

The Role of Supply Chain Integration in Sustainable Performance of Thai Manufacturing Organizations: A Mediation Effect of Supply Chain Performance

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Abstract- Sustainable performance is a serious concern for manufacturing organizations and a challenge for supply chain in the 21st century. Particularly a challenge is how to stimulate firms' social and environmental attentiveness and put integrated activates into practice for sustainable performances. This study examine the role of supply chain integration in sustainable performance of Thai manufacturing firm with mediating role of supply chain performance. For the fulfillment of the objective of this research, the data was collected from the plant managers and supply chain managers via questioners. It is found that internal integration and logistic integration positively influence the sustainable performance of manufacturing organizations. Supply chain integration could enhance the supply chain performance of the firm that ultimately increases the sustainable performance of the organizations. The study offers a new empirical evidence for managerial decision and it can contribute valued perceptions for manufacturing firms in the strategy development regarding supply chain. However, this study used only internal integration and logistic integration, the other important element of supply chain such as customer integration and supplier integration, could be used by researchers for future research.

Keywords; *Internal integration, logistic integration, supply chain performance, sustainable performance*

1. Introduction

Primary aim of Supply chain management (SCM) is to integrate and align the business strategies and operations by applying supply chain activities to satisfy customers demands [1, 2]. Business operations that are much needed of coordination and integration are procurement, production, advertising, transportation, and information accessibility. Strategically, customer emphasis, efficiency, excellence, quick response to customers and most significantly environmental sustainability are required to be integrated [3]. By considering increasing competition in supply chain and changes in customer demands,

competitive edge is essential to sustain by recognizing and applying supply chain mechanisms. Resultantly, all supply chain participants will enjoy improved performance [4]. However, Environmental sustainability is associated with supply chain perspective rather than organizational perspective [5-7]. Environmentally friendly supply chain process can be developed with the equal contribution of all supply chain partners for avoiding low-optimization with regard to partners [8].

When firms create continuous values for owners and stakeholders in line with the environmental necessities, it will result in the long-term performance of the business [9]. Business performance can brilliantly be achieved by sustainability that primarily includes the integrated developing process of innovative and creative business culture [10]. Resultantly, favourable culture will ultimately enhance operational performance of an organization and make it possible the appropriate utilization of prevailing resources of the business for better financial, environmental and societal performance [11]. Hence, satisfaction of owners, contractors, customers, employees and society is the result of financial, cultural, and social sustainability.

In last few decades, increasing global awareness regarding environmental safety gained wide attention of the researchers and stakeholders of operations and supply chain management [12]. Particularly in the context of production firms, supply chain management (SCM) is considered to be a significant management tool for sustainable performance improvement. Supply chain management represents the whole process of supply chain including environmental safety necessities [13]. Manufacturing firms are required to make sure the integration of supply chain for the purpose of coordinating environmental administration practices not only within the firm but also for the suppliers and the clients [14]. The implementation of SCM will not only enhance the cooperation between firms for recognizing common SCM but it also will influence the company's sustainable productivity [15]. SCM practices demand manufacturers to work with the coordination of suppliers and clients to

make better environmental sustainability. Decreases in environment emissions, sewage waste, solid waste, ingestion of lethal materials as well as better environmental performance are the expected outcomes of SCM practices implementation. However, organizational concern is to transform these activities into better market representation and performance. Eventually, managers of manufacturing firms are responsible better performance of an organization for which they are working [16].

Managers are responsible that in what ways they can make better performance of organization by developing supply chain. Managers must contribute for the improvement of supply chain before contributing in organization [4]. Resultantly, managers' contribution in "globalize to localize." Sequence for supply chain level results in organizational level success [17]. Nowadays, government organizations as well as individual customers demand environmentally suitable process, products and services. To make it sure, managers must recognize and adopt the long-term environment practices that may deal with the whole supply chain process. According to [3], environmental problems are associated with the of SCM major stream. [1] recommended that environmental exertions should be combined with the value chain in the whole process. [18] indicated that environmental managers have shifted their focus from the organization perspective to the supply chain perspective.

Whether getting "green" actually has the returns for firm, the phenomenon has been examined with questionable findings [2, 19]. Furthermore, [20] pointed out that environmental sustainability always creates favorable situation or it environmental and financial trade-offs for the supply process participants. Limited empirical studies are available on the issue that has considered the integrated and inclusive perspective. The researcher contributes to the literature of SCM by considering the currently developed perspectives [2, 16] for an all-inclusive SCM practices framework that will provide evidence for the prior studies regarding model efficiency. Commonly, it is recommended for manufacturing firms that they should implement the environmental sustainability as a strategy and should enhance existing capability of monitoring and comparing environment before and after implementation of supply chain management practices (SCM) by developing appropriate information system. Additionally, researcher recommend that better application of SCM practices likewise green procuring, customers association, Eco strategy, and investment recovery will result in enhanced environmental and financial outcomes that ultimately will provide support for successful operational and organizational performance. Theoretical model has been measured by applying national data collected from 159 managers employed in US manufacturing firms. The respondents

contributed in survey by providing input regarding organizational environmental practices as well as environmental practices integrated with dealers and clients.

[21] defined manufacturing firms as "business firms that uses components, parts or raw materials to make a finished good, where these finished goods can be sold directly to consumers or to other manufacturing businesses that use them for making a different product". According to IEA (2007), globally manufacturing concerns are major source of waste creation and they utilize foremost part of resources. From 1972 to 2004, there was an increase of 61% in the utilization of energy by manufacturing sector that contains one third of the world-wide consumption of energy. Apart from being the main cause of environmental issues like pollution increasing, abundant waste places, and reducing raw material sources, manufacturing industry makes 36 % input in emission of carbon dioxide (CO₂) globally (OECD, 2009). By considering the alarming environmental situations, a wider intention of managers, owners, customers and workers regarding impression of manufacturing businesses has been transformed to the stance that business should be environment friendly in its process and products [22]. The notion of sustainable manufacturing practices is associated with the processes, strategies, and the methods adopted by a firm in managing and monitoring the influence of their production procedure on natural environment.

2. Literature Review

2.1. Sustainable Performance

Sustainable performance of a business takes place when firms create continuous values for owners and stakeholders in line with the environmental necessities [9, 61-63]. Essential elements of sustainable value include performing better for environment, society, and more importantly by gaining the customer and shareholders satisfaction. [11] states "sustainability consists of actions that extend socially useful life of the organization, enhance the ability to maintain and renew viability of the biosphere and protect all living species, enhance ability of society to maintain itself and to solve its major problem and to maintain a decent of welfare, participation and personal freedom for present and future generations of humanity".

Sustainability is a brilliant method of conducting business, and activities of sustainable initiatives may be achieved by emerging innovative and optimistic business culture. The innovative culture will make it possible better performance of business and best utilization of available resources that will have maximum financial, environment, and societal outcomes [23]. [24] categorized sustainable performance in three contexts that are financial, environment, and social performance. The European Commission issued a sustainable expansion plan in 2001 by highlighting the significance of social unity,

environmental safety, and financial progress to go in parallel ways [25]. Furthermore, [26] discussed sustainable supply chain management in the sense where an advanced management practices having focused on integrated economy, environment, and society. Wholly, in the processes of purchasing, manufacturing, packaging, transporting, warehousing and disposal of the finished products with the support of supply chain management technology, it has ultimate aim of achieving long-term expansion of economy, environment and society.

Accordingly, in line with the framework of [9], three key extents of sustainability performances assessment are discussed in the anticipated model that are financial sustainability, social sustainability and environmental sustainability. Consequently, for the comprehensive understanding of sustainability concept, three elements of sustainability are much important for conducting business effectively in future and present [27]. In the business operation, environmental concerns and issues are significant to be considered. [28] defined environmentally sustainable performance as “the evaluation of organizational reduction for emissions, decrease of consumption for hazardous or harmful materials, and efficient energy or resources use”. Environmentally sustainable performance includes reduction in the use of assets that are pollution producers and waste creators in the result of business operations [27]. Sustainable performance in environment is concerned with the aims of business that include decrease in the number of environmental happening and finding appropriate solutions for operational activities associated with environment [29]. Environmental risks can be reduced by adopting environmental performance indicators. Further, it will support outside communication and policy creation for not only public sector organizations but also for private sector organizations [2, 15].

A greater social responsibility lies at the end of the firms that they are responsible for taking care of society as well as their employees. Socially sustainable performance defined by [1] in the words that it is an assessment of an organization regarding suitable working environment, social responsibility and contribution, tutoring and training, and employees’ development. Furthermore, he argues that where customers are having the strong knowledge about the social responsibilities of firms, firms will widely recognize and adopt ethical plans to improve community welfare regarding environment. There are numerous domains that should appropriately be addressed such as corporate governance, human resources, human privileges, and environment [30].

Additionally, [27] indicated social sustainable performance as the contribution of operational activities in the welfare of society for numerous stakeholders including contractor, workers, clients. Ultimately, whole of the responsibility lies with the managers for the application of social promise and contribution, social managerial strategies, employee’s management, and creation of suitable environment for operations. Besides this, United Microelectronics Corporation (2012) mentioned additional responsibility that lies with the managers are workers benefits, staff coordination, skill development, working environment, public wellbeing, social apprehensions and

social response. Better performance in social sustainability will make it easy for organizations to achieve its mission, vision and competitive advantage to sustain in the market.

2.2. Supply Chain Integration

The supply chain management (SCM) gained wide attention of scholars, partners and supply chain managers. Enhancing significance of SCM is because of the deteriorating environmental conditions like increasing pollution, abandoning waste places, and lessening raw material sources. Though, it is not only associated with friendly environment but it also addresses better business intelligence and increased incomes. Actually, SCM is a value originator for business rather than a cost centre (Wilkerson, 2005). Since manufacturing businesses are considered responsible for environmental liabilities of their contractors. Integrated environmental creativities are not only important for the organization internally, but it also influences the entire supply process and participants for making performance of the company sustainable [7]. Supply chain integration (SCI) is an approach of SCM that require contribution from supply chain partners. It is defined as “strategic collaboration of partner firms in a supply chain to manage the operational and environmental impacts of supply chain activities by coordinating the intra and inter-organizational processes” (Economic and Social Resource Council, 2015). The SCI explains that how and why green incorporation leads towards improved performance, and what and who are obligatory to be coordinated [31].

Coordination of environmental management among supply chain partners is also called as environmental collaboration (Economic and Social Resource Council, 2015). This collaboration within supply chain partners can be reduced by the supply chain integration absence. Integration of supply chain activities can probably have positive influence on cooperative activities related to environment [32]. Therefore, the SCI can be considered as “a novel concept when firms develop an approach to strategically integrate with suppliers, customers, internal, logistic, and technology to reduce environmental impacts” [16]. Successful SCI practices would contribute to reduction of environmental impacts of the supply chain [33].

2.3. Internal Integration

Internal integration means “environmental management practices conducted within a company” [34]. [15] classified internal integration as “level of integration in combining and improving information and internal resources in the company to generate knowledge sharing beyond the boundaries of individual functions or departments in reducing and preventing pollutions”. Communication and collaboration are critical for successful environmental practices that SCM includes entire departmental boundaries between and inside firms [35]. [13] focused on the impact of integration with the functional are inside the whole supply chain to advance environmental management.

Firms have faced organizational problems regarding adoption and implementation of environment friendly

practices numerous times [16]. Though, some SCM practices such as waste reduction and gaining customers competition regarding environment management would definitely demand organizational support [33]. Many firms in the market are wrapping their operations towards environmental necessities with respect to environment administration systems, environmental checking of sections, inside assessment of environmental reports, and ISO certifications 14001 [6, 36]. Consequently, internal organizational cooperation is much needed for the purpose of achieving long-term performance objectives regarding finance, society and environment. [4] examining SCM and argues that better coordination and cooperation among internal operations of an organization results in better long-term performance. Furthermore, [37] concluded that internal integration regarding SCM will enhance the economic performance of a firm. Companies with better integrated SCM are in the better position to accumulate its profits and gaining competitive position in the market [19]. [16] concluded that absence of internal integration and management support results in economic disaster.

Accordingly, [38] found significant positive association of integration with sustainable environmental performance. Formerly, [18] concluded positive effect of environmental management system (EMS) adopted by a business positively with operational performance measure like waste decrease associated with production. Internal organizational integration with the help of long-term performance mechanisms improves revenues and welfare of workers [3]. Internal organizational integration practices include experience of multi-functional collaboration and equipped with the qualified staff for environmental concerns are associated with the societal sustainable performance. Society sustainable performance involves healthier working setting, improved happiness, inspiration, participation, social obligation, and high contribution from workers [14]. Therefore, this study hypothesized.

H₁. Internal Integration has a significant positive influence on Supply Chain Performance.

2.4. Logistic Integration

Logistics integration defined as “environmental management practices of the planning, implementing, and controlling of goods or service to the point the consumer or customer is served” [39]. However, [5] demarcated logistic integration in the context of SCM that adoption of supply chain practices regarding clients and suppliers in terms of managing information and material movement along supply chain management. Logistic process can further be understood as the transportation material from one place to another place. By considering the communication flow, example of water bottles can be taken that water is an essential of life and entire critical process starts with taking water from its source and ends with the consumer usage. Important factors of consideration are transportation at the right time, correct place, and in the suitable condition. As per scope of green practices, each step of material and information flow must

meet the environmental necessities. An appropriate movement of information is required for better decision making regarding long-term performance management [40]. Conventionally, focus of supply chain remains on period, price, and correctness [41]. Alternatively, logistic integration associated with supplier and the customer perspective time productivity, cost saving, and correctness of knowledge exchange [40].

Association of logistics management and sustainable performance is a new direction for researchers [42]. [16] found that logistics management leads to improve working competences, decreases waste, make appropriation of resources, and fulfil necessities of environmental protection. Likewise, [43] indicated green supply as “which is designed not to only be environmentally friendly, but also economically functional”. Additionally, [44] argues that adoption of appropriate transportation modes can moderate environmental and cost objectives. The situation supports the verdict that environmental practice through increase in logistics can improve long term performance of firms. The discussed literature have a common conclusion that green logistic plays a vital role in reduction of firms environmental influence and improves operational efficiency of the business as well as better assets application and cost reduction. One major reason that can disturb the sustainable performance of an organization is the integration of logistics and technology [45].

In most of the manufacturing organizations, to achieve sustainable performance objectives by using logistics is a hard task without effective partnership and cooperation of supply chain associates [46]. Logistic integration plays a vital role regarding producers, contractors, and in developing suitable green logistics management [45]. The integration of supply chain participants with respect to material and information movement may possibly result in sustainable performance of an organization. Therefore, this study hypothesized on the bases of literature.

H₂. Logistic Integration has a significant positive influence on Supply Chain Performance.

2.5. Supply Chain Performance

Key elements for the measurement of supply chain performance are efficiency and effectiveness. Two other well recognised indicators of supply chain performance are cost- containment and performance reliability. First, cost-containment is associated with the activities of costs related to inbound or outbound happenings, storing costs, stocking costs, and rising asset turnover. Second, reliability indicator includes the order placement frequency, stock turns, level of safety stocks, inventory obsolesces, and product with warranty rights [47]. Performance of supply chain have been increasingly competitive more than ever before that just emphasized on cost minimizations or profit improvements [24]. In the new supply chain agenda, there are five steps to achieve supply chain excellent and real value, that included hire the right talent, adopt the appropriate technology, external collaboration, internal collaboration, and managing change in the supply chain [48]. Nowadays, the competition in the market is more among supply chains, rather than between individual companies. Therefore,

effective SCM has become a strong strategy to secure competitive edges in market competitions [49]. Subsequently, improving supply chain performance becomes a critical focus for every entity in the market competitions [50]. The study of [51] indicated that the levels of SCM mechanisms have positive and significant association with competitive advantages. Nowadays therefore, many firms are using SCM as their competitive weapons to improving performance [52]. Generally, there is different between supply chain performance and organizational performance. Supply chain performance looking for the intra-organizational and inter-organizational actual output or results, while organizational performance referred to the intra-organization or individual organizational actual output or results [53]. Therefore, this study hypothesized on the bases of literature.

- H3.** Supply Chain performance has significant positive influence on sustainable Performance of Manufacturing organizations.
- H4.** Supply Chain performance has significant mediation role between the relationship of internal integration and sustainable Performance of Manufacturing organizations.
- H5.** Supply Chain performance has significant mediation role between the relationship of logistic integration and sustainable Performance of Manufacturing organizations.

3. Research Framework:

Proposed framework of the study is presented in this section.

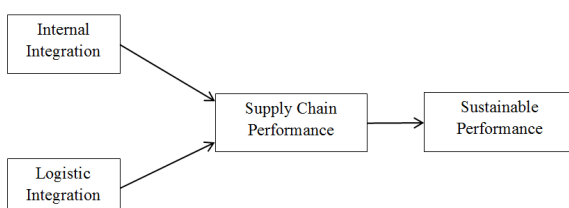


Figure 1. Proposed research framework

4. Methodology

With the focus of manufacturing firms, theoretical model of SCM performance is developed. For the purpose of analysis, data was collected from the plant level managers having focus on manufacturing sector. Data was collected from a sample of plant-level managers and supply chain managers who are working in manufacturing organizations of Thailand. Scales for the evaluation of supply chain integration, supply chain performance and sustainable performance are adapted from the previous studies. A non-probability quantitative sampling technique is used for the purpose of data collection. In line with the objectives of this research, sample was taken from the

selected manufacturing organization of Thailand. Main respondents of the research were plant managers and supply chain managers however, in the case of other than separate entities, top level executives were considered where they are responsible for Sales, manufacturing, and strategy making.

4.1. Development of the survey instrument

By reviewing the most pertinent theoretical and empirical researches, a questionnaire was developed. Questions were adapted from the previous studies. The ultimate questionnaire consists of 19 closed ended items. The questioner consists of four parts, first part was on the respondent and company profile, second parts contains the questions regarding sustainable performance, third part consists on the questions related to supply chain integration and last part contains the question regarding supply chain performance. The study used five -point Likert scale as a scale of measurement extending from “strongly disagree” to “strongly agree”. Lastly, total 250 questionnaire were getting filled by respondents among them 192 were complete in all respects that were included for analysis. So, response rate remains 77 percent. Moreover, adapted scales of sustainable performance was previously used by [27]. Scales of internal integration was adapted from [15]. Scale for logistic integration was adapted from the study of [5]. Scale for supply chain performance was adapted from the study of [54].

5. Analysis and Discussion:

This study used PLS statistical software for the purpose of analyzing data. In PLS, there is two-staged process involved for the analyzing data [55, 56]. First stage comprises on the examination of the “reliability” and “validity” of the data which is called “measurement model assessment”. Second stage consists on the assessment of study hypotheses which is called “structural model assessment”.

6. Measurement Model Assessment:

The measurement is carried out for the purpose of assessing the “reliability” and “validity” of the items of every construct. The factor loadings of the items and internal “composite reliability” (CR) use to investigate the reliability that construct. Meanwhile, “discriminant validity” (cross loadings) carried out for the assessment of construct validity. According to [57] items of scale that have loading equal to or less the 0.4 should be removed from the scale before further analysis. Therefore, the threshold value of loading for the measure reliability should be grater than 0.5, as recommended by [58]. Basically, the value of loading indicates the shared variance between the variables. The high value of loadings shows high shared variance, whereas, low value of loading shows less explanatory power of variables that

can affect the relationship between variables and goodness of model [59]. For the assessment of reliability of constructs, this study determined the value of ‘‘Cronbach’s alpha’’ and ‘‘composite reliability’’ that are presented in Table 1.

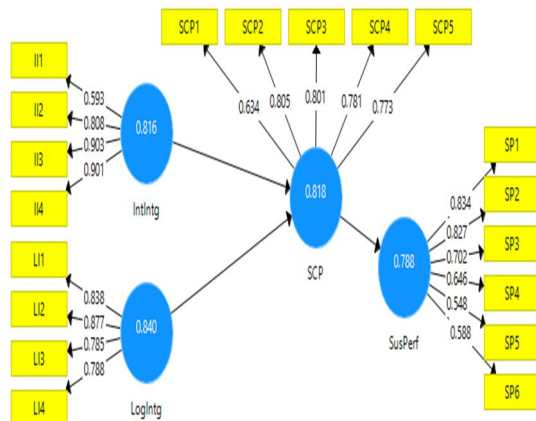


Figure 2. Measurement Model Assessment

Table 1. Values of alpha and CR:

Sr#	Const	alpha	CR
1	SP	0.723	0.804
2	Int Intg	0.903	0.889
3	Log Intg	0.814	0.786
4	SCP	0.908	0.935

‘‘Discriminant validity’’ could be explained as circumstances when two or more characteristically dissimilar ideas are not correlated to each other [60]. Moreover, ‘‘discriminant validity’’ can also be recognized by using ‘‘Fornell-Larcker’’ criterion. In this method, the ‘‘square root of AVE’’ should be higher than the correlations of any other variable. Table 2 presents that the ‘‘square root of AVE’’ for the examination of ‘‘discriminant validity’’ of this study.

Table 2. Discriminant Validity

Sr#	Const	1	2	3	4
1	SP	0.811			
2	Int Intg	0.651	0.823		
3	Log Intg	0.792	0.776	0.761	
4	SCP	0.712	0.575	0.700	0.699

7. Structural Model:

The second stage of data analysis in PLS is ‘‘assessment for structural model’’. This stage investigates the relationship between the variables. The structural model could be determined by conducting bootstrapping method [56]. Structural model assessment was performed to test the developed hypotheses relationships. This test can only

be done after measurement model analysis has ensured no violation.

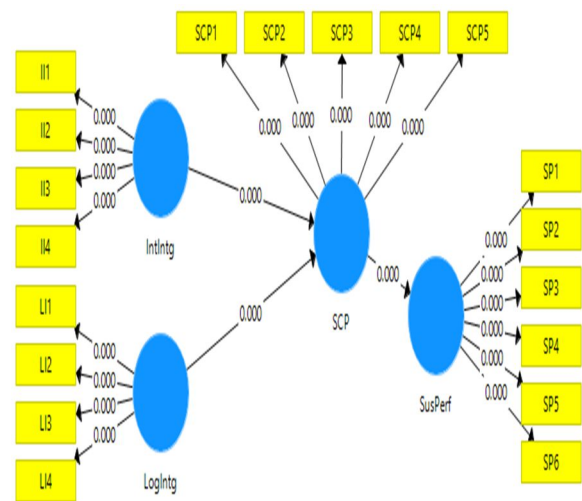


Figure 3. Structural Model Assessment

Table 3. Structural Model Assessment (Direct Results)

	β	STD	t-value	p-value
Int Intg -> SCP	0.584	0.039	15.097	0.000
Log Intg -> SCP	0.396	0.044	9.079	0.000
SCP -> SP	0.700	0.039	17.869	0.000

Structure model is carried out to investigate the proposed relationship among the variables. It has been found that internal integration has positive influence on supply chain performance. The β value 0.584 shows that internal integration positively affects supply chain performance. The t-value is 15.097 which is higher than the threshold value that is 1.96. Therefore, hypothesis H1 is supported. These findings are in line with the study of [1], who argued that internal integration like internal assessment is positively influence to the performance of any organization and have a relationship in many areas of supply chain performance.

Findings also indicated that logistic integration also has a significant and positive association with supply chain performance with coefficient of 0.396. Therefore, hypothesis H1 is supported. The t-value is 9.079 which is higher than the threshold value that is 1.96. Although previous studies [4,5] have confirmed on the significance of logistic integration and supply chain performance. Moreover, the variable of logistic integration has been proposed with the aim to enrich the supply chain integration. According to [6] and [7], the integration of logistics and supply chain performance linkage in environmental management scope is still a new phenomenon. Therefore, hypothesis H2 is supported. Lastly, as for relationship of supply chain performance (SCP) with sustainable performance (SP), the coefficient

of 0.700 and t-value of 17.869 indicates the significance positive effect. Therefore, hypothesis H3 is supported.

Table 4. Structural Model Assessment (Indirect Results)

	β	STD	t-value	p-value
Int Intg-> SCP-> SP	0.409	0.033	12.298	0.000
Log Intg -> SCP-> SP	0.277	0.037	7.478	0.000

Moreover, the findings of mediation effect are presented in Table 4. It is found that SCP significantly mediates the association between internal integration and sustainable performance of the Thai manufacturing organizations. Furthermore, it also has a significant mediation role between logistic integration and sustainable performance.

8. Conclusion:

Objective of this research was to investigate the effect of supply chain integration on sustainable performance of Thai manufacturing firms with the mediation effect of supply chain performance. This study adopted quantitative research approach to achieve the objective study. Survey questioner was carried out for the collection of data. The respondent of this study was plant managers and supply chain of the manufacturing organizations. SMART-PLS statistical software was applied for data analysis and "structural equation modeling" (SEM) method was applied for the assessment of hypotheses of the study. The Results of study indicated that internal integration has positive association with supply chain performance and sustainable performance of the manufacturing firm of Thailand. Moreover, logistic integration also has significant and positive association with supply chain performance and sustainable performance of manufacturing organizations.

These findings indicated that supply chain integration has a vital role in sustainable performance of the manufacturing firms and supply chain performance has significantly mediated the association of supply chain integration with sustainable performance of Thai manufacturing firms. The study is important for managerial decision and it can contribute valued perceptions for manufacturing firms in the development of supply chain strategy. This study provides a fresh insight to plant managers and managers of supply chain to understand the risks and opportunities that face manufacturing business for sustainable performances. The findings clearly indicated that internal and logistic integration is very important to improve sustainable performance.

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