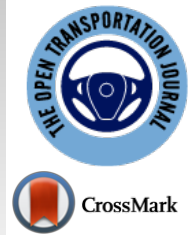




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## RESEARCH ARTICLE

### The Mediating Role of Transportation Practices during the COVID-19 Crisis in Thailand

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#### Abstract:

#### Objective:

This study aimed to investigate the influence of organisational driving forces on transportation practices during the COVID-19 crisis and the effect on the sustainability supply chain performance of Thailand's logistics service providers.

#### Methods:

The study used the explanatory-sequential mixed-method research design technique. The sample included 250 logistics service providers in Thailand. Purposive sampling was used to select the sample. A focus group discussion was conducted with three logistics experts and seven logistics service provider's top executives, totalling ten key informants. The data gathered was analysed using structural equation modelling to perform a confirmatory factor analysis and path analysis.

#### Results:

The results found that organisational driving forces and transportation practices during the COVID-19 crisis have typically affected sustainability supply chain performance. In addition, the mediation effects of transportation practices during the COVID-19 crisis have unveiled partial mediation in the presence of a direct effect. The qualitative study was found to be consistent with the quantitative method findings from the logistics industry-specific contexts.

#### Conclusion:

Overall, the results provide support for the contention of the contingency theory. Thailand logistics service providers can use the results to plan the supply chain management works, outline the strategy of the organisation, and develop the business to be more competitive.

**Keywords:** Sustainability supply chain performance, Organisational driving forces, Transportation practices, COVID-19, Crisis, Logistics service provider.

#### Article History

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## 1. INTRODUCTION

The logistics industry is one of the main industries growing and generating income continuously in Thailand, such as the Thai Post Office with a revenue of 30,000 million baht and Kerry Express with a revenue of 7,000 million baht [1]. The industry is supported by the government with the objective of pushing to promote Thailand as an ASEAN hub for production

and export market, including service business, automotive industry, and quality decorative accessories in the world market since Thailand has a high potential in terms of location and has modern production technology with international standards. In addition, there is a suitable location for the transportation of products. Nowadays, it is necessary that all sectors in Thailand must turn to consider the importance of sustainable supply chain management amongst Logistics Service Providers (LSPs) in order to generate massive income into the country [2].

However, during the crisis, the spread of Coronavirus or

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COVID-19 has disrupted industry growth. Logistics companies face tremendous challenges to reorganise to successfully deliver the goods on time to customers due to the difficulty in supply chains [3]. The automotive industry has been affected by the procurement of auto parts due to the widespread outbreak of COVID-19 in China. The crisis has occurred rapidly in recent years and has led to the closure of cities and countries. Moreover, the COVID-19 epidemic in Europe and America is happening rapidly. It affects the international shipping businesses both by boat and air, which require longer transit times or cannot transport products across the country. As a result, the size of the fleet has been reduced and flights have been cancelled continuously to sustain the business from the impact of the COVID-19 epidemic [4]. In addition, cross-border transportation between neighboring countries has also been affected by the border closures in some provinces, resulting in breaking the physical flow in terms of products and tourists [5]. As for the borders which are still open, there are strict screening measures, resulting in an increase in the time required for the transportation of goods or tourists [6]. The social distancing measures adopted by Thailand have evidently implicated LSPs in Thailand with delays in delivery times of approximately 0.2 days [3]. Such an epidemic has now negatively affected Thailand's LSPs momentarily [7].

Therefore, this research aimed to study the causal relationship of the organisational driving forces which have had positive effects on transportation practices during the COVID-19 crisis and have affected the sustainability supply chain performances of Thailand's LSPs. The paper is organised with a literature review on the sustainable supply chain performance, transportation practices during the COVID-19 crisis, and the organisational driving forces after the introduction section. This is followed by the methods, which are further elaborated using the explanatory-sequential mixed method. In the subsequent section, the findings are presented, with the conclusion and implications being discussed in the last section of the paper.

## 2. LITERATURE REVIEW

### 2.1. Sustainable Supply Chain Performance

A sustainable supply chain is an interaction between sustainability and a supply chain which is an important step from the latest operational and environmental audits and operational sustainability [8]. The sustainable supply chain performance dimensions comprise economic performance, environmental performance, social performance, and institutional performance [9].

First, economic performance is the most important incentive to implement a sustainable supply chain [10, 11]. Sustainable jobs may not generate positive profits and short-term sales due to very high initial costs. However, these guidelines will help companies improve their long-term performances by continuously improving their ability to manage environmental risks and improve environmental and social performances [12]. In this study, there are two aspects of economic performance, which are the marketing and financially operational results. Performance refers to the extent to which companies improve costs, quality, delivery, and

flexibility [13, 14]. Work accomplishment relates to the company's competitiveness, meaning the actual or accepted competitiveness of the manufacturer as compared to the main competitors in the target market [15]. In the sustainable development era, performance is less important when compared to other indicators [15, 16].

Second, environmental performance is an executive's concern because it is a requirement related to compliance and regulatory necessities under public awareness, including desires for organisational competitive advantages [12]. For example, reducing energy can improve environmental performance [17]. Environmental performance is also known as the achievement of an organisation regarding performance related to pollution control and efficient use of resources [18]. With an increasing demand for environmental and social performance, organisations do not only have to consider efficiency, costs, delivery, quality, and flexibility, but also the environmental and social performance. Environmental and social efficiencies are very important. The organisation's goal is to gain a sustainable competitive advantage [19].

Third, the social performance consists of three parts which are social responsibility, social issues, and philosophy of social response. Performance in social sustainability consists of 5 indicators, including human rights, employment problems, supplier relationships, community initiative, and public relations for corporate social responsibility [20]. The development of balanced scorecards to be in line with the environment and society and organisational performance in the stakeholder's view is a difficult task and has the nature of the complexity of social practices [21].

Fourth, institutional performance is another important factor that supports sustainable development, in addition to economic, social, and environmental performances. For the integration and importance to environmental protection, economic, social, and ecological sustainability are organised together by institutional sustainability as driving factors. This is a practical framework for assessing sustainability [22].

### 2.2. Transportation Practices during the COVID-19 Crisis

Logistics and supply chain practices (LSCPs) are the practices relating to an organisational system, the people, technology, activities, information, and resources involved in moving products or services from suppliers to customers. Excellent LSCPs, especially transportation as a part of logistics, lead the companies to sustainably higher profitability [23]. A good transportation plan is necessitated for the LSPs in Thailand to perform well for the customers [24]. Particularly, transportation practices during the COVID-19 crisis are very important to multinational companies. The efficient transportation practices can make the companies survive and recover quickly during or after the COVID-19 outbreak. The firms need to increase resilience and agility and focus on cost savings. The companies, besides that, should forecast customer demand accurately. They, moreover, should adapt new technologies and digitalisation trends to the traditional logistics strategies during the COVID-19 crisis [25].

Although there are various past studies on the dimensions of transportation practices [26, 27], the study focused on the

strategies the transportation companies adapted for the COVID-19 crisis in Thailand. Transportation practices during the COVID-19 crisis, therefore, consists of outsourcing, warehousing, and partnership [28]. Outsourcing refers to jobs done for a company by other companies. In the case of COVID-19 adaption, transportation companies hire more outsourcing carriers to deal with the problems of delays because of the higher numbers of online transactions during the COVID-19 crisis.

Moreover, warehousing is used to describe the merchandise storage, which would be distributed later. Location-distributed warehousing has been the strategy transportation companies have used to reduce the negative impacts when the government limits the period of transportation during the COVID-19 crisis. Finally, a partnership is defined as a relationship of two or more firms doing business for joint advantages. During the COVID-19 crisis, transportation companies have initially found their partners, especially international partners, as they have the technology to support express delivery.

### 2.3. Organisational Driving Forces

Organisational driving forces are the factors that affect the decisions and strategies a firm makes to create competitiveness, comprising fundamental competencies, employee turnover, and product and technological innovations [29]. A past study has pointed out three main organisational driving forces: top management, organisational culture, and employee motivation.

Top management refers to the highest management within the organisation itself with the duty of resource management, marketing, and work planning, including setting visions, missions, goals, and policies to give the direction for the organisation to be successful in the future [30]. Organisational culture is defined as an organisational environment that incorporates the assumptions, beliefs, and values shared by the members of the organisation and serves as a practical way of working in order to interact with the formal structures to shape behavior [31]. Employee motivation is about the needs and desires of the employee's mind. This will drive an employee to have certain behaviours that change from the original. In other words, it is an employee's efforts and willingness to work more than an unmotivated employee, on the condition that the behaviour can create satisfaction for that employee [32].

### 2.4. Underpinning Theory

The study has utilised the foundation of contingency theory in guiding the overall framework of the study. In this theory, companies operate under conditions that depend on the environment they deal with. This way is the most appropriate for the companies to face their unique business environments [33]. Through the lens of the contingency theory, this study has signified that the LSPs in Thailand can achieve sustainable supply chain performances through the transportation practices during the COVID-19 crisis through the specific organisational driving forces. The current situation of the COVID-19 pandemic has forced the LSPs to counter internally and

strategise the transportation practices to achieve sustainable performances and survive during the COVID-19 outbreak. Fig. (1) shows the theoretical framework of the study.

### 2.5. Hypothesis Development

Organisational drivers are the key factors in leading the companies to sustainability and strategic practices in the future [34, 35]. Moreover, it depicted that organisational factors, such as learning organisation and organisational commitment, positively affect supply chain performance [36]. Besides that, it is suggested that practices on logistics and supply chains within and outside business organisations lead to sustainable supply chain performance. In relation to this, organisations are typically motivated to achieve environmental sustainability by minimising the effects of transportation, such as GHG emissions, less fuel consumption, and maximising networking [37]. The decision pertaining to environmental performance is crucial for the managers to optimise the transport routes in order to achieve cost savings and less pollution [38, 39]. Additionally, it was found [40] that the transportation practices [25], during the COVID-19 outbreak, can enhance supply chain performance as a consequence of the companies driving forces. As companies find partnerships and change their forms of outsourcing and warehousing for the transportation practices during COVID-19, they can enhance their economic, environmental, and social performances; this study, therefore, has hypothesised that:

H1: Organisational driving forces have direct positive effects on sustainable supply chain performance.

H2: Organisational driving forces have direct positive effects on transportation practices during the COVID-19 crisis.

H3: Transportation practices during the COVID-19 crisis have a direct positive effect on sustainable supply chain performance.

H4: Transportation practices during the COVID-19 crisis mediates an effect of the organisational driving forces on sustainable supply chain performance.

### 2.6. Research Methodology

The explanatory-sequential mixed-method research design was used in the study. In this approach, the study utilised the quantitative data, which was clarified by the subsequent interpretation from the qualitative data [41]. The researchers collected data by using questionnaires with executives of the LSPs in Thailand to attain broad information. The questionnaire comprised 34 questions in measuring research variables of Organisational Driving Forces, Transportation Practices during COVID-19, and Sustainable Supply Chain Performance, developed from concepts using previous research [15, 19, 21, 22, 26, 30 - 32]. Besides, the qualitative method utilised a focus group to confirm the results [42]. Data was collected during the relief of the COVID-19 epidemic in Thailand since the government cancelled the "Curfew and Lockdown", which was COVID-19 defensive measures, becoming effective on June 1, 2020 [7]. The data collection was conducted from June 2020 until August 2020 during the COVID-19 epidemic to estimate realistic predictions of the study's hypotheses (Appendix Table 1-3).

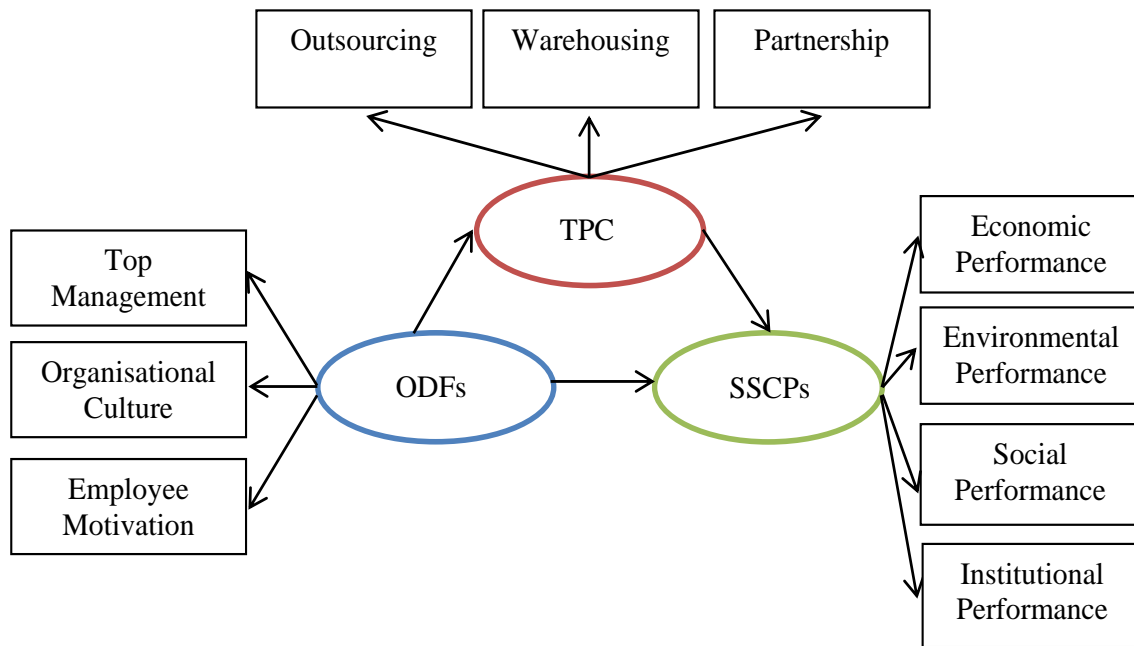


Fig. (1). Theoretical Framework.

The sample was 250 LSPs in Thailand. The sample size was adequate based on 10 times the number of parameters in the research model, by which it was equivalent to the minimum of 230 LSPs based on 23 parameters used in this study [43]. In addition, a test using G\*Power software version 3.1.9.2 with the power of a statistical test of 0.95 [44] and a maximum of three predictors pointing at a construct anywhere in the PLS path model signified a sample size of the minimum of 119, of which 250 samples were a sufficient sampling size for the study [45]. In addition, purposive sampling was used to select the sample. After the data were completely gathered and

analysed using Pearson’s correlation coefficients, Bartlett’s Test of Sphericity Chi-Square, Standard Deviation, Cronbach’s alpha coefficients, Average Variance Extracted (AVE), Maximum Shared Variance (MSV), Average Shared Variance (ASV) of the Confirmatory Factor Analysis (CFA) and path analysis, the focus group was conducted with three logistics experts and seven LSPs’ top executives, totaling ten key informants. The focus group discussion was qualitative research in nature, and the output is observational data captured in real-time to retrieve the natural setting perspectives from the industry. The overall research process is shown in Fig. (2) below.

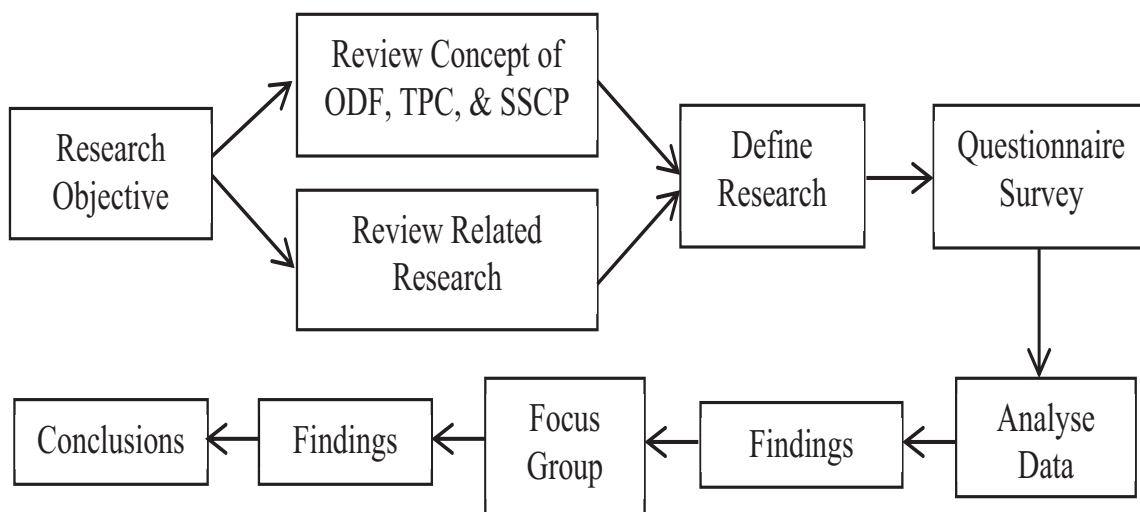


Fig. (2). Research Process.

**Table 1. Correlation analysis.**

Variables	ODF	TPC	SSCP
ODF	1	-	-
TPC	0.845**	1	-
SSCP	0.855**	0.881**	1
Mean	4.538	4.524	4.519
S.D.	0.462	0.470	0.487
Bartlett's Test of Sphericity Chi-Square = 1757.219; df = 6, p = .000			

Note: \*p < .01, \*\*p < .05.

ODF: Organisational Driving Forces, TPC: Transportation Practices during COVID-19 Crisis, SSCPs: Sustainable Supply Chain Performances

As shown in Fig. (2), from the research problem and research objectives, the study reviewed concepts from the past research; Organisational Driving Forces, Transportation Practices during the COVID-19 Crisis, and Sustainable Supply Chain Performance. The literature review was carried out on the related study published from the year 2016 until 2020. Based on the reviews, a research design explanatory-sequential mixed-method research has been initiated, the survey was conducted in the first stage. The study did data analysis by utilizing structural equation modelling through AMOS software. Besides, a focus group discussion was carried out, on which the findings were used to support the results from survey methodologies. The subsequent stage is discussion and ends with a conclusion of the study.

### 3. RESULTS

The results of the correlation analysis amongst the three latent variables: organisational driving forces, transportation practices during the COVID-19 crisis, and sustainable supply chain performance, found that all of them had correlation coefficients different from zero with statistical significance at the level of 0.01, as shown in Table 1. The most correlated variables were transportation practices during the COVID-19 crisis and sustainable supply chain performance (0.881),

followed by organisational driving forces and sustainable supply chain performance (0.855), and organisational driving forces and sustainable supply chain performance (0.845), respectively, by which all variables were correlated in the same direction, as shown in Table 1.

Construct validity was examined using CFA to inspect the observed variables in terms of consistency with the empirical data. Testing the results of the measurement model, as shown in Table 2, portrayed that all observed variables were at high levels, with the means being from 4.49 to 4.53. In addition, the first-order loadings (0.42-0.84) and Cronbach's alpha coefficients (0.83-0.89) were acceptable [46].

Moreover, the measurement models of the organisational driving forces, transportation practices during the COVID-19 crisis, and sustainable supply chain performance were considered in terms of reliability, convergent validity, and discriminant validity with the criteria of CR > .70; Convergent validity: AVE > .50; Discriminant validity: AVE > MSV; CR = composite reliability; AVE = average variance extracted; MSV = maximum shared variance; and ASV = average shared variance [44, 47], as shown in Table 3. Furthermore, the Goodness of fit by 2<sup>nd</sup> order CFA depicted passing values based on indices [48], as shown in Table 4.

**Table 2. Testing results of the measurement model.**

	Items' no.	EQ/O(x,-)	SD	Interpret	1 <sup>st</sup> order loading	$\alpha$	Remarks
-	-	-	-	-	-	-	-
<b>Organisational Driving Forces</b>	-	-	-	-	-	-	-
Top executives	4	4.52	0.50	High	(0.42-0.75)	0.86	Acceptable
Organisational culture	4	4.53	0.47	High	(0.55-0.84)	0.84	Acceptable
Employee Motivation	4	4.52	0.49	High	(0.55-0.65)	0.88	Acceptable
<b>Transportation Practices during the COVID-19 crisis</b>	-	-	-	-	-	-	-
Outsourcing	3	4.52	0.50	High	(0.65-0.80)	0.85	Acceptable
Warehousing	3	4.51	0.52	High	(0.68-0.84)	0.88	Acceptable
Partnership	3	4.53	0.51	High	(0.72-0.82)	0.86	Acceptable
<b>Sustainable Supply Chain Performances</b>	-	-	-	-	-	-	-
Economic Performance	5	4.51	0.51	High	(0.45-0.75)	0.83	Acceptable
Environmental Performance	5	4.52	0.52	High	(0.61-0.71)	0.89	Acceptable
Social Performance	5	4.49	0.50	High	(0.60-0.72)	0.87	Acceptable
Institutional Performance	5	4.50	0.47	High	(0.59-0.70)	0.85	Acceptable

**Table 3. Reliability, and convergent and discriminant validities.**

	CR	AVE	MSV	ASV
Organisational Driving Forces (ODFs)	0.837	0.520	0.491	0.476
Transportation Practices during the COVID-19 Crisis (TPC)	0.843	0.525	0.476	0.464
Sustainable Supply Chain Performances (SSCPs)	0.859	0.578	0.493	0.480

Notes: Threshold of reliability: CR>.70; Convergent validity: AVE>.50; Discriminant validity: AVE>MSV; CR = composite reliability; AVE = average variance extracted; MSV = maximum shared variance; and ASV = average shared variance.

**Table 4. Goodness of fit by 2<sup>nd</sup> order CFA.**

Index	P value	$\chi^2/df$	CFI	GFI	AGFI	RMSEA	Critical N	SRMR	Remarks
	>0.05	<2	>0.95	>0.95	>0.95	<0.05	>300	<0.05	
ODF	0.55	1.58	1.00	0.99	0.97	0.016	785	0.04	pass
TPC	0.69	1.25	1.00	0.98	0.96	0.000	622	0.02	pass
SSCP	0.72	1.66	1.00	0.99	0.98	0.023	568	0.04	pass

Notes: ODFs: Organisational Driving Forces, TPC: Transportation Practices during COVID-19 Crisis, SSCP: Sustainable Supply Chain Performances.

As shown in Table 5, hypotheses 1-4 were supported with statistical significance at levels of P-value<0.001. The table showed the C.R. (critical ratio) or T-Values of the testing results of all the hypotheses, except the hypotheses on the mediation effects as they were not calculated in AMOS. The testing results of hypothesis 1 described the T-value of 5.085. The testing results of hypothesis 2 indicated the T-value of 7.764. The testing results of hypothesis 3 described the T-value of 4.267. These T-values met the acceptable criterion of C.R. or T-value>1.96 [49].

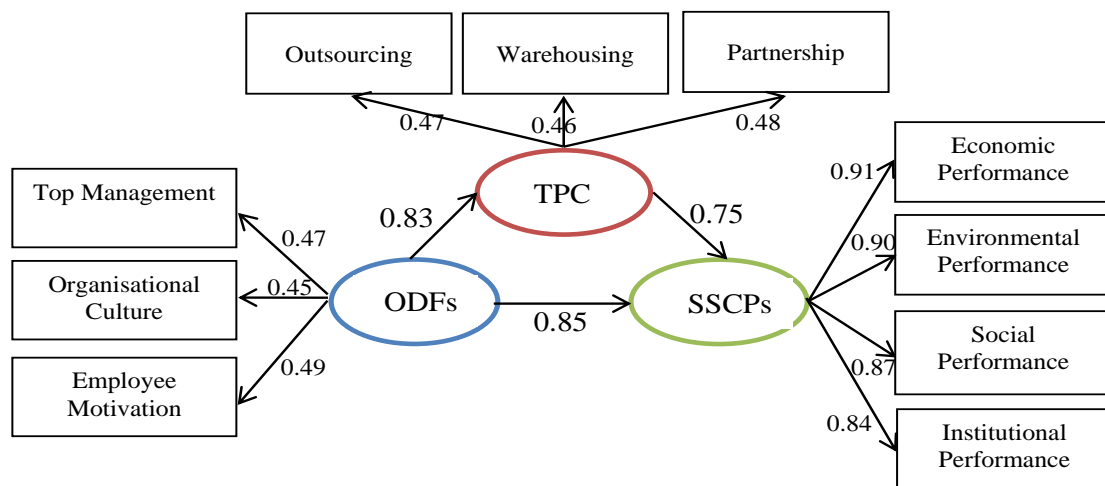
Path analysis by structural equation modelling was used to

test the 4 hypotheses comprising the proposed model of the effects of the organisational driving forces and transportation practices during the COVID-19 crisis on sustainable supply chain performances, the effect of the organisational driving forces on transportation practices during the COVID-19 crisis, including the mediating roles of transportation practices during the COVID-19 crisis on the effect of the organisational driving forces on sustainable supply chain performances of the LSPs in Thailand. The model fit analysis results were acceptable (Chi-square= 139.21; degree of freedom=72; P=0.57; relative chi-square=1.440; GFI=.972; AGFI=.941; TLI=.990; CFI =0.96; RMR=.009; and RMSEA=.048). The results are presented in Fig. (3).

**Table 5. Hypotheses testing direct effects results.**

Hypothesis	Path	(β)	S.E.	T-Value	Results
H1	Organisational Driving Forces Sustainable Supply Chain Performances	0.85**	0.65	5.085	Supported
H2	Organisational Driving Forces Transportation Practices during COVID-19 Crisis	0.83**	0.72	7.764	Supported
H3	Transportation Practices during COVID-19 Crisis Sustainable Supply Chain Performances	0.75**	0.57	4.267	Supported

Note: \*\*\* = p < 0.001, \*\* = p < 0.01, \* = p < 0.05; β=standardised coefficients; S.E.=standard error; Threshold of acceptable hypothesis: T-value>1.96.



**Fig. (3).** Structural Equation Modelling.

In addition, the study has taken the mediation analysis using the SEM [50] as the source of reference. The Sobel-z test [51] was established in the study to test the comparative size of the mediating path with the direct paths. H4 tested the mediating effect of transportation practices during the COVID-19 crisis on the relationships between organisational driving forces and sustainable supply chain performances. The result in Table 6 showed the significant path coefficient ( $\beta$ ) for  $X \rightarrow M$  (a) = 0.83, significant path coefficient for  $M \rightarrow Y$  (b) = 0.75, and also significant path coefficient for direct path  $X \rightarrow Y$  (c) = 0.85 at the significance level of 5% ( $p < 0.05$ ), with insignificant Sobel’s test statistics = 0.867 with the proportion of mediation = 0.423. Since there was a significant path for the direct path (c) with Sobel z being insignificant thus, the mediation effects of transportation practices during COVID-19 had partial mediation in the presence of a direct effect.

Furthermore, the qualitative study was performed using a focus group discussion. Based on the summary of the verbatim transcription analysis in Table 7, the study found that the majority of the key informants (78%) have verified the applicability of the studied variables in the context of their organisations for the constructs of organisational driving forces, transportation practices during the COVID-19 crisis, and sustainable supply chain performances. On the effects, most of the respondents suggested that organisational driving

forces influenced transportation practices during the COVID-19 crisis and sustainable supply chain performances. Likewise, organisational driving forces and transportation practices during the COVID-19 crisis were also found to have impacted the LSPs’ sustainable supply chain performances. Besides that, the informants also confirmed that as for the transportation practices during the COVID-19 crisis, the mediator of the model in the study could enhance the relationships between organisational driving forces and sustainable supply chain performances.

**4. DISCUSSION**

The purpose of this study was to assess the influence of the organisational driving forces construct, which has been conceptualised through the top management, organisational culture, and employee motivation, on transportation practices during the COVID-19 crisis, which corresponded to the outsourcing, warehousing, partnership, and sustainable supply chain performances which were measured through the economic performance, environmental performance, social performance, and institutional performance. This study has utilised the contingency theory to determine the best way for the LSPs’ in Thailand to conduct the transportation practices during the COVID-19 pandemic in order to continue to sustain their businesses during these difficult times.

**Table 6. Hypotheses testing indirect effects results.**

Hypothesis	Independent (X)	Mediator (M)	Dependent (Y)	X→M (a)	M→Y (b)	Direct X→Y (c)	SEa	SEb	Sobel Z	Proportion of Mediation	Remarks
H4	ODF	TPC	SSCP	0.83	0.75	0.85	0.72	0.57	0.867	0.423	X→Y is significant, but Z is insignificant partial mediation in the presence of a direct effect

Note: ODFs = Organisational Driving Forces; TPC = Transportation Practices during the COVID-19 Crisis; SSCPs = Sustainable Supply Chain Performances.

**Table 7. Summary of the Findings for the Qualitative Content Analysis.**

No.	Informant	-	-								-
		TM	OC	EM	OU	WA	PA	EC	EN	SP	IP
1	A	√	-	-	√	√	√	√	-	√	√
2	B	-	√	√	√	-	-	√	√	-	√
3	C	√	√	√	√	√	√	√	√	√	-
4	D	-	√	√	√	√	√	√	√	-	√
5	E	√	√	√	-	-	√	√	√	√	-
6	F	-	-	√	√	√	√	√	√	√	√
7	G	√	√	√	√	√	√	√	√	-	-
8	H	√	√	√	√	√	√	√	√	√	-
9	I	-	√	√	√	√	√	-	-	√	√
10	J	√	√	√	√	√	√	√	√	-	√
	Total	6	8	9	9	8	9	9	8	6	6
	Percentage Total	60 78%	80	90	90	80	90	90	80	60	60

Note: TM = Top Management, OC = Organisational Culture, EM = Employee Motivation, OU = Outsourcing, WA = Warehousing, PA = Partnership, EC = Economic Performance, EN = Environmental Performance, SP = Social Performance, and IP = Institutional Performance.

Based on the results, it showed that the organisational driving forces had positive influences on transportation practices during COVID-19. This signified that top management and organisational culture supported teamwork in the firms so that the employees utilised their knowledge and skills considerably to acquire the innovative practices in transportation [52], finding that more innovative behaviours could be elicited by a high level of leadership styles and organisational culture [53]. Besides that, employees were motivated to do their best transportation practices since they wanted to achieve well-being during COVID-19 [54, 55] on motivation in human resource practices.

In addition, the results revealed that transportation practices during the COVID-19 crisis having positive influences on LSPs' sustainable supply chain performances had been supported. This is because outsourcing, warehousing, and partnership practices could improve the LSPs' sustainable supply chain performances since during COVID-19 doing practices with supply chain partners could tackle the transportation problems and make more value for the company services through learning from supply chain partners to improve the firms' technologies, managing human resources effectively, and satisfying customer needs in terms of perfect order fulfillment. This case was in line with another research [56], suggesting that supply chain practices on outsourcing, vendor managed inventory, and relationships could boost up manufacturing organisations' performances and competitiveness.

Furthermore, the study found that organisational driving forces had a significant positive influence on LSPs' sustainable supply chain performances. Such findings have proven that top management has recovered the LSPs' profits lost during COVID-19 as they were responsible for planning budgets and seeking profitability to enhance sustainable supply chain performances [57] on the moderating effect of top management on supply chain performance and firm sustainability. Besides that, since organisational culture and employee motivation have generated cooperation within an organisation, employees have worked in the same direction and with quality to achieve the LSPs' goals and sustainable supply chain performances [58] on the role of motivations in driving sustainable supply chain management practices and sustainable performances [59], investigating a competitive culture is related to sustainable supply chain management and organisational performances.

Finally, the results of the study found the partial mediation effects of transportation practices during the COVID-19 crisis on the relationships between organisational driving forces and LSPs' sustainable supply chain performances. This had happened when some of LSPs occasionally hired taxi drivers to deliver the items to increase the speed of delivery and to help unemployed drivers during the COVID-19 crisis. In addition, some of the LSPs stored their products in out-of-town warehouses in several areas, such as Samut Sakhon, Samut Prakan, and Chachoengsao, to prepare for curfew situations announced by the government so that their deliveries were efficient. They even asked Korean firms to provide the service on the Cold Chain Express Delivery for their processed

products to improve the LSPs' sustainable supply chain performances. However, despite relying on the existing systems, many of the LSPs emphasised the development of the firms' online applications and systems to provide the customers with the convenience in placing orders, making payments, and receiving products. The use of information technology platforms is an alternate driving force in the current COVID-19 pandemic scenario [60] for the LSPs to achieve sustainable supply chain performances.

Besides that, the results of the study unveiled, in terms of organisational driving forces, that employee motivation is the most important factor, followed by top management and organisational culture, respectively, with the partial mediation effect of transportation practices during the COVID-19 crisis, which was comprised of significant factors, such as partnership, outsourcing, and warehousing. These results are in line with past studies [9, 14, 19]. In addition, the testing results of the causal relationships are consistent with other studies [8, 13, 14, 17, 18, 20].

In relation to this, Thailand's LSPs can use the research results obtained to properly and appropriately plan the supply chain management works, outline the strategy of the organisation, and develop the business to be more competitive. To increase sustainable supply chain performances of Thailand's LSPs, there should be more studies on logistics' flexibility, supply chain integration, supply chain collaboration, and business intelligence [40, 61]. Academicians, moreover, can use the research results to develop and create new knowledge on sustainable supply chain performance as there are limited studies available, and the concept can be applied to further research in similar dimensions to create new knowledge in other industries by adjusting the sample and the model in terms of other variables that affect the sustainable supply chain performance in the future.

## **CONCLUSION**

The findings on the causal relationship model found that the LSP's sustainable supply chain performance should focus on economic performance, environmental performance, social performance, and institutional performance, respectively. Furthermore, the organisational driving forces and transportation practices during the COVID-19 crisis, which have typically affected the LSP's sustainable supply chain performance, should be concentrated on economic performance, environmental performance, and social performance. To achieve sustainable supply chain performances, LSPs should start within their own organisations; by which, from the top management until the stakeholders, they must have clear planning and guidelines, including continuous follow-up to drive the organisations towards sustainability in the supply chains. Moreover, the qualitative study was consistent with the quantitative method through a focus group discussion, which found that the key informants agreed with the variables offered since LSPs have some industry-specific contexts.

In relation to this, the study used qualitative data captured in real-time to support quantitative research findings. The qualitative method was adopted as appropriate for exploring



people’s ‘lived experience’ and focusing on ‘naturally occurring ordinary events in natural settings’. The characteristics of observation data can provide a more reliable measurement of actual behaviour, which can significantly enhance this study's findings. Using real-time applications of the qualitative data during the COVID-19 epidemic in this study is significant in improving the LSPs performance and aligning with the curfew defensive measure in Thailand. This circumstance illustrates the need for qualitative data in determining the real LSPs strategy, particularly in facing the peak where the risk of COVID-19 increases is observed in the future.

Overall, the results provide support for the contention of the contingency theory. Through the lens of contingency theory, this study has denoted that the LSPs in Thailand can achieve sustainable supply chain performances (economic performance, environmental performance, social performance) through the transportation practices during the COVID-19 crisis (outsourcing, warehousing, partnership) by way of the specific organisational driving forces (top management, organisational culture, employee motivation).

Based on the outcome of this study, it is suggested that the technological adoption factor should be added in the context of achieving Sustainable Supply Chain Performance development today, as suggested by some key informants, since during the COVID-19 crisis, the customers have changed their behaviours by using e-commerce services. As a result, the firms should digitalise themselves to respond to the new customers’ new requirements. This reflects that digital connectivity with consumers is absolutely important during and after the COVID-19 crisis. Besides, transportation practices of LSPs during the COVID-19 crisis appeared in COVID-19 epidemic

round 1 (March-June, 2020) in Thailand, which allow LSPs to be well-prepared in their business operations since COVID-19 epidemic second round in Thailand has begun in December 2020.

Future research should focus on different dimensions of transportation practices during COVID-19, especially digitalisation due to the customer behaviour change and the effect of external driving forces, such as regulations, and social and marketing pressures on sustainable supply chain performance, to offer guidance to LSPs more comprehensively since the study investigated only internal driving forces.

**CONSENT FOR PUBLICATION**

Not applicable.

**AVAILABILITY OF DATA AND MATERIALS**

The raw and processed data and materials required to reproduce the above findings cannot be shared due to privacy and ethical reasons.

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None.

**CONFLICT OF INTEREST**

None.

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Declared none.

**APPENDIX**

Survey Questionnaire.

**Appendix Table 1. On a scale of 1 = strongly disagree to 5 = strongly agree, in terms of Organizational Driving Forces, your firm has been able to achieve all the following.**

	<b>Top Management</b>	1	2	3	4	5
1	Top management vision focused on environment	-	-	-	-	-
2	Top management vision focused on corporate social responsibility	-	-	-	-	-
3	Top management vision focused on the improvement of quality of life in related communities	-	-	-	-	-
	<b>Organisational Culture</b>					
4	Participation in related local community development	-	-	-	-	-
5	Responsibility for sustainable management given to specific persons	-	-	-	-	-
6	Evaluation to increase environmental management efficiency	-	-	-	-	-
	<b>Employee Motivation</b>					
7	Supporting employees in hazardous waste reduction	-	-	-	-	-
8	Supporting employees and stakeholders in environmental management	-	-	-	-	-
9	Emphasizing the improvement of employees’ quality of life	-	-	-	-	-

**Appendix Table 2. On a scale of 1 = strongly disagree to 5 = strongly agree, in terms of Transportation Practices, your firm has been able to achieve all the following.**

	<b>Outsourcing</b>	1	2	3	4	5
1	Jobs done for your firm by outsourcing firms during the COVID-19 crisis	-	-	-	-	-
2	Dealing with the problems of delays by outsourcing carriers during the COVID-19 crisis	-	-	-	-	-
3	Responsiveness to higher numbers of online transactions by the support from outsourcing carriers during the COVID-19 crisis	-	-	-	-	-
	<b>Warehousing</b>					

(Table App.) contd.....

4	Decentralized warehousing used to reduce the negative impacts when the government limits the period of transportation during the COVID-19 crisis	-	-	-	-	-
5	Adjusting replenishment in time and quantity corresponding to consumer behavior during the COVID-19 crisis	-	-	-	-	-
6	Increase in the size of warehouse area to support high customer demand during the COVID-19 crisis	-	-	-	-	-
	<b>Partnership</b>	-	-	-	-	-
7	Express delivery technologies supported by business partners during the COVID-19 crisis	-	-	-	-	-
8	Reduction in risk of supply shock by collaborating with various suppliers during the COVID-19 crisis	-	-	-	-	-
9	Communication with customers to follow demand trends during the COVID-19 crisis	-	-	-	-	-

**Appendix Table 3. On a scale of 1 = strongly disagree to 5 = strongly agree, in terms of Sustainable Supply Chain Performance, your firm has been able to achieve all the following.**

	<b>Environmental Performance</b>	1	2	3	4	5
1	Reduction in solid and water waste	-	-	-	-	-
2	Reduction of environmental accidents	-	-	-	-	-
3	A decrease in consumption of hazardous /toxic materials	-	-	-	-	-
4	Improvement in environmental compliance	-	-	-	-	-
5	Reduction in health and safety incidences	-	-	-	-	-
	<b>Social Performance</b>	-	-	-	-	-
6	Improvement in the image as "a good place to work in"	-	-	-	-	-
7	Enhancement of corporate image as an ethical organization	-	-	-	-	-
8	Firm improved employee or community health and safety	-	-	-	-	-
	<b>Economic Performance</b>	-	-	-	-	-
9	Reduction in costs of manufacturing and distribution	-	-	-	-	-
10	Increase in sales of products	-	-	-	-	-
11	Increase in organizational profits and profit margins	-	-	-	-	-
12	Increase in market share for the organization's products	-	-	-	-	-
13	Penetration of new markets	-	-	-	-	-
	<b>Institutional Performance</b>	-	-	-	-	-
14	Publication on organizational sustainability	-	-	-	-	-
15	Reduction in all forms of corruptions	-	-	-	-	-
16	Reduction in disagreement with supervised public and private sectors	-	-	-	-	-

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