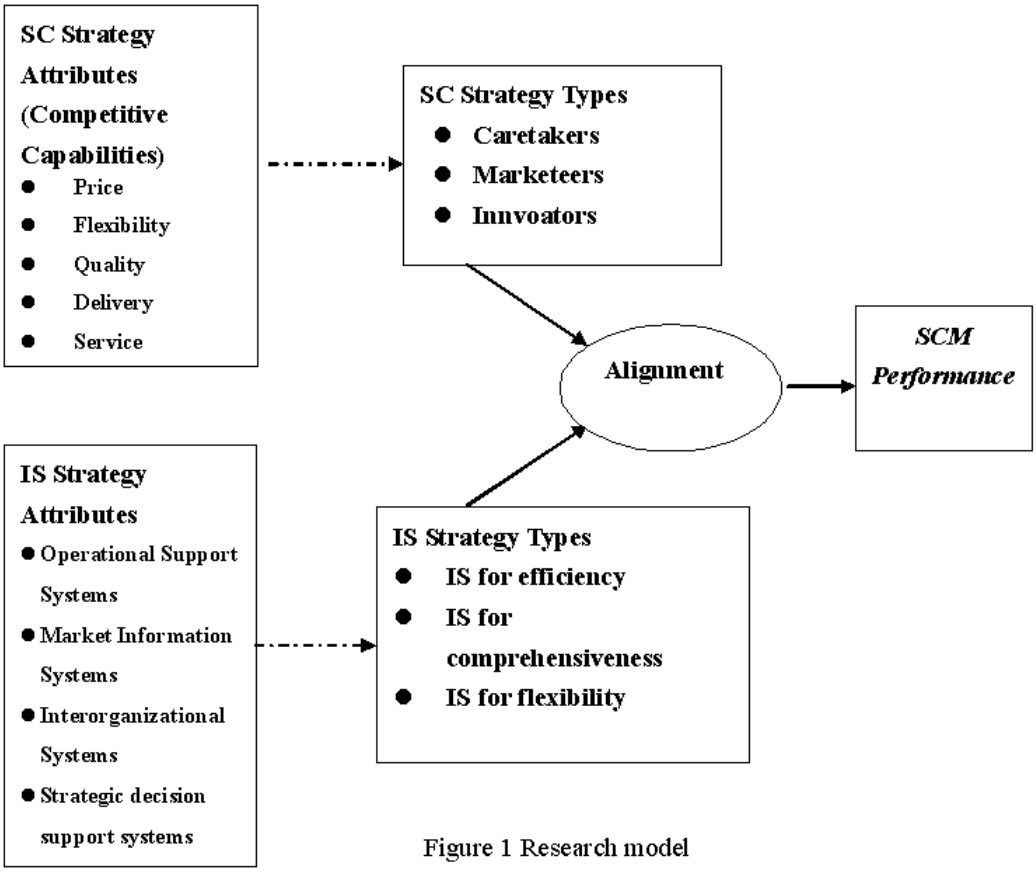

Figure 1 Research model

For organizational researchers, fit was treated as an important concept for measuring the performance impacts of environment-strategy coalignment (Venkatraman and Prescott 1990). IS studies have also suggested that the alignment between IT strategy and business strategy have positive effect on firm performance (Sabherwal and Chan, 2001; Bergeron, Raymond and Rivard, 2004). Accordingly, we believe that the IS strategy may affect firm performance positively under the extent that it is in 'alignment' with SC strategy.

Hypothesis 1. The alignment between SC strategy and IS strategy is positively associated with SCM performance.

First of all, the Caretakers' strategy suggests that firms should offer low-price product with high-quality in its industry, meet the delivery schedule and make fast delivery (Miller and Roth 1994). The "IS for efficiency" strategy which oriented toward internal and inter-organizational efficiency would thus be suitable for firms using Caretakers' strategy. Second, the Marketeers' strategy relies on several key market oriented competitive capabilities, such as conformance quality, delivery dependability, low cost and broad distribution. "IS for comprehensiveness" strategy enabling comprehensive decisions and quick responses through knowledge of other organizations would therefore fit Marketeers (Sabherwal and Chan 2001). Finally, the Innovators' strategy mainly emphasizes on the ability to make changes in product design and introduce new products quickly (Miller and Roth 1994). "IS for flexibility" strategy focusing on market flexibility and fast strategic decisions therefore best describes the Innovator. In summary, we propose our hypothesis:

Hypothesis 2. For Caretakers, the alignment between IS strategy and "IS for efficiency" strategy is positively related to SCM performance.

Hypothesis 3. For Marketeers, the alignment between IS strategy and "IS for comprehensiveness" strategy is positively related to SCM performance.

Hypothesis 4. For Innovators, the alignment between IS strategy and "IS for flexibility" strategy is positively related to SCM performance.

4. RESEARCH METHOD

A survey methodology for data collection, and the partial least squares (PLS) method was applied to analyze the collected data in order to test hypotheses in our proposed research model. The unit of analysis was the manufacturing firm in a supply chain.

4.1 Sample and data collection

Along a supply chain, there may be multiple stakeholders comprised of various suppliers, manufacturers, distributors, retailers, and customers. The members of a supply chain interact each other directly or indirectly through their upstream or downstream partners, from point of origin to point of consumption (Lamber and Cooper, 2000). In this paper, we attempt to empirically examine the SCM performance implications of alignment from manufacturers' standpoint and focus into the strategies of manufacturer in a supply chain and therefore manufacturers as the focal companies. Therefore, we limited our sampling frame to manufacturing industries in supply chain and those manufacturing companies place much more emphasis on SCM performance.

We followed a systematic approach in constructing the mailing list for the survey. Numerous manufacturing firms were selected and contacted by an introductory letter or a follow-up phone call describing the study and eliciting the firm's support. One hundred and seventy seven questionnaires were sent to those companies were willing to fill. Participants could choose paper survey instrument which postage-paid return envelopes were provided or online survey instrument. A total of 159 questionnaires were returned, a gross response rate 89.8 %. Out of these, a total of 8 questionnaires were eliminated for various reasons. Therefore, 151 usable responses were adopted, for an effective response rate of 85.31%. Sample characteristics of the respondent firms in this study are given in Table 5.

Table 5 Respondents and Companies Characteristics

Respondent Position	**Number**	**Percentage**
Information Division Manager	62	41.1
Non- Information Division Manager	53	35.1
Non-Manager	35	23.2
Missing	1	0.6
Total	151	100.0
Geographic Dispersion		
Regional (Taiwan)	15	9.9
National (Taiwan, China)	27	17.9
Worldwide	109	72.2
Total	151	100.0
Employees		
< 101	16	12.0
101-500	41	27.7
501-1000	27	17.0
1001-2000	25	17.0
>2001	40	25.1
Missing information	2	1.2
Total	151	100.0
Annual Revenue (in US$Million)		
< 20	46	30.5
21-100	53	35.1
101-300	22	14.6

301-1000	19	12.6
>1001	8	5.3
Missing information	3	1.9
Total	151	100.0

Nonresponse bias was assessed by examining that early and late respondents were not significantly difference (Armstrong and Overton 1977; Pavlou and Fygenson 2006). Thus we compared the difference between the respondents return within the first three weeks and after three weeks by using t-test for firm size and employee number, by using chi-square test for geographic dispersion and industry type. No significant difference was found for the firm size (t=1.7; p=0.091), employee number (t= -0.58; p=0.564), geographic dispersion (χ^2 =3.02, df = 2, p=0.221), industry type (χ^2 =4.67, df = 3, p=0.918) between early and late respondents, indicating nonresponse bias should not be a major concern in this study.

4.2 Measures

In this paper, all items in the questionnaire are developed either by adapting measures that had been validated by other researchers or by converting the definitions of constructs into a questionnaire format. Specifically, the items for the SC strategies — price, flexibility, quality, delivery and service — were revised from Miller and Roth's (1994) manufacturing strategy research, and the items for measuring IS strategy were adapted from previous Sabherwal and Chan's (2001) IS strategy studies. Finally, the items for the dependent variable— SCM performance —were also adapted from Brewer and Speh (2000) using balanced scorecard measure supply chain performance. The questionnaire items for SC strategy, IS strategy, and SCM performance attributes were measured using a seven-point Likert scale that range from 1 = strongly disagree to 7 = strongly agree with 4 = neither as the neutral response. The questionnaire items measuring constructs are listed in Appendices A-1, A-2, and A-3.

A pretest of the questionnaire was performed to ensure content validity and reliability within the target context. Three experts in the IS and SCM area were invited to assess wording clarity, task relevance, and question item sequence adequacy.

4.3 Reliability and validity of research constructs

The constructs in this study were evaluated in terms of composite reliability and construct validity by using confirmation factor analysis (CFA) in partial least squares (PLS) method (Wasko and Faraj 2005). The means, standard deviations, and composite reliabilities of all the research variables are given in Table 6. As shown in Table 6, composite reliabilities of all factors exceeded 0.83, well above the required minimum of 0.60 (Bagozzi and Yi 1988) or 0.70 (Gefen et al. 2000), indicating the existence of internal consistence (Hair et al. 2006).

Table 6 The Research Variables

	Composite Reliability	**No. of items**	**Mean**	**S.D.**
Supply Chain Strategy				
Overall	**0.91**			
Price		1	5.13	1.11
Flexibility	0.85	3	5.22	0.95
Quality	0.84	2	5.25	0.96
Delivery	0.89	2	5.17	1.05
Service	0.84	2	5.09	1.07
IS Strategy				
Overall	**0.95**			
Operational support systems	0.91	5	5.12	0.99
Market information systems	0.93	4	4.70	1.21
Interorganizational systems	0.91	4	4.91	1.08
Strategic decision support systems	0.92	3	4.68	1.20
SCM Performance				

Overall	**0.96**			
Customer	0.94	4	4.93	1.09
Internal business process	0.94	4	4.72	1.09
Innovation and learning	0.93	4	4.72	1.07
Financial	0.94	4	4.65	1.13

*All variables are measured on a seven-point scale.

Notes: Composite reliability = $(\sum\lambda_i)^2/【(\sum\lambda_i)^2+\sum Var(E_i)】$

Convergent validity was assessed by checking the factor loadings to see if items within the same construct highly correlated among themselves (Kankanhalli et al. 2005). It was evaluated for the measurement scales using factor loadings criteria, which all indicator should be significant and exceed 0.70 (Fornell and Larcker 1981). As shown in Appendices A-1, A-2, A-3, and B, most items exhibited factor loading higher than 0.7 on their respective constructs, providing evidence of acceptable item convergence on the intended constructs. One exception was the fifth item of the operational support systems for IS strategy scale (OSS5), which loadings was slightly below 0.7(see Appendix A-2).

Discriminant validity was assessed by examining the factor loadings to see if questions loaded more highly on their intended constructs than on other constructs (Cook and Campbell 1979). We considered both loadings and cross-loadings to establish discriminant validity; the results of confirmatory factor analysis are shown in Appendix B. One item (OSS5) from operational support systems was dropped because it has high cross-loadings, which own-loading are not higher than cross-loadings (see Appendix B). After omitting this item, the reliability of the construct improved to 0.91 (Table 6).

Table 7 Correlation between Constructs

	FLEX	**QUAL**	**DELI**	**SERV**	**OSS**	**IOS**	**MIS**	**SDSS**	**CUST**	**IBP**	**I&L**	**FINC**
FLEX	0.807											
QUAL	0.70	0.853										
DELI	0.59	0.53	0.897									
SERV	0.70	0.62	-0.63	0.850								
OSS	0.35	0.35	-0.28	0.34	0.815							
IOS	0.27	0.34	-0.24	0.33	0.64	0.852						
MIS	0.37	0.22	-0.24	0.41	0.42	0.69	0.879					
SDSS	0.30	0.26	-0.20	0.37	0.52	0.69	0.79	0.896				
CUST	0.47	0.54	-0.50	0.50	0.54	0.48	0.27	0.34	0.899			
IBP	0.53	0.51	-0.45	0.53	0.58	0.65	0.54	0.57	0.76	0.899		
I&L	0.44	0.41	-0.38	0.50	0.34	0.62	0.69	0.65	0.53	0.79	0.880	
FINC	0.45	0.45	-0.34	0.53	0.42	0.68	0.71	0.67	0.49	0.75	0.85	0.896

Note: **FLEX: Flexibility; QUAL: Quality；DELI: Delivery；SERV: Servicee；**
OSS: Operational Support Systems ; IOS: Interorganization Systems ;
MIS: Market Information Systems; SDSS: Strategic Decision Support Systems; CUST: Customer; IBP: Internal Business Process;
I &L : Innovation and Learning; FINC: Financial
*The shaded numbers in the diagonal row are square roots of the average variance extracted.

For satisfactory discriminant validity, the square root of the AVE from the construct should be greater than the correlation shared between the construct and other constructs in the model (Fornell & Larcker, 1981). Table 7 lists the correlations among constructs, with the square root of the AVE on the diagonal. The diagonal values exceed the inter-construct correlations; hence the test of discriminant validity was acceptable. Therefore we conclude that the measure for each construct satisfies construct validity.

5. DATA ANALYSIS AND RESULTS

5.1 Data Analysis

Because it is difficult and problematic to examine alignment using moderation or interaction effects of variables, which raises questions concerning multiple variables are involved (Venkatraman, 1989). A profile deviation approach relying on a theoretical or empirical "configuration" is recommended for assessing alignment between two multivariate constructs (Drazin and Van de Ven 1985, Gresov 1989, Sabherwal and Kirs 1994, Venkatraman and Prescott 1990).

The data-analysis process was divided into four broad steps: (1) normalization; (2) classification of all respondent firms into Caretaker, Marketeer, and Innovator; (3) computation of alignment between SC strategy and IS strategy; and (4) testing of the four hypotheses. These steps, and the specific tasks within each step, are stated below.

First step, the normalization of research variables was employed to compute normalized score. By using the z-score, we compute standardization value of each variable and determine the relative location of observation in a data set. The z-score for any observation can interpret as the number of standard deviation (x_i) is from the mean ($\bar{x}$). For example, the value of subsample, $x_i = 46$, the sample mean, $\bar{x} = 44$, and sample standard deviation, $s = 8$, have been computed previously. The z-score of the subsample is 0.25. The standardization scores were used for the remaining data analyses.

Second step, three sub-steps were employed to classify each of respondent firms into Caretaker, Marketeer, or Innovator. First sub-step, the ideal SC strategy profile (in terms of the five SC strategy attributes including 10 competitive capabilities) was identified for Caretakers, Marketeers, and Innovators, as earlier discussed and summarized in Table1. The ideal values of normalized scores set to 1, 0, -1, for high, medium, and low respectively. Second sub-step, the Euclidian distance between each firm's SC strategy and the three categories' ideal SC strategy was computed. For example, for any subsample, its distance from Caretaker was computed as follows:

$$\text{Distance (Caretakers)} = \sqrt{\sum \{(Xj - Ij,_{CAR})^2\}}, \qquad (1)$$

where X_j = the normalized score for the jth SC strategy attribute, $I_{j, CAR}$= the ideal normalized score of the jth SC strategy attribute for Caretakers, the$\Sigma$is across the various values of j, and j ranges from 1 to 5 for five SC strategy attributes. For Marketeers and Innovators, the distance computation is the same as Caretakers. Third sub-step, these distances were used to classify each firm into one of the three SC strategy types. Each firm was classified into the type of SC strategy with a least distance.

Third step, the alignment between SC strategy and its group's ideal IS strategy was computed and three tasks were involved in this step. First task, in terms of four IS strategy attributes, the ideal IS strategy profiles for Caretakers, Marketeers, and Innovators were configured as earlier discussed and summarized in Table 2. Again, the ideal values of normalized scores set to 1, 0, -1, for high, medium, and low respectively. Second task, we computed the Euclidian distances between each firm's IS strategy and the ideal IS strategy profiles for the SC strategy type to which it belongs. For example, if a firm had been classified as a Caretaker, the distance was computed from the ideal IS strategy profile for "IS for Efficiency", because that IS strategy was expected to be best aligned with the Caretaker SC strategy. Third task, alignment was computed by one minus the above Euclidian distance. A firm's IS strategy with a smaller Euclidian distance means it is closer to the ideal profile and indicates its alignment degree is higher.

Final step, research hypotheses were tested. Only two variables- alignment and SCM performance were focused for all of the research hypotheses. A regression analysis can obtain the correlation coefficient between these two variables and then adequately use it to examine all of the research hypotheses without sacrificing any significant information.

Hypothesis 1 was tested with all three SC strategies by examining the correlation between alignment and SCM performance. Hypotheses 2, 3, and 4 were verified using the correlations between alignment and SCM performance within Caretakers, Marketeers, or Innovators respectively.

5.2 Results

5.2.1 Caretakers, Marketeers, and Innovators

We found that 49, 67, and 35 of firms were classified into the SC strategy of the Caretakers, Marketeers, and Innovators, respectively. This result conforms to Fohlich and Dixon's (2001) IMSS (International Manufacturing Strategy Survey) 1998 surveys for North America data ,that is, this survey did not significantly differ in relative size with IMSS 1998 samples for three SC strategy types ($\chi^2 = 5.462$, degrees of freedom = 2; no significant at $p \leq 0.05$). The similarity of the above results with prior research in relative size makes confidence to the configurations of Caretaker, Marketeer, and Innovator generated in this study. The frequency of the three types was summarized in Table 8. Table 8 also indicates the means and standard deviations of the SCM performance for each SC strategy type from the different perspectives: overall, internal business process, innovation and learning, and financial.

Table 8 The three Strategic Configurations

	Frequencies			
Industry	**Caretakers**	**Marketeers**	**Innovators**	**Total**
Electric machinery electronics, telecommunication	21	31	13	65
Steel, motor vehicles & parts manufacturing	6	8	4	18
Textile, plastics & rubber manufacturing	7	6	6	19
Other manufacturing	14	21	11	46
Missing information	1	1	1	3
Total	49	67	35	151
SCM performance	Mean(S.D.)	Mean(S.D.)	Mean(S.D.)	Mean(S.D.)
Overall	4.28(0.81)	5.13(0.95)	4.69(0.88)	4.75(0.96)
Customer	4.43(1.11)	5.43(0.89)	4.69(1.01)	4.93(1.09)
Internal business process	4.20(0.98)	5.16(1.00)	4.59(1.09)	4.72(1.09)
Innovation and learning	4.29(0.89)	5.02(1.18)	4.73(0.87)	4.72(1.07)
Financial	4.21(0.87)	4.92(1.29)	4.74(0.98)	4.65(1.13)

Note: The cross-tabulation of strategy by industry is done in terms of observed frequencies.

5.2.2 Performance Implications of Alignment

The correlation between alignment and SCM performance was significantly associated (for whole sample, we found: Pearson's correlation coefficients r = 0.650; significant at $p \leq 0.001$). Table 9 summarizes all results using linear regression with SCM performance as the dependent variable, alignment as the key independent variable. The overall regression model is significant (F=108.959, $p \leq 0.001$) for whole sample. The value of R^2 (0.422) suggests that 42.2 percent of the variance is explained by variable. Hypothesis 1－proposing an overall association between alignment and SCM performance－is thus supported. The linear regression model is significant (F=22.575, $p \leq 0.001$) for Caretaker, (F=10.533, $p \leq 0.01$) for Innovators, and (F=62.588, $p \leq 0.001$) for Marketeers. Alignment was also significantly associated with SCM performance in Caretaker, Innovator, and Marketeer respectively, thereby providing support for Hypothesis 2, 3 and 4.

Table 9 Implications of Alignment for SCM Performance

	R^2	Adjusted R^2	F-value	Standardize coefficient	Conclusion
Whole	0.422	0.419	108.959***	0.650	H1 was supported.
Caretakers	0.324	0.310	22.575***	0.570	H2 was supported.
Innovator	0.242	0.219	10.533**	0.492	H3 was supported.
Marketeers	0.491	0.483	62.588***	0.700	H4 was supported.

Predicator: alignment, Dependent Variable: performance

*** p < = 0.001, * * p < = 0.01, * p < = 0.05

Note: Similar results were obtained when multiple regressions were conducted with SCM performance as the dependent variable and a number of control variables including firm size, industry type, and geographic dispersion.

Further analysis was carried out to make sure the significant results were not due to covariation with control variables. Therefore, we further examined whether these variables: firm size, industry type, and geographic dispersion may influence SCM performance or not. All these results were validated using multiple regressions with SCM performance as the dependent variable, alignment as the key independent variable, and three control variables, including firm size, industry type, and geographic dispersion. The results indicated that none of the three control variables had a significant impact on SCM performance. Therefore, the results of hypothesis tests appeared to be stable and independent of control variables.

6. DISCUSSION

6.1 Implications

Several implications and contributions of this study would be identified. First, the Hypotheses 1, 2, 3, and 4 are all supported. This finding demonstrates an alignment between SC and IS strategy will positively impact on SCM performance. It implies that the focal company could increase their overall performance through aligning the competency of effectiveness, efficiency, and flexibility within a supply chain, and then reaches its ultimate aim of strategic management (Smith et al., 1991). As a result, all members within a supply chain can achieve on SCM improvement.

Second, the finding of this study suggests for practitioners that to simply monitor the level of IS investment within an organization is not enough but that to understand and monitor the nature of this investment is also necessary. In Table 2, we identified several IS strategy attributes that would be appropriate for Caretakers, Marketeers, and Innovators and these expectations were all supported in this study. It is noted that Caretakers will have more beneficial to develop and use operational support systems, interorganizational systems, and strategic decision support systems rather than market information systems. Likewise, it is more helpful to emphasis on market information and strategic decision support systems than on operational support systems for Innovators.

Third, by using Venkatraman's (1989) fit as profile deviation approach this study also contributes to understanding of Caretakers, Marketeers, and Innovators by developing the ideal profile of the SC strategy attributes, which is different from Miller and Roth's (1994) cluster analysis method. Each firm is classified into Caretakers, Marketeers, and Innovators by computing distances between each firm's measures of SC attributes and the ideal SC strategy profiles. Therefore, this paper makes a methodological contribution because prior research on Miller and Roth's (1994) typology had not used such a way to classify all respondent firms into Caretakers, Marketeers, and Innovators.

6.2 Limitations

As with any empirical research, this study also has several limitations in interpreting and applying the research findings. First, the discussion of alignment is simplified to avoid from complicating discussing and testing hybrid strategies in this paper. Thus, only SC and IS strategies

are discussed in this paper.

Second, this study proposed the impact of the alignment on SCM performance from the perspective of focal company. It is often deemed the manufacturer as a focal company within a supply chain. Therefore, other participants in a supply chain such as suppliers, distributors, and retailers were not taken into account in this study. However, further research is needed to extend the applicability of the findings to other industries.

6.3 Suggestions for Future studies

There are several ways in future research which could strengthen the results of this study. First, it is needed to validate the ideal SC and IS strategy profiles we developed and used for Caretakers, Marketeers, and Innovators further. It would be especially important to examine whether these profiles are equally valid for large multinational and small local companies, for companies in other industries rather than manufacturing industries were studied here, and for companies those headquarter are outside of research site, Taiwan. The differences of across-industry and across-supply chain in performance implications of alignment are also needed to theoretically predict and test by further research.

Second, a better understood is needed in processes by which alignment is worked out practically and effectively in firms. The respondents were asked to fill the questionnaires about their companies over the past two years in this survey. The cross-sectional nature of this study prevented us from examining both the dynamics of alignment and the long-term performance implications of alignment. The longitudinal study could explore these crucial views of alignment and gain a better insight of the impacts of alignment on performance in supply chain.

Third, in this paper, the research model we proposed from the perspective of manufacturer who is taken to be a focal company within a supply chain. Further research is needed to examine the standpoint from other members of supply chain such as suppliers, distributors, and retailers.

Finally, Brewer and Speh's (2000) balanced scorecard (BSC) approach was adopted to measure the SCM performance in this paper. However, it is a perceptual measure rather than an objective measure. For example, it measures SCM performance from customer perspective by customer value ratio which is difficult measure by questionnaire. Therefore, using key performance indicators (KPIs) approach may also be a good benchmark and choice in measure SCM performance for future research.

7. CONCLUSION

SCM provides a new way for firms to integrate key business processes from end users through original suppliers (Lamber and Cooper 2000), and has led managers to spend vast sums to improve SCM process (Ketchen and Giunipero 2004). The effective SCM may improve the performance of an individual organization and improve the performance of the whole supply chain (Li et al. 2006). But managing supply chain is so complex that often makes the promised improved outcomes go unfulfilled (Ketchen and Giunipero 2004). Therefore, understanding what distinguishes effective and ineffective SCM has been a critical issue for researchers and practitioners (Ketchen and Giunipero 2004). This study developed and tested a theoretical model of SCM performance impact research to reflect the basic knowledge in this area. Besides contributing to theory building in the area of SCM, the results of the study offer useful implication to SCM practitioners.

Another contribution of this study is the application of theoretical frame of strategy management and the impact of alignment perspective on SCM performance. Such "strategic alignment" notion proposed that organizational performance is the consequence of fit between two or more factors such as strategy, structure, technology, culture, and environment (Burns and Stakler, 1961). It could be one of the contributions to prove that it can be also applicable to explain the effect of strategic alignment on organizational performance in the supply chain, since few studies have paid attention on this issue for SCM.

Finally, the findings of this study can help administrators in the supply chain gain a basic understanding of the determinants of organizational performance resulting from SCM. Manufacturers' administrators in the supply chain may become aware of the 'fit' between strategies

and used in the supply chain. Researchers may find this study useful to help select new research areas of SCM.

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APPENDIX A-1 Factor loading and composite consistency of **Supply Chain Strategy** Attributes

Construct	Measure	Factor Loading
PRIC: Factor 1 for Supply Chain Strategy—**PRICE**		
PRIC1	The capability to compete on price compared to main competitors.	
FLEX: Factor 2 for Supply Chain Strategy—**FLEXIBILITY**		
FLEX1	The capability to make rapid design changes and/or introduce new products quickly compared to main competitors.	0.83
FLEX2	The capability to response to swings in volume compared to main competitors.	0.73
FLEX3	The capability to deliver a broad product line compared to main competitors.	0.85
QUAL :Factor 3 for Supply Chain Strategy—**QUALITY**		
QUAL1	The capability to offer consistent quality compared to main competitors.	0.85
QUAL2	The capability to provide high performance products compared to main competitors.	0.85
DELI: Factor 4 for Supply Chain Strategy—**DELIVERY**		
DELI1	The capability to deliver products quickly compared to main competitors.	0.90
DELI2	The capability to deliver on time (as promised) compared to main competitors.	0.90
SERV: Factor 5 for Supply Chain Strategy—**SERVICE**		
SERV1	The capability to provide after sale service compared to main	0.85
SERV2	The capability to distribute the product broadly compared to other competitors.	0.85

APPENDIX A-2 Factor loading and composite consistency of **IS Strategy** Attributes

Construct	Measure	Factor Loading
OSS: Factor 1 for IS Strategy—**OPERATIONAL SUPPORT SYSTEMS**		
OSS1	IS improve the efficiency of our day-to-day business operations.	0.74
OSS2	IS support effective coordination across functions（e.g., marketing, manufacturing）and product lines.	0.78
OSS3	IS provide us with the facts and figures we need to support our day-to-day decision making.	0.82
OSS4	IS enable us to develop detailed analyses of our present business situation.	0.86
OSS5	IS provide sufficiently detailed information to support product decision making.	0.69
OSS6	IS support detailed analyzses of major business decisions.	0.82
IOS: Factor 2 for IS Strategy— **INTERORGANIZATIONAL SYSTEMS**		
IOS1	IS enable us to develop stronger links with suppliers.	0.84
IOS2	IS enhance our ability to negotiate with our suppliers.	0.88
IOS3	IS enhance our ability to negotiate with our customers.	0.84
IOS4	IS enable us to develop stronger links with customers.	0.84
MIS:Factor 3 for IS Strategy—**MARKET INFORMATION SYSTEMS**		
MIS1	IS assist us in setting our prices relative to the competition .	0.83
MIS2	IS help us introduce new products and/or services in our markets.	0.91
MIS3	IS help us monitor changes in our market share.	0.87
MIS4	IS permit us to rapidly adjust our prices.	0.90
SDSS: Factor 4 for IS Strategy—**STRATEGIC DECISION SUPPORT SYSTEMS**		
SDSS1	IS facilitate strategic business planning.	0.89
SDSS2	IS help us model possible future outcomes of alternative courses of action.	0.91
SDSS3	IS are used to forecast key indicators of business performance.	0.89

APPENDIX A-3 Factor loading and composite consistency of **SCM Performance** Attributes

Construct	Measure	Factor Loading
CUST: Factor 1 for SCM Performance－**CUSTOMER**		
CUST1	SCM has effectively enhanced customer view of product or service quality of our company.	0.89
CUST2	SCM has effectively enhanced customer view of timeliness (i.e., reduce order response time) to our company.	0.91
CUST3	SCM has effectively enhanced customer perception of flexible response to our company.	0.89
CUST4	SCM has effectively enhanced the perception of customer value ratio (i.e., level of satisfaction / cost per order) to our company.	0.90
IBP: Factor 2 for SCM Performance－**INTERNAL BUSINESS PROCESS**		
IBP1	SCM has effectively enabled us to reduce the waste or inefficiency of logistics processes in our company.	0.90
IBP2	SCM has effectively enhanced supply chain cycle efficiency (i.e., total value-added time / total time in the supply chain) in our company.	0.87
IBP3	SCM has effectively enhanced flexible response rate (i.e., the number of choices offered relative to response time) in our company.	0.91
IBP4	SCM has effectively enhanced the percentage of supply chain target costs achieved in our company.	0.92
I&L: Factor 3 for SCM Performance－**INNOVATION AND LEARNING**		
I&L1	SCM has effectively reduced the time elapsed between product finalization point and customer delivery through product or process innovations in our company.	0.89
I&L2	SCM has effectively balanced the product category commitment ratio (i.e., the percentage of the seller's total product category sales that are sold to a particular customer / customer's product category needs that bought from that seller) with partners in our company.	0.91
I&L3	SCM has effectively increased information flow among supply chain partners to share vital information sets in our company.	0.84
I&L4	SCM has effectively enhanced the ability of environmental scanning to detect the threats through the emergence of substitute technologies or products in our company.	0.87
FINC: Factor 4 for SCM Performance－**FINANCIAL**		
FINC1	SCM has gained higher profit margins by supply chain partner in our company.	0.88
FINC2	SCM has improved cash flow（cash-to-cash cycle）in our company.	0.88
FINC3	SCM has enhanced the customer growth and profitability in our company.	0.91
FINC4	SCM has enhanced the return on supply chain assets（ROA）in our company..	0.92

APPENDIX B Results of Confirmatory Factor Analysis

Scale Items	FLEX	QUAL	DELI	SERV	OSS	IOS	MIS	SDSS	CUST	IBP	I&L	FINC
FLEX1	0.83	0.57	0.42	0.60	0.29	0.24	0.38	0.34	0.37	0.46	0.39	0.44
FLEX2	0.73	0.65	0.56	0.45	0.34	0.19	0.09	0.15	0.46	0.44	0.29	0.29
FLEX2	0.85	0.50	0.48	0.63	0.26	0.21	0.40	0.22	0.33	0.40	0.38	0.35
QUAL1	0.56	0.85	0.56	0.54	0.34	0.26	0.19	0.20	0.52	0.44	0.37	0.31
QUAL2	0.63	0.85	0.34	0.53	0.29	0.32	0.19	0.24	0.40	0.44	0.32	0.45
DELI1	0.58	0.56	0.90	0.60	0.28	0.21	0.27	0.19	0.43	0.40	0.37	0.34
DELI2	0.49	0.39	0.90	0.53	0.24	0.22	0.17	0.16	0.47	0.41	0.32	0.28
SERV1	0.57	0.56	0.57	0.85	0.41	0.27	0.25	0.29	0.49	0.48	0.34	0.37
SERV2	0.62	0.50	0.49	0.85	0.22	0.29	0.46	0.35	0.36	0.41	0.51	0.52
OSS1	0.24	0.29	0.26	0.18	0.74	0.38	0.01	0.18	0.51	0.41	0.08	0.16
OSS2	0.28	0.31	0.24	0.26	0.78	0.52	0.19	0.35	0.47	0.45	0.25	0.33
OSS3	0.28	0.25	0.22	0.30	0.82	0.48	0.39	0.46	0.42	0.43	0.28	0.35
OSS4	0.34	0.30	0.24	0.33	0.86	0.60	0.50	0.52	0.39	0.53	0.35	0.44
OSS5	0.32	0.34	0.26	0.39	0.69	0.72	0.64	0.64	0.43	0.53	0.53	0.55
OSS6	0.27	0.27	0.18	0.30	0.82	0.62	0.58	0.60	0.43	0.51	0.41	0.41
IOS1	0.21	0.30	0.24	0.22	0.70	0.84	0.41	0.47	0.48	0.59	0.45	0.53
IOS2	0.24	0.30	0.17	0.28	0.63	0.88	0.52	0.55	0.48	0.60	0.48	0.55
IOS3	0.21	0.28	0.18	0.29	0.56	0.84	0.66	0.64	0.39	0.52	0.57	0.59
IOS4	0.25	0.28	0.22	0.32	0.48	0.84	0.76	0.70	0.29	0.49	0.61	0.66
MIS1	0.31	0.19	0.19	0.30	0.54	0.63	0.83	0.67	0.34	0.54	0.59	0.59
MIS2	0.36	0.25	0.25	0.40	0.34	0.57	0.91	0.67	0.15	0.44	0.63	0.66
MIS3	0.33	0.22	0.22	0.40	0.49	0.69	0.87	0.75	0.28	0.49	0.62	0.65
MIS4	0.30	0.13	0.19	0.35	0.37	0.55	0.90	0.69	0.17	0.42	0.57	0.59
SDSS1	0.34	0.26	0.23	0.41	0.58	0.60	0.74	0.89	0.27	0.51	0.55	0.62
SDSS2	0.28	0.28	0.16	0.34	0.45	0.65	0.80	0.91	0.29	0.53	0.68	0.66
SDSS3	0.18	0.16	0.14	0.26	0.54	0.61	0.59	0.89	0.36	0.49	0.50	0.52
CUST1	0.32	0.45	0.40	0.37	0.49	0.40	0.11	0.23	0.89	0.63	0.36	0.33
CUST2	0.45	0.43	0.53	0.48	0.51	0.45	0.28	0.33	0.91	0.69	0.51	0.44
CUST3	0.51	0.55	0.52	0.51	0.51	0.45	0.30	0.37	0.89	0.71	0.54	0.49
CUST4	0.42	0.51	0.36	0.44	0.49	0.43	0.26	0.30	0.90	0.72	0.49	0.50
IBP1	0.47	0.52	0.41	0.45	0.61	0.59	0.40	0.52	0.72	0.90	0.61	0.62
IBP2	0.47	0.43	0.43	0.47	0.42	0.55	0.58	0.55	0.59	0.87	0.81	0.71
IBP3	0.47	0.44	0.42	0.50	0.53	0.57	0.43	0.48	0.74	0.91	0.72	0.67
IBP4	0.50	0.46	0.37	0.47	0.62	0.60	0.52	0.52	0.69	0.92	0.70	0.69
I&L1	0.42	0.40	0.39	0.44	0.36	0.50	0.53	0.55	0.55	0.77	0.89	0.72
I&L2	0.48	0.43	0.37	0.52	0.34	0.52	0.62	0.57	0.46	0.70	0.91	0.76
I&L3	0.32	0.31	0.35	0.39	0.44	0.60	0.58	0.53	0.49	0.72	0.84	0.73
I&L4	0.34	0.28	0.24	0.39	0.28	0.56	0.68	0.62	0.35	0.60	0.87	0.78
FINC1	0.40	0.39	0.29	0.45	0.29	0.57	0.73	0.64	0.27	0.59	0.83	0.88
FINC2	0.39	0.38	0.30	0.45	0.40	0.57	0.56	0.57	0.51	0.73	0.75	0.88
FINC3	0.40	0.43	0.32	0.49	0.47	0.62	0.63	0.57	0.44	0.67	0.72	0.91
FINC4	0.43	0.40	0.33	0.49	0.53	0.69	0.63	0.61	0.52	0.69	0.74	0.92