ABSTRACT
The purpose of this paper is to examine the SSP paradigm in supply chain context. SSP is the central paradigm of the strategy literature. Current study designed to foster a better understanding of the impact of supply chain uncertainty on the elements characterizing strategic decisions that lead to improved supply chain structure and operational performance.

In line with the previous research, this study also represents the empirical efforts to explore and test the relationships between supply chain uncertainty, strategy, structure and operational performance.

This research seeks to advance our understanding on the application of SSP paradigm in supply chain context, by incorporating the impact of uncertainty. This is a very timely study due to the increased risk and vulnerability of supply chains to disruptions. This study highlights the nature of uncertainties and strategies to achieve a resilient supply chain network for a sustained operational performance.

KEY WORDS
Supply Chain Uncertainty, Supply Chain Strategy, Supply Chain Structure, Operational Performance, Thailand

1. Introduction

In response to an increasing the uncertainties within the supply chains in the industries, companies searching for a way to sustain competitive advantage in the 1980s invested heavily in efficient business approaches like just-in-time, total quality management, and reengineering designed to optimize the performance of certain firm processes. Firms discovered, however, that the performance advantages obtained from such methods were quickly reduced as competitors implemented similar approaches (Atkinson 1986; Bechtel and Jayaram 1997; Boghossian 1988; Schonberger 1982; Teece 1981).
2. Literature Review

Strategy-Structure-Performance (SSP)

The SSP paradigm is intended to provide a foundation in preparation for extension into a supply chain environment that will be related to the research framework and its concept presented in a later section of the manuscript. In addition, previous use of SSP theory in a supply chain logistics context is described here and the scholars (Defee and Stank 2005; Rodrigues, Stank, and Lynch 2004; Stonebraker and Afifi 1994) point out the need to further study and test the relationship among strategy-structure-performance (SSP) paradigm to the supply chain environment.

Supply Chain Uncertainty

Supply chain uncertainty is defined as the decision making for situations in the supply chain in which the decision maker does not know definitely what to decide as he is indistinct about the objectives; lacks information about (or understanding of) supply chain or its environment; lacks of information processing capacities; is unable to accurately predict the impact of possible control action on supply chain behavior; or, lacks effective control actions (Van der Vorst and Beulens 2002).

Demand Uncertainty

Demand uncertainty is defined as the downstream or demand uncertainties take a form of unforeseen demand variability, in turn creating problems in planning and controlling that jeopardize delivery performance (Fisher et al., 1994).

Supply Uncertainty

Supply uncertainty is defined as upstream or supply uncertainties can be manifested through late deliveries, poor quality of incoming materials or parts (Davis, 1993).

The models presented by Fisher (1997), Mason-Jones et al. (2000), and Christopher (2002) and Towill, Naim, and Wikner (1992) implied that supply chain strategy should be formulated based on levels of demand uncertainty. Lee has expanded on Fisher works by incorporate level of supply uncertainty. Lee’s model emphasized four strategic choices of efficient supply chain, responsive supply chain, risk-hedging supply chain and agile supply chain as shown in Figure 2.

Source: Fisher (1997), and Lee (2002)

**Figure 2:** Model of Supply Chain Strategy

Supply chain uncertainty is another key driver for the right supply chain strategy. A stable supply process is none where the manufacturing process and the underlying technology are mature and the supply base is well established. On the other hand, an evolving supply process, its manufacturing process and underlying technology, are still under early development and are rapidly changing, and as a result the supply base may be limited.

Thus, it is more challenge to operate a supply chain that is in the right column of Figure 2 than in the left column; and similarity given to the operating in lower row of Figure 2 than in the upper row (Lee 2002).

Source: Lee (2002)

**Figure 3:** The Uncertainties Reduction Strategies

Demand Uncertainty Reduction Strategies is the way of reduction a ‘bullwhip effect’ which is an amplification of order variability as one goes upstream along a supply chain.

Supply Uncertainty Reduction Strategies is the way of reduction the risk of supplier not being able to ramp up fast enough in the production introduction phase as well as the risks of suppliers over producing at the end of product life cycle.

Obviously, the common characteristic of both reduction strategies is relying on the Information Technology and Internet which playing an important role in shaping the supply chain strategies (Lee 2002).
Supply Chain Strategies

Supply Chain Strategy is the strategy that requires the coordination and commitment of multiple firms to implement company strategic objectives. It utilizes inter-firm coordination as the capability that facilitates achievement of objectives (Christopher and Ryals 1999).

According to Lee (2002), some uncertainty characteristics require supply chain strategies with initiatives and innovations that can provide a competitive edge to companies. These strategies can be classified into four types shown in Figure 4.

Efficient Supply Chains

Efficient supply chain is defined as the utilization of strategies aimed at creating the highest cost efficiencies in the supply chain (Lee 2002).

The aim of this strategy is to create the highest cost efficiencies in the supply chain. Non-value-added activities should be eliminated, economy of scales should be pursued, optimization techniques should be deployed, and information linkages should be established (Lee 2002).

Risk-Hedging Supply Chains

Risk-hedging supply chain is defined as the utilization of strategies aimed at pooling and sharing resources in a supply chain so that the risks in supply disruption can also be shared; it is therefore a risk-hedging strategy (Lee 2002).

The aim of this strategy is to pool and share resources in a supply chain so that the risks in supply disruption can also be shared. It is therefore a risk-hedging strategy (Lee 2002).

Responsive Supply Chains

Responsive supply chain is defined as the utilization of strategies aimed at being responsive and flexible to the changing and diverse needs of the customers (Lee 2002).

The aim is to be responsive and flexible to the changing and diverse needs of the customers. The main two approaches that can work with are build-to-order and mass customization (Lee 2002).

Agile Supply Chain

Agile supply chain is defined as the utilization of strategies aimed at being responsive and flexible to customer needs, while the risks of supply shortages and disruptions are hedged by pooling inventory of other capacity resources (Lee 2002).

The aim is to be responsive and flexible to customer needs, while the risks of supply shortages and disruptions are hedged by pooling inventory of other capacity resources. This is the combination of ‘hedge’ and ‘responsiveness’ supply chains (Lee 2002).

Supply Chain Structure

Supply chain structure is defined as the integration, both within the firm and across supply chain members is a central theme required for effective coordination of activities across multiple firms, entailing the common use of materials and systems to create timely, high quality product and information flows that drive enhanced performance. Thus supply chain structure implies the integration of the organization governing the network of supply chain members and the links between members through which the enterprise is administered (Lambert, Cooper, and Pagh 1998).

According to Bowersox, Closs, and Stank (1999), they concluded that the supply chain structural integration are: 1) behavioral context relates to how a firm manages the relationships among supply chain entities, 2) planning and control context incorporates information technology and planning system, as well as measurement system, 3) operational context includes internal and external operations. The aforementioned integrated structural elements have direct impact to the operational performance and could create the sustainable competitive advantages to the firms that lead to the greater level of operational performance will be discussed below.

Supply Chain Relationship

Supply chain relationship is defined as the level of integration, interconnectedness, or interdependence
among the trading partners within the supply chain network (Lockamy and Smith 2000).

Managing supply chain relationships includes both managing upstream (supplier), called as ‘supply relationship’, and downstream (customer), called as ‘demand relationship’ (Tan, Kannan, and Handfield 1998). Some (Beth, Burt, Copacino, Gopal 2003) have argued that supply chain management should concentrate on demand management and firms should focus on managing customer relationships. However, many studies based on empirical data have found that firms should equally focus on managing supplier involvement, called as strategic supplier partnership because supplier performance plays its role in shaping performance (Stuart, Deckert, McCutcheon, and Kunst 1998; Vonderembse and Tracey 1999).

**Patterns of Supply Relationship – Strategic Supplier Partnership**

Strategic Supplier Partnership is defined as the long-term relationship designed to leverage the strategic and operational capabilities of individual participating organizations to achieve significant ongoing benefits to each party (Monczka et al. 1998; Balsmeier and Voisin 1996; Noble 1997; Sheridan 1998; Stuart 1997).

**Pattern of Demand Relationship – Customer Relationship**

Customer Relationship is defined as the practices to manage customer complaints, build long-term relationships with customers, and improve customer satisfactions (Tan, Kannan, and Handfield 1998; Claycomb, Droge, and Germain 1999; Aggarwal 1997).

**Technology and Planning Integration**

Technology integration is defined as the coordination of systems and relevant data (Choy, Lee, and Lo 2003). Systems coordination entails the capability to exchange information with internal and external firm supply chain members in a timely, responsive, and usable format. Internal coordination of information allows a single manager to coordinate internal resource deployment; accessibility to data across the supply chain facilitates inter-organizational synchronization and improved resource use. (Bowersox, Closs, and Stank 1999).

**Information Management System**

Information Management System is defined as the commitment and capability to facilitate supply chain resource allocation through seamless transactions across the total order-to-delivery cycle (Bowersox, Closs, and Stank, 1999).

**Internal Communication**

Internal Communication is defined as the capability to exchange the information across internal functional boundaries in a timely, responsive, and usable format (Bowersox, Closs, and Stank 1999).

**Connectivity**

Connectivity is defined as the capability to provide and exchange data in a timely, responsive, and usable format (Bowersox, Closs and Stank 1999).

**Collaborative Forecasting and Planning**

Collaborative forecasting and planning is defined as the customer collaboration to develop shared visions and mutual commitment to jointly generated action plans (Bowersox, Closs and Stank 1999).

**Measurement System**

Measurement system is defined as the competency required to assess performance through supply chain, and track performance across the borders of internal functional areas and external supply chain partners enables managers to monitor key dimensions of individual firm and supply chain operations (Bowersox, Closs, and Stank 1999).

**Integrated Operation**

Integrated operation is defined as the integration of both internal - with cross functions, and external – with supplier and customers, operations (Bowersox, Closs, and Stank 1999).

**Integrated internal operation**

Integrated internal operation is defined as the joint activities and processes within a firm that coordinate functions related to procurement, manufacturer, and customer distribution (Bowersox, Closs, and Stank 1999). Internal operations comprise dimensions that reflect a firm’s ability to seamlessly link supply chain activities across internal functional areas (Bowersox, Closs, and Cooper 2002; Stank, Keller, and Daugherty 2001).

**Integrated external operation**

Integrated external operation is defined as the integration of operational processes to create close ties with suppliers,
and respond to the demand of customers (Bowserox, Closs, and Stank 1999).

One goal of external integration is to outsource specialized activities that previously were developed and performed internally to external supply chain partners that can perform an activity or process more cost effectively.

**Firm’s Operational Performance**

SSP portrays performance as resulting from the fit of structure to the chosen strategy of the firm. Strategic determination is equated with establishing goals while performance is the evaluation of how well the goals are met (Chandler 1962; Hofer and Schendel 1978; Mentzer and Konrad 1991). Atkinson, Waterhouse, and Wells (1997) define three roles for performance measurement: Operational performance is defined as the performance that deals with the time required to deliver a customer’s order. It’s specified in terms of speed of performance and its flexibility (Bowserox, Closs, and Cooper (2002). Speed is the elapsed time from when a customer establishes a need to order until the product is delivered and is ready for customer use. And the flexibility is the ability to accommodate special situations and unusual or unexpected customer requests.

**3. Conceptual Framework**

The conceptual model of this study is presented in figure 4 indicating the impact of Supply Chain Uncertainty on Supply Chain Strategy. The theoretical framework propose relationships between supply chain Strategy, Structure (as measured by Supply Chain Relationship, Technology and Planning Integration, Measurement System, Organizational Structure) as the determinants of Firm’s Operational Performance. The framework also posits that the reduction of Supply Chain uncertainty as measured by Demand Uncertainty and Supply Uncertainty is also determined by the role of Technology and Planning Integration. These relationships are primarily based on theoretical considerations; the model is portrayed in the figure 5 and four research focuses are explained below.

![Figure 5: Conceptual Framework with Proposition: A Model of Relationship between Supply Chain Strategy, Structure, and Operational Performance](image)

**Research Focus 1: The impact of Supply Chain Uncertainties on Supply Chain Strategies**

Lee (2002) expanded Fisher’s work to include not only demand uncertainty but also supply uncertainty. Lee’s model identified four types of supply chain strategies called efficient supply chain, responsive supply chain, risk hedging supply chain and agile supply chain. Fisher’s model made a significant contribution by specifying the need to tailor supply chain strategy according to demand uncertainty and identifying aspects of demand uncertainty, however Lee made the model more comprehensive by incorporating aspects of supply uncertainty.

The matching between ‘low’ demand and supply uncertainties, the ‘efficient supply chain’ is deployed. The matching between ‘low’ demand uncertainty and ‘high’ supply uncertainty, the ‘risk-hedging supply chain’ is deployed. The matching between ‘high’ demand uncertainty and ‘low’ supply uncertainty, the ‘responsive supply chain’ is deployed. While, the matching between ‘high’ demand and supply uncertainties, the ‘agile supply chain’ is deployed.

Hence, the first focus of this research is the testing the impact of Supply Chain Uncertainties on Supply Chain Strategies as shown in Figure 6.

**Q1: Does Supply Chain Uncertainty impact on Supply Chain Strategy?**
Therefore, the following hypotheses is offered:

\( H_1: \) Firms with the different levels of supply chain uncertainty emphasise different types of supply chain strategies

Research Focus 2: Relationship between supply chain strategy and types of structure

RF2.1: Supply Chain Relationship

A conceptual framework developed by Watts, Kim, and Hahn (1992) claimed that buyer-seller relationships need to be consistency with the deployed strategies. The second research focus proposes that under different supply chain environments taking into account supply and demand uncertainty, firms emphasize different types of supply chain relationship.

A shared vision and shared objectives among customers and supplier about interdependency and principles of collaboration must exist in integrating the relationship across supply chain entities. Relationship integration require willingness on the part of supply chain partners to create structure that encourage cross-organizational behavioral (Bowersox, Closs, and Stank 1999).

Hence, the research focus here is questioned below, is also presented in Figure 7.

Q2.1: Does the Supply Chain Strategies lead to the development of supply chain relationship?

Therefore, the following hypotheses is offered:

\( H_2: \) A firm that adopts a supply chain strategy will demonstrate a high level of supply chain relationship

RF2.2: Technology Integration and Planning Integration

Technology integration is the coordination of systems and relevant data (Choy, Lee, and Lo 2003). Systems coordination entails the capability to exchange information with internal and external firm supply chain members in a timely, responsive, and usable format. Internal coordination of information allows a single manager to coordinate internal resource deployment; accessibility to data across the supply chain facilitates inter-organizational synchronization and improved resource use (Bowersox, Closs, Stank 1999). The relationship is shown in Figure 8.

Q2.2: Does the Supply Chain Strategies lead to development of Technology and Planning Integration?

Therefore, the following hypotheses is offered:

\( H_3: \) A firm that adopts a supply chain strategy will demonstrate a high level of Technology and Planning Integration across supply chain entities.
RF2.3: Measurement System

Structural measurement systems represent another key structural element of coordinated logistical operations. Developing measurement systems that can track performance across the borders of internal functional areas and external supply chain partners enables managers to monitor key dimensions of individual firm and supply chain operations (Bowersox, Closs, and Stank 1999). Therefore, the relationship is shown in Figure 9:

Q2.3: Does the Supply Chain Strategies lead to development of Measurement System?

Therefore, the following hypotheses is offered:

$H_4$: A firm that adopts a supply chain strategy will demonstrate a high level of development of measurement systems across supply chain entities.

RF2.4: Integrated Operation

Integrated internal operation is achieved by linking operations into a seamless, synchronized operational flow, encouraging front-line managers and employees to use their own discretion, within policy guidelines, to make timely decisions. Bowersox, Closs, and Cooper 2002; Stank, Keller, and Daugherty 2001).

At the same time, external integration synchronizes the core competencies of selected supply chain participants to jointly achieve improved service capabilities at lower total supply chain cost (Bowersox, Closs, and Cooper 2002; Forza 1996; Stank, Keller, and Daugherty 2001; Vargas, Cardenas, and Mataranz 2000). The relationship is shown in Figure 10.

Q2.4: Does the Supply Chain Strategies lead to development of Organizational Structure?

Therefore, the following hypotheses is offered:

$H_5$: A firm that adopts supply chain relationship structure will demonstrate a high level of operational performance.

Research Focus 3: Relationship between types of Supply Chain Structure and Firm’s Operational Performance

SSP portrays performance as resulting from the fit of structure to the chosen strategy of the firm. Goals established in strategy formulation are eventually translated into performance measures that are evaluated periodically, and ultimately drive adjustments to goals and strategies. Performance, therefore, is the measurable outcome of strategy execution and structural implementation as shown in Figure 11.

Q3: Do the types of Supply Chain Structure impact on Firm’s Operational Performance?

Therefore, the following hypotheses are offered:

$H_6$: A firm that adopts supply chain relationship structure will demonstrate a high level of operational performance.
Research Focus 4: The impact of Technology and Planning Integration on the reduction of Supply Chain Uncertainties

In Lee’s model, it is more challenge, if it’s possible to move the uncertainty characteristic of the product from the right hand column to the left, or from the lower row to the upper one, then the performance will improve.

Figure 12 shows the two kinds of strategies that improve the performance through uncertainty reduction – demand uncertainty reduction and supply uncertainty reduction.

Source: Lee (2002)

Figure 12: The Uncertainty reduction strategies

According to Lee (2002), Technology involvement, i.e. internet and connection can help to regain control of supply chain efficiency in reduction of both demand and supply uncertainties. Developing technology framework for sharing of information and tight collaboration can help to control supply chain efficiency (Lee 2002) as shown in Figure 13.

Q4: Does the Technology and Planning Integration impact on the reduction of Supply Chain Uncertainties?

Thus, the researcher posits the hypotheses and offered as:

H10: A firm that adopts the higher level of supply chain uncertainty reduction will demonstrate the higher level of technology and planning integration structure.

In the next section, the research methodology is discussed. In addition, the constructs utilized in this study are further explained along with establishing constructs. Lastly, the key respondents utilized in the study are determined.

4. Research Methodology

The researcher used the conceptual study to design and develop the understanding how supply chain uncertainties impact SSP Paradigm. The research firstly used “qualitative” data analysis to investigate the relationship between supply chain strategy, structure, and performance. The results from discussion among many manufacturers and retailers found that they have realized the importance of working closely together, but only few have succeeded in doing it right. The researcher gathered and used the data to develop the questionnaire survey to test or simulate or evaluate the hypothetical relationship between supply chain strategies (as measured by supply chain uncertainties), the types of supply chain structure, and operational performance, that’ll be the next step for the researcher to conduct ‘quantitative’ data analysis.

Sample

Samples were obtained a group of the firms operating globally in Consumer Packaged Goods Industry. This industry has been selected due to the increasing number of precuts offered from manufacturers at retail stores and the narrow retail margins are making it more and more difficult for retailers in the consumer goods industry to manage their operations effectively.

Based on the sample size criteria of Hair et al. (1998), a total of 345 (23 parameters*15 samples per parameter = 345) samples were required to test the model.

Research Instrument and Survey Design

The main research instrument will be adopted from the initial designed questionnaire based on previous studies. The questionnaire was designed in English and was revised after interviewed and had pre-test done with 30 respondents. It was then translated into Thai and back-translated by having one person to translate from English to Thai, and having the other to do back translation from Thai to English in order to confirm the validity of the questionnaire using the method suggested by Douglas and Craig (1983).
Respondents were asked to indicate agreement with statements related to demonstrating the relationship between strategy and structure based on a five-point scale where 1 = Strongly Disagree and 5 = Strongly Agree for some of the predictors and also “Extremely High” and “Extremely Low” will be also used.

For firm’s operational performance, the researcher used subjective performance measures in this study for three major reasons. First, past studies indicated that both perceptual and objective measures of performance yield consistent results (Wisner 2003, Rodrigues, Stank, and Lynch 2004). Next, the secondary financial data indicating the expenses, revenues, and returns of firms from emerging markets is either unavailable or difficult to obtain and disclose due to the size and non-public nature of their businesses (Sapienza, Smith, and Gannon, 1988). Finally, the scales used in logistics research has been widely accepted and well established, the category of performance evaluation was ranked number two that many authors who have utilized the scales for research appearing in many logistics journals (Keller et al. 2002). “Very Low Performance” and “Very High Performance” will be used. Item purification of the original measurement items was conducted through a qualitative assessment of nomological validity, that is, that the scale expresses the relationships shown to exist based upon previous research (Hair et al. 1998). This will be followed by quantitative analysis consisting of correlation analysis, reliability evaluation (using item-to-total correlations as well as Cronbach’s alpha), and principal component and confirmatory factor analysis validity.

The researchers used the technique of Structural Equation Modeling (SEM) to examine the relationships, an extension of several multivariate techniques, most notably multiple regression and factor analysis (Hair et al. 1998), this could help the researcher to be able to examine the multiple relationships at a time. The implications of the findings will be discussed in the next section.

5. Data Analysis

The survey was circulated and all responses were received from MNC companies in CPG industry. The targeted key informants included supervisors to managers, who are typically the decision maker of the firms on supply chain functions, including of sales, marketing, logistics, supply chain, finance, IT, and human resources. The selected informants based on the ones who are most knowledgeable about the firms’ functional activities as the indicating on their positions which was asked before the questionnaire was handed in to them.

Non-Response Bias

To investigate the possibility of non-response bias in the data, a test for statistically significant differences in the responses of early and late waves of returned surveys was performed (Armstrong and Overton 1977; Lambert and Harrington 1990). Each survey sample was split into two groups on the basis of early and late survey return times; t-tests were performed on the responses of the two groups. The f-test and t-tests of major SSP constructs and key demographics yielded no statistically significant differences among the survey items tested.

Reliability Assessment and Confirmatory Factor Analysis

To ensure model identification, one can separate the measurement models and the structural model. If each measurement model is identified independently, then the structural model is identified (Maruyama 1998).

a) 1st Order of Construct

To ensure model identification, one can separate the measurement models and the structural model. If each measurement model is identified independently, then the structural model is identified (Maruyama 1998).

The model was checked to assure that the parameter estimates, i.e. $X^2/df \leq 3$ (Chau 1997), RMSEA ($\leq .10$, Chau 1997), RMR ($\leq .03$, Bentler and Chou 1987, Bollen 1989), GFI / NFI / CFI / IFI ($\geq .90$ Byrne 1998), exhibited those determined threshold, and were consistent with the underlying theory.

The first measurement model tested was “Supply Chain Uncertainty – Demand (SUD)”. Reliability Scale was at 0.81, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.1.

![Figure A.1: Supply Chain Uncertainty – Demand Measurement Model](image-url)
The second measurement model tested was “Supply Chain Uncertainty – Supply (SUS)”. Reliability Scale was at 0.87, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items shown in Figure A.2.

Figure A.2: Supply Chain Uncertainty – Supply Measurement Model

The third measurement model tested was “Supply Chain Strategy – Efficiency (SSE)”. Reliability Scale was at 0.72, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items shown in Figure A.3. One of 4 items exhibited the insignificant parameter estimates that effected to scale of reliability. This item was considered unimportant to the model, thus was deleted (Byrne 1998).

Figure A.3: Supply Chain Strategy – Efficiency Measurement Model

The fourth measurement model tested was “Supply Chain Strategy – Responsiveness (SSR)”. Reliability Scale was at 0.78, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items shown in Figure A.4.

Figure A.4: Supply Chain Strategy – Responsiveness Measurement Model

The fifth measurement model tested was “Supply Chain Strategy – Risk-Hedging (SSH)”. Reliability Scale was at 0.71, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.5. One of 4 items exhibited the insignificant parameter estimates that effected to scale of reliability. This item was considered unimportant to the model, thus was deleted (Byrne 1998).

Figure A.5: Supply Chain Strategy – Risk-Hedging Measurement Model

The sixth measurement model tested was “Supply Chain Strategy – Agile (SSA)”. Reliability Scale was at 0.83, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.6.

Figure A.6: Supply Chain Strategy – Agile Measurement Model
The seventh measurement model tested was “Supply Chain Relationship – Customer (SRC)”. Reliability Scale was at 0.80, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.7.

The eighth measurement model tested was “Supply Chain Relationship – Supplier (SRS)”. Reliability Scale was at 0.86, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.8.

The ninth measurement model tested was “Technology and Planning Integration – Information Management System (TPM)”. Reliability Scale was at 0.85, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.9.

The tenth measurement model tested was “Technology and Planning Integration – Internal Communication (TPC)”. Reliability Scale was at 0.85, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.10. One of 4 items exhibited the insignificant parameter estimates that effected to scale of reliability. This item was considered unimportant to the model, thus was deleted (Byrne 1998).

The eleventh measurement model tested was “Technology and Planning Integration – Connectivity (TPC)”. Reliability Scale was at 0.83, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.11. One of 4 items exhibited the insignificant parameter estimates that effected to scale of reliability. This item was considered unimportant to the model, thus was deleted (Byrne 1998).

The twelfth measurement model tested was “Technology and Planning Integration – Collaborative Forecasting and Planning (TPF)”. Reliability Scale was at 0.91, which is above .70 at acceptable level (Nunnally and Bernstein 1994).
1994). This model was evaluated using 4 items show in Figure A.12.

**Figure A.12: Technology and Planning Integration – Collaborative Forecasting and Planning Measurement Model**

The thirteenth measurement model tested was “Measurement System – (MS)”. This model was evaluated using 4 items show in Figure A.13. Reliability Scale was at 0.73, which is above .70 at acceptable level (Nunnally and Bernstein 1994). Two of 4 items exhibited the insignificant parameter estimates that effected to scale of reliability. These items were considered unimportant to the model, thus was deleted (Byrne 1998). None of the results were shown from the test.

**Figure A.13: Measurement System Measurement Model**

The fourteenth measurement model tested was “Internal Integrated Operation (OSI)”. This model was evaluated using 4 items show in Figure A.14. Reliability Scale was at 0.78, which is above .70 at acceptable level (Nunnally and Bernstein 1994). One of 4 items exhibited the insignificant parameter estimates that effected to scale of reliability. This item was considered unimportant to the model, thus was deleted (Byrne 1998).

**Figure A.14: Internal Integrated Operation Measurement Model**

The fifteenth measurement model tested was “Internal Integrated Operation (OSI)”. This model was evaluated using 4 items show in Figure A.15. Reliability Scale was at 0.79, which is above .70 at acceptable level (Nunnally and Bernstein 1994). One of 4 items exhibited the insignificant parameter estimates that effected to scale of reliability. This item was considered unimportant to the model, thus was deleted (Byrne 1998).

**Figure A.15: External Integrated Operation Measurement Model**

The sixteenth measurement model tested was “Firm’s Operational Performance - Speed (FPS)”. This model was evaluated using 4 items show in Figure A.16. Reliability Scale was at 0.77, which is above .70 at acceptable level (Nunnally and Bernstein 1994).

**Figure A.16: Firm’s Operational Performance - Speed Measurement Model**
The seventeenth measurement model tested was “Firm’s Operational Performance - Flexibility (FPF)”. Reliability Scale was at 0.79, which is above .70 at acceptable level (Nunnally and Bernstein 1994). This model was evaluated using 4 items show in Figure A.17.

Figure A.17: Firm’s Operational Performance - Flexibility Measurement Model

When viewing the model fit indices at the 1st order of construct for each of measurement models in Figures A.1-A.17, a good fit is apparent regarding each of the measurement models, except the measurement models that owned only 2 items, i.e. measurement system. Goodness of Fit Index (GFI), Normed Fit Index (NFI), Comparative Fit Index (CFI), and Incremental Fit Index (IFI) were all, except the measurement models that owned only 2 items, i.e. measurement system, greater than .90, suggesting excellent model fit (Byrne 1998).

But, Root Mean Square Residual (RMR) was all, except the measurement models that of measurement system, strategy of agile and responsiveness, which is less than .03 (Bentler and Chou 1987, Bollen 1989); this value was the indicative of good fit in the 1st order of construct. Also, Root Mean Square of Error approximation (RMSEA) was mostly over than .10, this value was the indicative of not-good fit in some measurement model (Chau 1997).

b) 2nd Order of Construct

The 2nd order of construct for each measurement model continued the measurement to ensure the good fit of model. This is to measure the full conceptual model, and exhibited the correlations.

The full measurement model tested was “Strategy-Structure-Performance (SSP)”. This model was evaluated using 18 constructs with 60 items shown in Figure B.1. Reliability Scale was at 0.95, which is above .70 at acceptable level (Nunnally and Bernstein 1994). The model was checked to assure that the parameter estimates, i.e. $X^2/df \leq 3$, RMSEA $\leq 0.10$, Chau 1997), RMR $\leq 0.03$, Bentler and Chou 1987, Bollen 1989), GFI / NFI / CFI / IFI $\geq 0.90$ Byrne 1998), exhibited those determined threshold, and were consistent with the underlying theory.

Figure B.1: Strategy-Structure-Performance Measurement Model – Correlations
When viewing the model fit indices that had the correlation across all the items as shown in Figure B.1, at the 2\textsuperscript{nd} order of construct for each of measurement model, a good fit is non-apparent to this model. Goodness of Fit Index (GFI), Normed Fit Index (NFI), Comparative Fit Index (CFI), and Incremental Fit Index (IFI) was .75, .73, .78, .78 respectively, they all are lower than .90 (Byrne 1998), suggesting non-good model fit. Root Mean Square Residual (RMR) was .05, which is above .03 indicates that model not fit data well (Bentler and Chou 1987, Bollen 1989). Also, Root Mean Square of Error Approximation was about .14, which is above .10 (Chau 1997), this value was the indicative of non-good fit. The \(\chi^2/df\) (418.47 / 114) showed statistic for the overall model was 3.68, which is above 3 (Chau 1997), suggesting the model does not fit the sample data as well.

However, the critical ratio and p-value is quite acceptable for all constructs as presented in table b.1. Critical Ratios (C.R.) showed very positive sign for all, and the significant level for all is at \(p < .001\).

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<tr>
<th>Table B.1: Regression Weights – CFA 2\textsuperscript{nd} Order</th>
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<td>Estimate</td>
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<tr>
<td>TPM &lt;--- TP</td>
</tr>
<tr>
<td>TPI &lt;--- TP</td>
</tr>
<tr>
<td>TPC &lt;--- TP</td>
</tr>
<tr>
<td>TPF &lt;--- TP</td>
</tr>
<tr>
<td>MS1 &lt;--- MS</td>
</tr>
<tr>
<td>MS3 &lt;--- MS</td>
</tr>
<tr>
<td>OSI &lt;--- OS</td>
</tr>
<tr>
<td>OSE &lt;--- OS</td>
</tr>
<tr>
<td>FPS &lt;--- FP</td>
</tr>
<tr>
<td>FPF &lt;--- FP</td>
</tr>
</tbody>
</table>

c) Alternative Model

In order to make the model fit data well, and make all fit measure can be accepted, the researcher modified the model in order to get the overall model fit to the SEM, it’s presented in Figure C.1. This model was evaluated using 12 constructs with 40 items shown in Figure C.1. Reliability Scale was at 0.93, which is above .70 at acceptable level (Nunnally and Bernstein 1994). The model was checked to assure that the parameter estimates, i.e. \(\chi^2/df\) (\(\leq 3\), Chau 1997), RMSEA (\(\leq .10\), Chau 1997),
When viewing the model fit indices that had the correlation across all the items as shown in Figure C.1, a good fit is apparent to this model. Goodness of Fit Index (GFI), Normed Fit Index (NFI), Comparative Fit Index (CFI), and Incremental Fit Index (IFI) was .91, .84, .91, .92 respectively, they all are lower than .90 (Byrne 1998), suggesting good model fit. Root Mean Square Residual (RMR) was .03, which indicates that model fit data well (Bentler and Chou 1987, Bollen 1989). Also, Root Mean Square of Error Approximation was about .08, which is lower than .10 (Chau 1997), this value was the indicative of good fit. The x²/df (90.889 / 46) showed statistic for the overall model was 1.98, which is below 3 (Chau 1997), suggesting the model fits the sample data well.

The Critical Ration (C.R.) is also presented in the figure C.2 to justify the either supportive or non-supportive of hypotheses.

### Table C.2: Regression Weights – Alternative Model

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUS ---- SU</td>
<td>.642</td>
<td>.191</td>
<td>3.358***</td>
<td></td>
</tr>
<tr>
<td>SUD ---- SU</td>
<td>1.558</td>
<td>.464</td>
<td>3.358***</td>
<td></td>
</tr>
<tr>
<td>SSE ---- SS</td>
<td>1.140</td>
<td>.293</td>
<td>3.895***</td>
<td></td>
</tr>
<tr>
<td>SSA ---- SS</td>
<td>.878</td>
<td>.225</td>
<td>3.895***</td>
<td></td>
</tr>
<tr>
<td>FPS ---- FP</td>
<td>.814</td>
<td>.135</td>
<td>6.031***</td>
<td></td>
</tr>
<tr>
<td>FPF ---- FP</td>
<td>1.229</td>
<td>.204</td>
<td>6.031***</td>
<td></td>
</tr>
<tr>
<td>SRS ---- SR</td>
<td>1.066</td>
<td>.142</td>
<td>7.516***</td>
<td></td>
</tr>
<tr>
<td>SRC ---- SR</td>
<td>.935</td>
<td>.125</td>
<td>7.516***</td>
<td></td>
</tr>
<tr>
<td>MS1 ---- MS</td>
<td>.891</td>
<td>.166</td>
<td>5.377***</td>
<td></td>
</tr>
<tr>
<td>MS3 ---- MS</td>
<td>1.122</td>
<td>.209</td>
<td>5.377***</td>
<td></td>
</tr>
<tr>
<td>TPI ---- TP</td>
<td>.861</td>
<td>.093</td>
<td>9.297***</td>
<td></td>
</tr>
<tr>
<td>TPF ---- TP</td>
<td>1.162</td>
<td>.125</td>
<td>9.297***</td>
<td></td>
</tr>
</tbody>
</table>

The structural equation model was analyzed based on the research constructs of alternative model; Maximum Likelihood Estimation (MLE) was used to fit the structural model presented in Figure C.2.
Hypotheses Testing

The revised conceptual model based on the modification above is presented in figure 14.

Figure 14: Conceptual Framework with Proposition: A Model of Relationship between Supply Chain Strategy, Structure, and Performance

To test the hypothesized relationship between supply chain uncertainty, supply chain strategy, supply chain structure, and firm’s operational performance, the researcher used the estimates of the path coefficients, i.e. Critical Ratio (C.R) and Probability (P-Value) that showed in Figure C.2

Based on the results (shown in Figure C.2), in responding to the research question of “Does fit between supply chain strategy and structure lead to the greater level of firm’s operational performance?” The empirical data results showed that partial of them only supported the given theory. No argument from the research results presented the relationships existing between supply chain strategy and supply chain structure. But, there’s no significant evidence proved that those fits could help to enhance the firm’s operational performance after the testing finished. The reasons and some suggestions are given in the below discussions

Firstly, H1 (A firm with the different levels of supply chain uncertainty emphasize different types of supply chain strategies), the structural model expressed the relationship between supply chain uncertainty (SU) and supply chain strategy (SS) that the value of Critical Ratio (C.R.) was at .69, the Probability (P) of getting C.R. was at .49. It implied that there is no significantly different from zero at the .05 level for SU in the prediction of SS. The effect of SU on SS is not on the significant level. The result revealed that SU appear to have non-direct effect on SS, though it’s discussed in the literature review by Lee (2002) that SS should be responded to SU in different circumstances. The selected firms on this study owned purely functional products and strong stable process which show very low demand and supply uncertainty. Based on the anecdoted evidence suggested by managers whom the researcher interviewed with, more factors should be considered in determining the strategy. The future research direction will be pointed out in the next section.

Second, H2 (A firm that adopts a supply chain strategy will demonstrate a high level of supply chain relationship) the structural model expressed the relationship between supply chain strategy (SS) and supply chain relationship (SR) that the value of Critical Ratio (C.R.) was at 4.94, the Probability (P) of getting C.R. was at less than .001. It implied that there is a significant relationship in absolute value from zero at the .001 level for SS in the prediction of SR.

The results asserted that the alignment of supply chain strategy had a positive relationship on supply chain relationship. According to the results shown in Figure C.2, the path relating these two constructs was positive and significant (standard coefficient = 1.06, and above C.R. and p < .001), thus providing strong evidence to support this H2. This indicated that the adoption of supply chain strategy increase the level of consideration in managing the better customer’s and supplier’s relationships. Managers believed that it would be beneficial in enhancing the firms’ SS and SR if related customers and suppliers were involved in the firm’s policy making that related to activities such as developing, planning, evaluating of the firm’s products / services (Bowersox, Closs, and Stank 1999).

Third, H3 (A firm that adopts a supply chain strategy will demonstrate a high level of Technology and Planning Integration across supply chain entities), the structural model expressed the relationship between supply chain strategy (SS) and technology and planning integration (TP) that the value of Critical Ratio (C.R.) was at 2.05, the Probability (P) of getting C.R. was at .04. It implied that there is a significant relationship in absolute value from zero at the .05 level for SS in the prediction of TP.

The results asserted that the alignment of supply chain strategy had a positive relationship on technology and planning integration. According to the results shown in Figure C.2, the path relating these two constructs was positive and significant (standard coefficient = .55, and above C.R. and p < .05), thus providing strong evidence to support this H3. This indicated that the adoption of supply chain strategy increase the level of demonstration in technology and planning integration. Managers believed that it would be beneficial in enhancing the firms’ SS and TP as this would be the key enables for them to work across supply chain entities, both internal and external. The degree of information technology connectivity is
critical to supply chain success (Bowersox, Closs, and Stank 1999).

Fourth, H4 (A firm that adopts a supply chain strategy will demonstrate a high level of development of measurement systems across supply chain entities), the structural model expressed the relationship between supply chain strategy (SS) and measurement system (MS) that the value of Critical Ratio (C.R.) was at 3.82, the Probability (P) of getting C.R. was at least .001. It implied that there is a significant relationship in absolute value from zero at the .001 level for SS in the prediction of MS.

The results asserted that the alignment of supply chain strategy had a positive relationship on measurement system. According to the results shown in Figure C.2, the path relating these two constructs was positive and significant (standard coefficient = .59, and above C.R. and p < .001), thus providing strong evidence to support this H4. Managers believed that the extension of the measurement criteria to all supply chain entities, both internal functions and external supply chain partners will give them the benefits to track performance and monitor key dimensions in all aspects.

Fifth, H5 (A firm that adopts supply chain relationship structure will demonstrate a high level of firm’s operational performance), the structural model expressed the relationship between supply chain relationship (SR) and firm’s operational performance (FP) that the value of Critical Ratio (C.R.) was at .96, the Probability (P) of getting C.R. was at less than .34. It implied that there is no significant relationship different from zero at the .05 level for SR in the prediction of FP.

The results asserted that the fit between supply chain strategy and supply chain relationship had non-impact on firm’s operational performance. According to the results shown in Figure C.2, the path relating these two constructs was positive (standard coefficient = .29), but there was no significant as shown in the above C.R. and p < .05, thus providing strong evidence not to support this H5.

The lack of the relationship between supply chain relationship and firm’s operational performance may need for further investigation. It is unclear why there was no such relationship existed in the study though the good operational performance required The supply-chain-management literature reports a number of studies on the operational performance benefits that a firm derives from linking with suppliers and with customers. Narasimhan and Jayaram (1998) similarly demonstrated that by managing suppliers strategically, a firm could improve its operational performance, in terms of dependability, flexibility, cost, and quality. Most recently, Salvador et al. (2001) reported that when firms interact with suppliers and with customers on issues related to materials flow and quality, firms can expect better time-related operational performances in terms of speed and delivery punctuality.

Sixth, H6 (A firm that adopts technology and planning integration structure will demonstrate a high level of firm’s operational performance), the structural model expressed the relationship between technology and planning integration (TP) and firm’s operational performance (FP) that the value of Critical Ratio (C.R.) was at 1.94, the Probability (P) of getting C.R. was at less than .05. It implied that there is a significant relationship different from zero at the .05 level for TP in the prediction of FP.

The results asserted that the fit between supply chain strategy and technology integration had a marginally direct effect on firm’s operational performance. According to the results shown in figure C.2, the path relating these two constructs was positive (standard coefficient = .60), and there was a as shown in the above C.R. and p < .05, thus providing strong evidence to support this H6, though it’s the marginal effect. The result from qualitative analysis showed that managers believed that it would be beneficial to invest information system to enhance the firm’s operational performance and improve customer’s satisfaction. Generally, Huang and Mak (2001) argued that information technology has been widely adopted in various businesses and industries, and further it has become the infrastructure and essential element of business management and operations; therefore from the manager’s point of view the correlation between TP and FP becomes less importance. The result is that it’s generally accepted by managers that TP does appear to have a positive relationship, though marginal effect, on FP.

Seventh, H7 (A firm that adopts measurement system structure will demonstrate a high level of firm’s operational performance), the structural model expressed the relationship between measurement system (MS) and firm’s operational performance (FP) that the value of Critical Ratio (C.R.) was at -0.35, the Probability (P) of getting C.R. was at 7.39. It implied that there is no significant relationship different from zero at the .05 level for MS in the prediction of FP, there was no support for this H7 since firm’s operational performance is not significantly influenced by measurement system.

This is surprising since the strong relationship between supply chain strategy and measurement system was shown in H4. Measurement System forms the basis for calibrating the many parts of supply chain by providing timely feedback on strategic initiatives so that management can take corrective action to ensure that
goals and objectives are met (The Global Logistics Research Team at Michigan State University 1995). Thus, the unclear is shown as it’s generally agreed that the ‘fit’ between strategy and structure will positively impact on firm’s operational performance. As Bowersox, Closs, and Stank (1999) stated that the development of measurement system is to enable managers to monitor key dimensions of individual firm and supply chain operations; therefore, suggest a modification in the conceptual model for future research proves to be worthwhile in terms of including some mediating variables, i.e. integration operation (internal and external) as shown in the previous study of Rodrigues, Stank, and Lynch (2004).

Finally, H₆ (A firm that adopts supply chain uncertainty reduction will demonstrate the high level of technology and planning), the structural model expressed the relationship between supply chain uncertainty (SU) and technology and planning integration (TP) that the value of Critical Ratio (C.R.) was at 1.55, the Probability (P) of getting C.R. was at 0.12. It implied that there is no significant relationship different from zero at the .05 level for SU in the prediction of TP.

As a result of there was no impact on SU to SS, managers’ views showed that this construct, SU, was not relevant to this conceptual model. And this hypotheses is own researcher’s implication by interpreting what Lee (2002) mentioned about the reduction on supply chain uncertainty could be made by involving the technology integration into the firm. That recommendation showed that firm engages more technology in order to reduce the supply chain uncertainty, which finally help to enhance the supply chain efficiency. Therefore, the further investigation on the certain structures that can help to reduce the uncertainty in future research proves to be worthwhile.

6. Implications

Research Implications

The aim of the research will provide the analysis and empirical support for Thai context on SSP paradigm of Stank and Defee (2005), and strategy-structure-process-performance linkages of Rodrigues, Stank, and Lynch (2004). The researcher found the well ‘fit’ between strategy and structures. Supply chain strategy was found to have a strong influence on such structures. From our findings, firms considered highly to well establish the relationships with both customers and supplier, to invest into technology and system as well as to create the tracking control in order to evaluate the performance. Therefore, we can conclude that supply chain strategy stimulated the well establishment of structures. By applying the complementary theory of supply chain uncertainties that addressed on the supply chain strategy, this perspective explained the unexplored phenomenon of the effects on supply chain strategy into SSP paradigm.

The findings of the research will have several implications and meaningful to managers in the global marketplace. This study will elaborate on the effects of relationship between strategy and each structural component. Practitioners may utilize this knowledge to as the guideline to ensure that ‘strategic fit’ between firm and supply chain partners is created, and to support the improvement of decision-making to ensure the right strategic approach to customer and supplier to the best influence firm’s operational performance. Specifically, they support the importance of well collaborative working and knowing your supply chain partners. Therefore, managers should ensure the alignment and making strategic ‘fit’ to enhance the greater level of firm’s operational performance; especially when considering the new member into company supply chain. Further, they will provide some justification for the extensive investment on creating the better structure in terms of technology, relationships, and measurement system. The researcher also highlighted the importance of adopting the higher level of technology in the company; it will certainly support the company to cope with supply chain uncertainties, though there’s no direct relationship. Relationship is highlighted for the selected industry of which the relationship is very importance in achieving the shared goals. It also highlights the well structuring of measurement system will create the alignment across supply chain entities to achieve business objectives and goals.

7. Limitations and Direction for Future Research

The conceptual model didn't answer the research questions well enough, and the model need to be justified by the modifications more in-depth as the present empirical results partially support the researcher’s conceptual model due to several reasons. Firstly, limitation of time led the sample population could not reach the minimum requirements of 320 respondents, total distributions reached only to 307 respondents. Second, since the empirical data were provided by individual informants, the existence of possible biases cannot be discounted. Third, the current data were collected majority in Thailand; thus it should not be assumed that the present results represent the wider case.
Future research may be needed, and attempt to find more theories and research in individual industry, and then explain the effects of relationship in different industries and compare across the industry.

As the weakness of researcher’s current model firstly was on the non-significance of relationship between supply chain uncertainty and supply chain strategy, the researcher would suggest that the future research should investigate on other factors that will impact on supply chain strategy. Second, the modification of current model needs to be examined in order to clarify the ‘fit’ between strategy and structure enhanced firm’s operational performance as the present results showed the indirect relationship that was opposed to the prior study of Rodrigues, Stank, and Lynch (2004), except technology and planning integration which marginally effects. Finally, the certain structures to reduce supply chain uncertainties need to be revealed.

Furthermore, research on how the fit among different industries in the same or different strategies and structures may enhance firm’s operational performance in the presence of global businesses and offers another fruitful avenue for future studies.

References


