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THE EFFECT OF SUPPLY CHAIN INTEGRATION ON SUPPLY CHAIN PERFORMANCE OF THAI PAPER MANUFACTURERS: MEDIATION EFFECTS OF SERVICE COMPETENCY AND LOGISTICS FLEXIBILITY

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Abstract
This research aims to study the levels of supply chain integration, service competency, logistics flexibility and supply chain performance of paper manufacturing businesses in Thailand plus influences of supply chain integration, service competency and logistics flexibility on the supply chain performance of paper manufacturing businesses in Thailand, and to study the indirect influence of logistics flexibility and service competency on the supply chain performance of paper manufacturers in Thailand. The sample was 300 paper manufacturing companies obtained from stratified sampling. The tool was a questionnaire. Statistics used in data analysis included frequency, percentage, mean, standard deviation, confirmatory factor analysis and structural equation models. The results found that supply chain integration, service competency, and logistics flexibility and the supply chain performance of the paper manufacturing business in Thailand were at a high level. In addition, supply chain integration, service competency, logistics flexibility influenced supply chain performance of paper manufacturing businesses in Thailand. The findings can provide guidelines for developing and improving the paper manufacturing business in Thailand in increasing the efficiency and effectiveness of the supply chain. For theoretical and suggestions, academics or interested parties can use these findings to conduct additional research to develop logistics and supply chain management in other industries in the future.
Keywords: Supply Chain Integration, Supply Chain Performance, Service Competency, and Logistics Flexibility.

Introduction

From the report on supply chain performance issues, the trends in the global economy, particularly in the era of globalization have intensified business competition (Soonthornpipit et al., 2021), especially, in Thailand's paper industry. This led paper industry operators to enhance their organizational capabilities to maintain sustainable and progressive businesses (Sommanawat et al., 2021; Aunyawong et al., 2021). A crucial factor for organizational development is the ability to analyze and evaluate supply chain performance concerning the standards or benchmarks of similar organizations within the country and internationally (Phrapratanporn et al., 2019). This awareness allows them to capitalize on organizational strengths and weaknesses and utilize wide-ranging data to enhance logistics and supply chain performances, ultimately improving their competitiveness (Wisedsin et al., 2020; Pakornpongwatthana & Aunyawong, 2022; Wararatchai et al., 2023). As supply chain encompasses various business activities involving cost management, time, and

customer satisfaction, utilizing internal management tools is essential for a successful outcome while striving in today's competitive landscape (Srisawat & Aunyawong, 2021).

Furthermore, driving supply chain performance higher than competitors can establish an edge and bolster all businesses collectively (Muhammad et al., 2022). Supply chain management services are a key strategy adopted by entrepreneurs to increase competitiveness and supply chain efficiency, aiming to reduce product and service costs (Sinthukhammoon et al., 2021; Jose et al., 2022). Presently, Supply chain management plays an increasingly vital role in Thailand's economy, as the sector has experienced growth. It has led to increased job opportunities, contributing to the nation's economic advancement. The paper industry in Thailand, known for adapting alongside economic growth, is prominently associated with packaging products, especially paper packaging. Paper packaging, popular for being an environmentally friendly, recyclable product, has become more favorable, supporting environmental conservation efforts, and promoting product identity (Setthachotsombut et al., 2022).

The comprehensive integration of the supply chain is a vital strategy that business should prioritize. If implemented effectively, it fortifies each segment of the supply chain, leading to heightened competitiveness. The integration may require collaborative strategies and time, yielding sustainable market growth and correlating with supply chain efficiency and organizational quality (Kursat & Turker, 2022). Evidence from both research and academic work clearly indicates that supply chain integration positively impacts organizational efficiency (Alshurideh et al., 2022).

Literature Review

Service Competency

Service competency refers to the necessary knowledge and skills of the employee. In serving customers, the ability to provide service is involved with individuals ranging from raw material manufacturers, processing plants, wholesalers, and retailers to the consumer (Jose et al., 2022). Its main transportation activities, inventory services, purchase orders, information services, related financial activities, and additional activities are warehouse management, product care, purchasing, and packing including the management of customer needs. In addition to directly related activities, such a process will require Infrastructure: transport networks communicate information and finance including factors that regulate and support the relevant regulations (Alkire & Hammedi, 2021). The scope covers public and private sectors, local, national, and global, all of which lead to satisfaction to customers through effective management (Espino-Rodríguez & Taha, 2020). From the factor synthesis of service competency, it comprised 4 factors: tangibility, responsiveness, assure, and empathy.

Logistics Flexibility

Logistics flexibility is one of the logistic competencies (Aunyawong et al., 2020). Production flexibility is often considered as a physical resource, such as a flexible production system, transportation flexibility etc., but the current market is cheap and driven by customer demand, which has more diverse needs, obtain high quality and speed of delivery (Arunachalam et al., 2021). This caused the organization to adapt to keep up with the needs of customers originally;

most people only viewed flexibility, in terms of production flexibility which is related to the management within the organization. Therefore, insufficient support for unstable external conditions because the business model relates to the supply chain, is complicated (Tweedie et al., 2019). To address challenges, and develop competitiveness, organizations need to improve greater flexibility at various levels. From the factor synthesis of logistics flexibility, it consisted of 4 factors: physical supply flexibility, purchasing flexibility, physical distribution flexibility, and demand management flexibility.

Supply Chain Integration

Supply chain integration means managing production and distribution in close and efficient coordination (Lai & Lee, 2023). Supply chain members must see themselves as part of a team with the aim of working together to maximize the benefits for all parties in the supply chain in line with supply chain integration (Waiyawuththanapoom et al., 2023). They are a strategic collaboration and supply chain management for the purpose of supply chain integration to make operations in the supply chain efficient (Asare et al., 2023). There is accurate information enabling us to deliver products and services to customers with satisfaction. From the factor synthesis of supply chain integration, it involves 3 factors: supplier integration, customer integration, and internal integration.

Supply Chain Performance

Supply chain performance is the process of planning, organizing, and executing all activities related to the product. From the beginning to the last point, it may use the word from the process of upstream to downstream of the supply chain resulted in a good performance or stood out from the established standard, along with the creation of a system for the flow of information that causes the process (Purwanto & Juliana, 2022). The work of each department is transmitted throughout the organization with supply chain efficiency and supply chain effectiveness. From the factor synthesis of supply chain performance, it contains 2 factors: supply chain efficiency and supply chain effectiveness.

Hypothesis Development

From the objectives of this research, the researchers occasionally have reviewed the concepts, theories, and related research of many scholars (Espino-Rodríguez & Taha, 2020; Pintuma et al., 2020; Tirastittam et al., 2020; Alkire & Hammedi, 2021; Arunachalam et al., 2021; Srisawat & Aunyawong, 2021; Jose at al., 2022; Laguir et al., 2022; Wararatchai et al., 2022; Hambali et al., 2022; Asare et al., 2023; Lai & Lee, 2023). Thus, the model, as shown in Figure 1, may still be inconsistent with empirical data and the relationship of cause and effect variables. Therefore, the following hypotheses are proposed.

H1: Supply chain integration has a positive direct influence on Service competency.
H2: Supply chain integration has a positive direct influence on supply chain performance.
H3: Supply chain integration has a positive direct influence on logistics flexibility.
H4: Service competency has a positive direct influence on supply chain performance.
H5: Logistics flexibility has a positive direct influence on service competency.
H6: Logistics flexibility has a positive direct influence on supply chain performance.

H7: Supply chain integration has a positive indirect influence on supply chain performance, mediated by service competency.
H8: Supply chain integration has a positive indirect influence on supply chain performance, mediated by logistics flexibility.

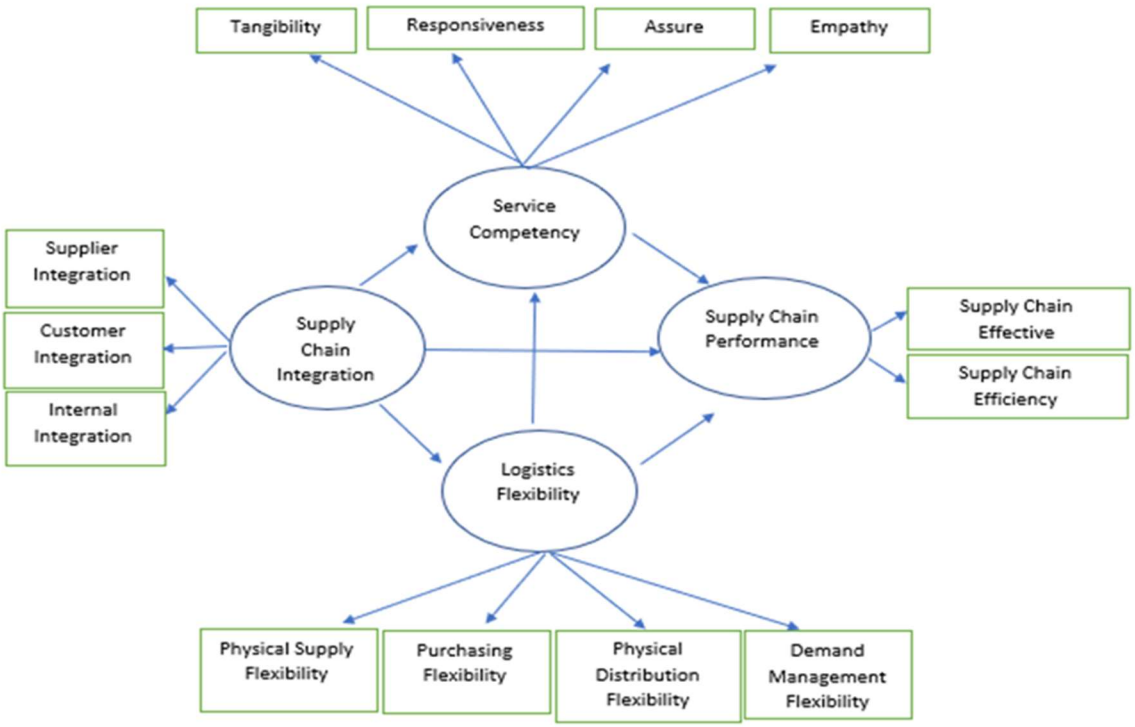

Figure 1 Research conceptual framework

Methodology

Data Collection

The sample size of this research was obtained by calculating the sample size according to the condition for using Structural Equation Modeling (SEM) statistics is that the sample size is not less than 20 times the observed variable in the model because it will cause the variable to be distributed more normally (Hair et al., 2010). The conceptual framework of this research has 13 observed variables, so a sample group of not less than or equal to 260 samples (13 x 20). The researcher then determined to collect data from 300 samples of paper manufacturers. The questionnaire was adopted from the previous studies and the questionnaire was rated on a five-point Likert scale that ranged from 1 which shows strongly disagree and 5 for strongly agree.

Data Analysis

Descriptive statistics

The descriptive analysis of the study had been conducted by using SPSS. It found that supply chain integration (SCI) mean score was 3.83, service competency (SVC) mean score was 3.63,

logistics flexibility (LOF) mean score was 4.01, and supply chain performance (SCP) mean score was 3.87, which demonstrated a high level of all variables. In addition, Skewness and Kurtosis were used to gauge the variables' levels in the research. Skewness valued between -3 and +3 and kurtosis valued between -10 to +10, as suggested by Kline (2011), indicated a normal distribution, especially when utilizing SEM, as shown in Table 1.

Table 1 Descriptive statistics

Variable	$\bar{x}$	S.D.	Remark	Skewness	Kurtosis
Supply Chain Integration (SCI)	3.83	.57	High	-	-
Supplier Integration (SCI_1)	3.76	.68	High	-.359	.939
Internal Integration (SCI_2)	3.83	.68	High	-.299	-.246
Customer Integration (SCI_3)	3.91	.67	High	-.525	.153
Service Competency (SVC)	3.63	.58	High	-	-
Tangibility (SVC_1)	3.66	.65	High	-.566	.885
Assure (SVC_2)	3.48	.67	High	-.194	.673
Responsiveness (SVC_3)	3.65	.70	High	-.461	.059
Empathy (SVC_4)	3.75	.75		-.935	.903
Logistics Flexibility (LOF)	4.01	.63	High	-	-
Physical Supply Flexibility (LOF_1)	4.02	.73	High	-.837	.421
Purchasing Flexibility (LOF_2)	4.03	.72	High	-.952	.555
Physical Distribution Flexibility (LOF_3)	3.97	.69	High	-.903	.242
Demand Management Flexibility (LOF_4)	4.01	.71		-.862	.426
Supply Chain Performance (SCP)	3.87	.77	High	-	-
Supply Chain Efficiency (SCP_1)	3.77	.85	High	-.643	.437
Supply Chain Effective (SCP_2)	3.96	.86	High	-1.171	1.310

Inferential Analysis

The SEM technique has been applied for conducting the inferential analysis. This section was divided into the following two sections: measurement model and path analysis, as recommended by Henseler et al. (2009).

Results

Measurement Model

Before the assessment of the structural model, the assessment of the measurement model was necessary to check its reliability and validity. The reliability and validity could be checked through convergent and discriminant validity. The Cronbach alpha (α) could not decrease below 0.7, factor loadings could not decrease from 0.5, composite reliability could not decrease below 0.7 and lastly, average variance extracted (AVE) could not decrease by 0.5. These suggested criteria have been explained in the following previous literature (Hair et al., 2014; Hair et al., 2017). All the values fulfill the criteria of convergent validity, as shown in Table 2.

Table 2 Factor loadings, reliability, and validity

Construct		b	β	α	CR	AVE	t	R^2
Supply Chain	SCI_1	1.000	.871	.797	.813	.594	<-->	.780
Integration (SCI)	SCI_2	.821	.706				12.852	.462

Construct		b	β	α	CR	AVE	t	R^2
	SCI_3	.823	.724				13.498	.496
Service Competency (SVC)	SVC_1	1.000	.700	.852	.83	.556	<-->	.826
	SVC_2	.834	.577				13.002	.596
	SVC_3	1.346	.906				11.885	.478
	SVC_4	1.244	.762				9.877	.350
Logistics Flexibility (LOF)	LOF_1	1.000	.919	.914	.895	.683	<-->	.840
	LOF_2	.794	.737				15.944	.556
	LOF_3	.923	.900				21.206	.826
	LOF_4	.775	.731				15.575	.544
Supply Chain Performance (SCP)	SCP_1	1.000	.791	.762	.758	.611	-	.626
	SCP_2	1.000	.772				<-->	.609

Note: Supply Chain Integration (SCI), Service competency (SVC), Logistics flexibility (LOF), Supply chain performance (SCP)

On the other hand, the discriminant validity could be checked through Fornell and Lacker's cross loadings and Hetromonotrait correlations (HTMT). The discriminant validity in the Fornell and Lacker could be assessed through the AVE square root that diagonal values should have greater correlations from other below values (Hair et al., 2017; Henseler et al., 2015). For the recommended values for the HTMT in the discriminant value, the correlation among the construct should be less than 0.85 (Hair et al., 2017; Henseler et al., 2015). Table 3 presented that all constructs had discriminant validity.

Table 3 Discriminant validity

	Fornell and Lacker				HTMT			
	SVC	SCI	LOF	SCP	SVC	SCI	LOF	SCP
SVC	.746							
SCI	.286	.770			.387			
LOF	.403	.255	.827		.346	.277		
SCP	.466	.371	.594	.781	.540	.470	.632	

Note: Supply Chain Integration (SCI), Service competency (SVC), Logistics flexibility (LOF), Supply chain performance (SCP)

Structural Equation Model

After the measurement model assessment, the next process was to test the structural model of the study to test the study hypotheses. For this purpose, the company 300 resampling technique has been applied in the SEM. The SEM direct effect has shown Supply chain performance (SCP) had a significant and positive connection with Service competency (SCV). In addition, Logistics flexibility (LOF) and Supply chain integration had a positive and significant effect on Supply chain performance. The findings have shown that competitive advantage and logistics flexibility are

integral factors that could help enhance the Supply chain performance of the paper industry in Thailand. This could also have been seen from the mean score of managers which have similar average values as compared to others. Another possible reason is that there could be an overlapping of other variables in the model. The above-discussed values are predicted in the following Table 4.

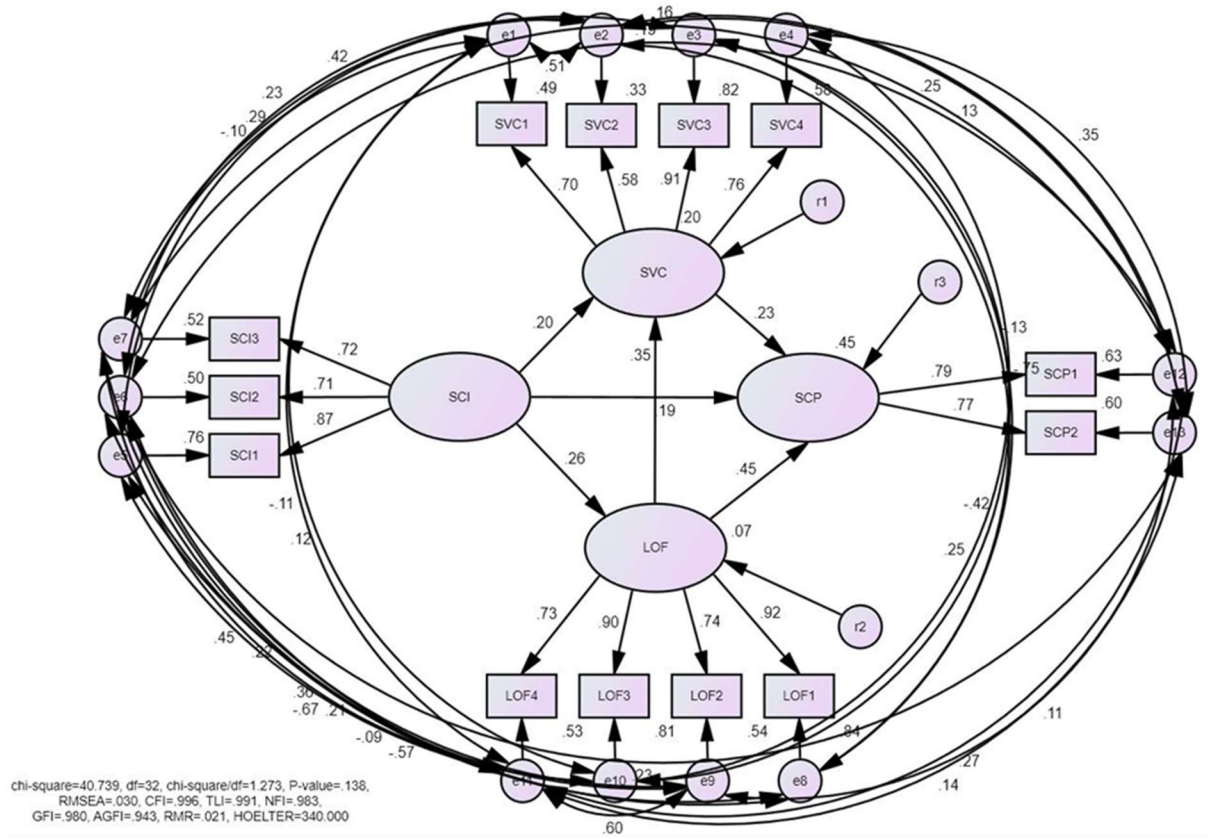

Figure 2 Structural equation modeling

Table 4 Hypothesis Testing results

Hypotheses	Path	(β)	p-value	t-value	Results
H1	Supply Chain Integration -> Service Competency	.196	.004	4.369	Supported
H2	Supply Chain Integration -> Supply Chain Performance	.190	.003	3.433	Supported
H3	Supply Chain Integration -> Logistics Flexibility	.255	.000	3.104	Supported
H4	Service Competency -> Supply Chain Performance	.229	.000	4.193	Supported
H5	Logistics Flexibility -> Service Competency	.353	.000	4.546	Supported
H6	Logistics Flexibility -> Supply Chain Performance	.453	.000	7.622	Supported

Hypotheses	Path	(β)	p-value	t-value	Results
H7	Supply Chain Integration -> Service Competency -> Supply Chain Performance	.046	.001	-	Supported
H8	Supply Chain Integration -> Logistics Flexibility -> Supply Chain Performance	.137	.002	-	Supported

Conclusion and Discussion

The research findings and discussions reveal that in analyzing supply chain integration, the most influential variables are supplier integration, followed by internal integration and customer integration. Consequently, paper manufacturing businesses must strategize collectively within the network of paper traders and suppliers, sharing production and quality data, methodologies, and strategies to reduce production costs while collectively enhancing operational capabilities in quality, cost, and meeting customer demands (Hiranphaet et al., 2022; Sooksai et al., 2022). Additionally, engaging in procurement practices to ensure value and cost reduction in operations will significantly improve the economic efficiency and growth of the business. Furthermore, supply chain integration plays a pivotal role in enhancing a company's service capabilities efficiently and directly impacts the efficiency of the supply chain as a crucial tool in organizational operations (Aunyawong et al., 2018; Aunyawong et al., 2020).

The analysis of service competency reveals that the most influential variables are assure, followed by empathy, tangibility, and responsiveness in order. Therefore, paper businesses must uphold agreements with their supply chain partners as agreed, proactively solve issues, and establish long-term business partnerships that involve shared tangible aspects. Sharing techniques to enhance productivity and cost reduction, exchanging risk related information, preventing operational interruptions, and maintaining paper quality are crucial to continuously earn customer trust (Pintuma & Aunyawong, 2021; Yuyangyuen & Aunyawong, 2023). To improve service competency, close collaboration in planning and executing supply chain activities toward common goals and benefits is essential. Manufacturers in the paper industry need to actively engage in joint development efforts. Such businesses need to actively contribute to cooperative activity development (Som et al., 2019; Nualkaw et al., 2021).

The analysis of logistics flexibility indicates that the most influential variables are physical supply flexibility, physical distribution flexibility, purchasing flexibility, and demand management flexibility, in that order. As a result, paper manufacturing businesses must ensure the quality of paper before delivering to customers, ensuring on-time and in-full delivery, and consistently meeting customer demands for continuous customer purchases. This involves developing supply chain capabilities, utilizing existing resources efficiently, and aligning with previous research findings, emphasizing building trust in supplier relationships, continuous understanding of customer needs, fostering closer customer relationships, and enhancing inter-departmental coordination to improve efficiency and effectiveness (Waiyawuththanapoom et al., 2020; Espino-Rodriguez et al., 2022; Waiyavat et al., 2022). Moreover, many companies prioritize developing

supply chain performance to elevate competitive abilities by focusing on delivering quality products and reducing operational costs across different operational domains (Hendijani et al., 2022; Wisedsin et al., 2020).

The analysis of supply chain performance reveals that the most influential variable is efficiency, followed by effectiveness. Therefore, paper manufacturing businesses should prioritize having logistics service providers that suit their operational needs directly, thereby reducing operational costs and enhancing overall operational efficiency (Phrapratanporn et al., 2022; Prachayapipat et al., 2022). Practices and policies supporting collaborative efforts to improve service efficiency contribute significantly to overall economic performance (Lenuwat and Boon-Itt, 2019; Kerdpitak et al., 2022).

The analysis of the Structural Equation Modeling discovered that supply chain integration, service competency, and logistics flexibility positively influence the supply chain performance of Thai paper manufacturing businesses. Furthermore, the supply chain integration has both direct and indirect positive impacts on the supply chain performance of these companies. The research highlights that service competency and logistics flexibility significantly contribute to supply chain performance, as observed in past studies. The service competencies have a meaningful and positive correlation with the effectiveness and efficiency of the organization's supply chain, enhancing overall visibility across the entire supply chain (Laguir et al., 2022; Srisawat & Aunyawong, 2021; Wararatchai et al., 2022). Moreover, competitiveness and supply chain fosters stakeholders' engagement, allowing for predictive analytics, needs assessment, collaborative practices, and information sharing, which are instrumental in enhancing competitive capabilities and managerial efficiency in supply chain operations (Hambali et al., 2022; Pintuma et al., 2020; Tirastittam et al., 2020).

For practical and academic recommendations, the paper entrepreneurs and academicians should focus on other factors affecting supply chain performance, such as e-procurement, planning or automatic planning or ordering , real-time production management, inventory management, accurate shipment tracking, timely delivery of products and services, tracking information and documents, etc. to create a good experience for customers and be able to predict various risks in advance in order to deal with various uncertain situations effectively.

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