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The critical nature of road logistics industry process capability's role in sustainable tourism development

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Abstract

Globally, logistics cost an average of 11% of a country's gross domestic product (GDP). Furthermore, Thailand's 40 million foreign tourists are provisioned by a logistics system which relies on roads 97.68% of the time to deliver nearly half a billion tonnes of goods. However, Thailand has national logistics' cost averaging 14% of its GDP. With Thailand's revenues from logistics reaching $96.5 billion in 2019, the authors saw the importance of undertaking a study to determine how the Thai road logistics industry process capability (PC) is influenced by knowledge absorption capability (KAC), technology capability (TC), product innovation (PI), and service innovation (SI). By use of multi-stage random sampling, a sample of 483 owners, executives, and managers was obtained, whose responses from the seven-level scale questionnaire were analysed using LISREL 9.10 software. From both the initial CFA and final SEM of the eight hypotheses model, all the model's causal variables were found to influence PC positively. This can be explained by 81% of the variance in the Thai road logistics industry PC (R^2). The causal variables influencing Thai logistics industry PC ranked from highest to lowest were KAC, TC, PI, and SI, with total effect (TE] values at 0.90, 0.81, 0.30 and 0.10, respectively. Therefore, in a smartphone-enabled, Internet-connected, social media world, Thai road service organizations need to marry 'technological innovation' process capabilities to ensure a competitive advantage and survivability. However, the need for a digitally enabled, 21st-century knowledge worker becomes even more crucial, but companies find obtaining these workers a difficult task, with Thai educational systems hard-pressed to deliver them. As a result, Thailand needs to educate and train a new generation of workers in the transportation and logistics sectors.

Keywords: Competitiveness, infrastructure, SEM, supply chain management (SCM), Thailand.

Introduction

Infrastructure and logistics systems development in a nation is an essential factor in building competitiveness (Yergaliyev & Raimbekov, 2016). During the first three quarters of 2019, Thailand reported 26.5 million foreign visitors, with these foreign guests spending an estimated $39 billion (Worrachaddejchai, 2019a) (Figure 1). Additionally, the Tourism Authority of Thailand (TAT) is now projecting 20 million domestic tourists per month will make 170 million domestic trips in 2019 (Worrachaddejchai, 2019b). However, these foreign and domestic tourists move mostly over roads, whose buses, vans, and cars compete for the same space as the vehicles and trucks moving the hundreds of millions of tonnes of goods provisioning the same resorts, hotels, and local shopping/tourist area destinations. Therefore, efficient logistics systems are a critical factor for a nation's stable economic growth, with logistics and transport capabilities stimulating the rapid development of related tourism industries and other industrial sectors (Yergaliyev & Raimbekov, 2016). According to the World Bank, most countries place great importance on the need for logistics in growth and integration, as trade development along with the associated transportations systems is at the heart of economic development stimulation (Arvis et al., 2018). Additionally, a well-run internal and external logistics system is paramount to a nation's competitiveness.

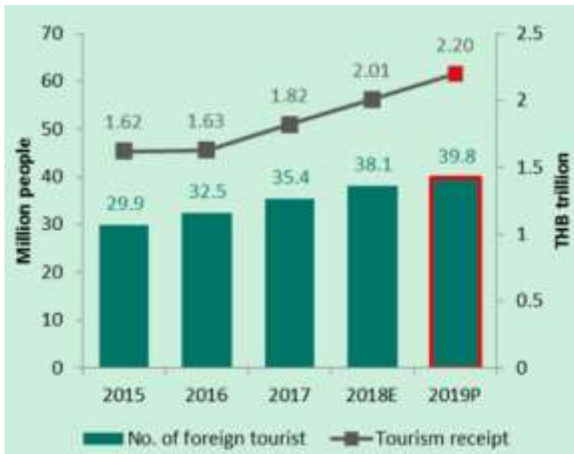

Figure 1. Foreign Tourists Arrivals to Thailand 2015-2019.
Source: Kasikorn Research Center. (2019),
As of 18 September 2019, 1 trillion baht was approximately $32,752 billion.

Also, government and commercial enterprises depend on efficient logistics systems which enhance their competitiveness (Mangan et al., 2008; Pimonratanakan & Ayasanond, 2018; Tseng et al., 2005). Additionally, manufacturing optimization and distribution methods requires logistics and the associated management techniques, which increases the efficiency and competitiveness of the organization. Logistics systems and processes have also been proven to be vital elements in integrating business marketing and management systems (Drašković, 2009). Also, Li (2014) discussed logistics as the management of merchandise between its origin and where it is consumed. Additionally, logistics has also been stated to be a branch of engineering, which involves creating 'people systems' as opposed to 'machine systems' (Gencer & Akkucuk, 2016). In the Chinese language, the English word 'flow' has been adopted to represent the idea of logistics (Li, 2014).

In Thailand in 2016, logistics represented 14% of the costs of the country's GDP (World Bank Group, 2018), whose logistics revenues are forecast to reach $96.5 billion in 2019 (Spire Research, 2016). However, regional neighbours Singapore and Malaysia both reporting logistics costs below 10% of GDP (Sivalai & Rojniruttikul, 2018). Additionally, Thailand was only 34th of 167 countries ranked in the global logistics rankings from 2018 (World Bank Group, 2018).

Reasons for Thailand's higher logistics cost have been attributed to the Kingdom's inefficient logistics infrastructure and the lack of systematic connectivity (NESDP, 2017). However, road transport represents an essential sector of the economy (Pomlaktong et al., 2007). Therefore, Thailand has made substantial investments in the country's transportation infrastructure under the 12th National Economic and Social Development Plan (NESDP), which has set a goal to cut logistics costs to 12% of GDP by 2021 (NESDP, 2017; Theparat, 2018). This compares to other research in which logistics costs, when compared to production's final cost, have averaged 11% globally. However, as a comparison, China averages 14%, the EU 11%, and 10% in the US and Canada (Yergaliyev & Raimbekov, 2016).

Thailand's 12th NESDP plan (2017-2021) also details the transport infrastructure development for major cities and border towns, as well as the methods for improved connectivity with neighbouring countries (NESDP, 2017). The plan also lays out the importance of the management and development of a sustainable national tourism plan (Pimonratanakan & Ayasanond, 2018), as tourism and efficient logistics support are highly connected elements. The new Thai plan's objectives include raising rail transport load factors to 4% of total transport from the present 1.4%, increasing waterway transport from 12% to 15% while reducing road transport by 2021 from 88% to 80% (NESDP, 2017). In 2015, the total domestic volume of transported goods was 494 million tonnes, of which 97.68% was road transport, 2.30% rail, and 0.02% air.

Another mechanism which can reduce a nation's logistics' cost is rail development, which has been stated to be instrumental in reducing logistics costs. As such, Thailand has also laid out plans for rail mega-projects with the intent to increase carrying capacity, while lowering the effects of weather, and reducing energy consumption (Tseng et al., 2005).

Funding for envisioned logistics and infrastructure projects, however, has been a bumpy road for Thailand. Recently, the $1.3 billion Thailand Future Fund (TFF) was offered to public investors (Nguyen, 2018), which was touted as a mechanism for road current and future infrastructure construction financing using investor money instead of public funds.

Problem statement

Although Thailand is now 34th globally on the World Bank's logistics performance index (LPI), Thailand still falls significantly below its regional peer of Singapore, which is fifth (Arvis et al., 2018). With logistics cost still high at 14% of GDP (compared to a global average of 11%), improvement requires significant effort to be undertaken to improve the Kingdom's road infrastructure. However, the variables affecting a road transport logistics company's process capability (PC) are far more complex. Therefore, the authors chose to investigate an eight hypothesized relationship model between the study's five theory supported latent variables. As such, the study sets out to investigate how the Thai road industry's logistics process capability (PC) is affected by an organization's knowledge absorption capability (KAC), service innovation (SI), technology capability (TC), and product innovation (PI).

Literature review

After an examination of the recent literature and related theory, the authors selected the following latent variables and observed variables for the conceptual framework and the SEM path analysis.

Knowledge Absorption Capability (KAC)

In the most recent World Bank report on trade logistics, it was stated that logistics is executed primarily by private firms for private firms (Arvis et al., 2018). This is consistent with a study on the impact of knowledge transfer from Australian small and medium enterprises' [SMEs] supply chain businesses in which innovation was stated as playing an essential key role in a firm's knowledge transferability from customers and suppliers, as well as significantly impacting the performance of a firm (De Zubielqui et al., 2018). Fanbasten (2014) also indicated that an

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organization's innovation capacity and their ability to function as a learning organization had a significant and positive effect on how well the business performed. Furthermore, other KAC studies indicate the importance of a firm's ability to identify and take in external knowledge (Cohen & Levinthal, 1990; Dahlander & Gann, 2010), as this significantly impacts a company's performance and capacity for innovation (Sulistyo & Ayuni, 2018). Also, a business must learn to balance human orientation and system orientation strategies, as this will lead to increasing their knowledge management performance (Hsieh, 2007). Furthermore, other research has contended that external innovation knowledge sourcing is a critical process in which innovation activities are allowed to flow into an organization (Dahlander & Gann, 2010). Specific examples include corporate giants such as IBM, Xerox, and P&G (Brunswicker & Vanhaverbeke, 2015).

Therefore, the authors formulated the following three hypotheses from the literature's review and theory related to KAC:

H1: KAC directly influences SI.
H2: KAC directly influences TC.
H3: KAC directly influences PI.

Service Innovation (SI)

Services differ from traditional product development, which instead requires innovation management process adoption (Brentani, 1989; Gallouj & Weinstein, 1997). This is consistent with a recent McKinsey report, in which it was reported that new digital organizations are threatening traditional service provider's profits, their growth ability, and even their firm's business model (D'Emidio et al., 2015). Therefore, innovation is critical to survival, with service activities playing a central role in the integrated interplay that constitutes advanced economies (Hauknes, 1998).

The European Commission has also calculated that 66% of the employment within the European Union (EU) is involved in the services sector (European Commission, 2012). Therefore, SI shapes new industries and restructures old ones. It has also been suggested that the services sector power of innovation will determine the German economy's ultimate strength (Herrman, 2011). As such, SI is crucial for a nation or a region.

In Taiwan, Hu et al. (2008) reported on knowledge sharing ability, a team's culture, and SI performance, and indicated they play a significant and robust role. Also, teamwork plays a vital role in a service organization's innovation ability (Chen et al., 2007; Sundstrom, 1999). Therefore, developing service innovations demands a clear strategy from businesses, whose core should include search, selection, implementation, and evaluation of innovative concepts (Herrman, 2011).

Therefore, the authors formulated the following two hypotheses from the literature's review and theory related to SI:

H4: SI directly influences TC.
H5: SI directly influences PI.

Technology Capability (TC)

Studies have concluded that information communications technology (ICT) is a topic of great concern to researchers within the logistics industry (Closs et al., 1997). In China, Ji et al. (2009) have determined that information systems (IS) integration ability directly affects the capability of logistics processes, how close the partnership becomes, and supply chain management (SCM) capability. These findings are also consistent with Zhang et al. (2011) which from a research review on the interrelationships of ICT, SCM, and supply chain performance (SCP), reported that ICT frequently and positively affects SCP and SCM.

In the 2018 LPI report, the World Bank researchers also confirmed that most logistic firms are very satisfied with their ICT infrastructure (Arvis et al., 2018). Earlier, Closs et al. (1997) stated that most global firms feel their logistics operating and planning systems are highly capable, with internally led processes better than those requiring external coordination. Furthermore, the overall competence of logistics operations are tied to on-time operations, a user-driven format, and flexibility.

Therefore, the authors formulated the following two hypotheses from the literature's review and theory related to TC:

H6: TC directly influences PI.
H7: TC directly influences PC.

Product Innovation (PI)

Product innovation has been described by Tohidi and Jabbari (2012) as a process that includes technical design, research, and research & development (R&D). Product innovation has been referred to as 'technological innovation,' which additionally includes marketing a new product's management, production, and commercial activities (Llanto & del Prado, 2014).

The Organisation for Economic Co-operation and Development (OECD) has also reported that innovation consists of the implementation of significantly improved goods or service products. Furthermore, innovation is also related to the introduction of new marketing or organizational methods or processes, how workplaces are organized, and a firm's external relations (OECD, 2018).

In research of 83 studies over 23 years concerning organizational innovation, innovation was found to significantly and positively help in a firm's superior performance (Vincent et al., 2004). Also, it has positive and significant short-term and long-run effects on a firm's profitability (Stoneman et al., 2018), as R&D and patents add 2.5% to 8% to a firm's market value. Furthermore, success in foreign markets was also found to be positively related to PI, with foreign capital participation, a significant predictor of PI (Llanto & del Prado, 2014).

Therefore, the authors formulated the following final hypothesis from the literature's review and theory related to PI:

H8: PI directly influences PC.

Process Capability (PC)

Process capability has been discussed in terms as PC relates to 'Six Sigma' which is focused on the capability measurement of processes and guiding their improvements (Goldsby & Martichenko, 2005). Additionally, Dierickx and Cool (1989) have stated that an organization's competitive advantage can come from the intelligent deployment of assets and capabilities. It has been further reported that process innovation deals with an organization increasing its capability by optimization, with internal and external organizational R&D needing to focus on quality control, improving productivity and sustainability (Narvekar & Jain, 2006; Park et al., 2011; Peppard & Rylander, 2005; Williams & Ecker, 2011).

Furthermore, PC is how a business achieves minimum logistics costs by using effective operations while simplifying an organization's workflow. Also, PC is related to standards for key logistics processes, while proving consistent low-price and high-quality services for customers.

Also, in developing economies, supply chain sustainability performance is all about people, where there is a balance between technical and social controls (Annan et al., 2016). Additionally, according to Spanish SME research, the strategy of process innovation is determined by acquiring embodied knowledge, which then becomes critical to overcoming organizational internal capability weakness (Hervas-Oliver et al., 2014). In Indonesia, SME business performance was also significantly affected by innovation (Najib & Kiminami, 2011).

The Research Framework

Model and hypotheses development for the Thai road industry logistics PC are shown in Figure 2.

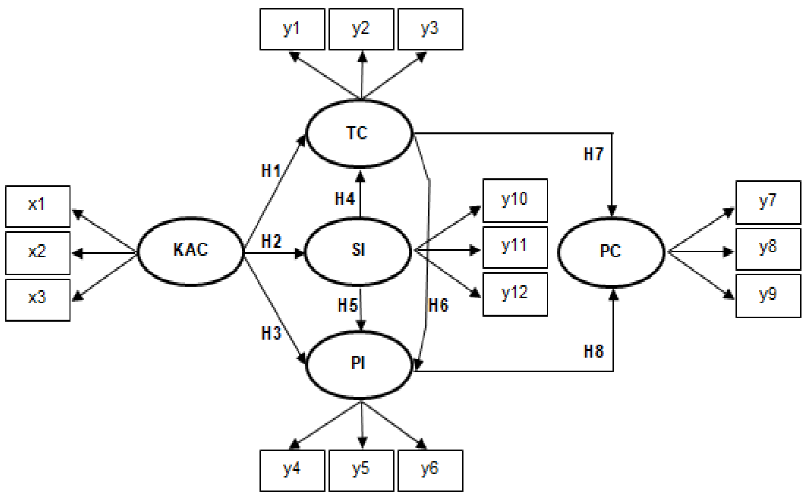

Figure 2. Conceptual Model for PC.
Source: Authors' conceptual model developed from theory and literature.

Methods and Materials

The methods and materials section details the process and mechanics of the study's analysis.

Population and Sample

From the Thai online database provided by the Thai Yellow Pages at http://www.yellowpages.co.th., the study's population of 2,045 road operators was obtained.

Concerning the sample size, a multitude of researchers has suggested various criteria for sample sizes when a CFA and SEM are used. However, it has been suggested that 15 cases per predictor are sufficient (Pituch & Stevens, 2016), while others such as Schumacker and Lomax (2010) have suggested a multiple of 10-20. From these and other scholars input, and to assure study validity, including non-response errors, an initial target of 500 questionnaires was initially targeted.

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Questionnaire Design Process

From the review of similar studies and related theory, a questionnaire was created, which in parts 2-6 used a 7-level Likert scale to analyse the respondents' opinions of each item. On the scale, strongly agree = 7, no comment = 4, and strongly disagree = 1. The study's validity and reliability testing of the research instruments was undertaken by use of a try-out conducted at a firm not subsequently used in the actual survey. Therefore, the pre-test involved the distribution and collection of 30 questionnaires whose content validity was assessed by five experts. The five experts held positions as academics, logistics company executives, and field operations managers. The detailed description of each latent variable, the reliability assessment by use of Cronbach's α (Tavakol and Dennick, 2011), along with the associated observed variables and the detailed item description are detailed in Tables 4 and 5.

Collection of the Data

Data collection began with a sample survey which was reviewed by the faculty's student advisory committee. Subsequently, a multi-stage random sample process was undertaken by the research teams to solicit logistic road company owners, executives, and managers by both the post and e-mail. The regional results from the study's 2-phase sampling process are shown in Table 2. In 2017, the Yellow Pages database contained 2,045 road operators at http://www.yellowpages.co.th. Commencing with this sample group, from phase 1 in May 2017, 232 questionnaires were returned. From Phase 2 in July 2017, 251 questionnaires were returned or collected after an interview process, for a total of 483 (Table 1).

Table 1. Regional survey results

Region	Sample	May 2017			July 2017				**Audited Totals**
		Post	e-mail	Total	Post	e-mail	Interview	Total	
Northern	29	10	3	13	12	2	2	16	29
Central	140	48	11	59	64	9	7	80	139
Northeast	30	9	5	14	11	2	3	16	30
Eastern Seaboard	73	28	7	35	25	5	4	34	69
Southern	36	12	8	20	11	2	3	16	36
Bangkok	192	74	17	91	69	12	8	89	180
Total	500	181	51	232	192	32	27	251	483

Source: Authors' study.

Analysis of Data

The content validity from the five experts was assessed using Cronbach's α, with $\alpha \geq 0.9$ being considered 'excellent' (Cronbach, 1990; George and Mallery, 2010). From the try-out, α values were 0.85 to 0.98 (Table 4 and Table 5), so the items were judged to be 'good' to 'excellent.' Data analysis was conducted with LISREL 9.1 software.

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Results

Personal and company characteristics (*n*=483)

From the 483 usable questionnaires returned, it was established that 63.15% were men, while 36.85% were women. Also, 44.31% of the respondents were 41-50 years of age, with 60.66% having achieved an undergraduate BA or BS degree (Table 2).

Table 2. Management's characteristics (*n*=483)

	Count	%
Gender		
Men	305	63.15
Women	178	36.85
Total	483	100.00
Age		
21-30	36	7.45
31-40	191	39.54
41-50	214	44.31
Over 50	42	8.70
Total	483	100.00
Education Level		
Vocational	18	3.73
-Bachelor Degree	293	60.66
-Postgraduate	172	35.61
Total	483	100.00
Company revenue (millions of Baht)*		
Less than 1million	54	11.18
1 – 10	285	59.01
11 – 30	114	23.60
Over 30	30	6.21
Total	483	100.00
Company position		
Owner	204	42.24
Executive	106	21.95
Manager	173	35.82
Total	483	100.00
Employee total		
Less than 50	370	76.60
51 – 200	95	19.67
Over 200	18	3.73
Total	483	100.00
Company age		
Five or fewer years	174	36.02
6 – 10 years	180	37.27
Over ten years	129	26.71
Total	483	100.00
Is the company ISO quality management system certified?		
Certified.	132	27.33
Not certified.	351	72.67
Total	483	100.00
Registered Capital (millions of Baht)*		
Less than 5	226	46.79
5 – 50	185	38.30
Over 50	72	14.91
Total	483	100.00

Source: Authors questionnaire. *USD $ 32,722.00 on 17 September, 2019.

Goodness-of-Fit (GoF) Analysis

A GoF assessment was made for the model's fit during the CFA. From that, all indices were either validated or found to be acceptable (Table 3).

Table 3. GoF criteria, results, and supporting theory.

Statistic and theory	Criteria	Result	
χ2	$p \geq 0.05$	0.20	Baghaei et al. (2017), Rasch (1980)
χ2 / df degrees of freedom	≤ 2.00	1.30	Byrne (1998)
RMSEA	≤ 0.05	0.02	Hu and Bentler (1999)
goodness-of-fit index (GFI)	≥ 0.90	0.99	Jöreskog et al. (2016)
adjusted goodness-of-fit index (AGFI)	≥ 0.90	0.96	Hooper et al. (2008)
root mean square residual (RMR)	≤ 0.05	0.01	Byrne (1998)
standardized root mean square residual (SRMR)	≤ 0.05	0.01	Hu and Bentler (1999)
normed fit index (NFI)	≥ 0.90	0.99	(Bentler and Bonett, 1980; Hooper et al., 2008).
comparative fit index [CFI)	≥ 0.90	1.00	Schumacker and Lomax (2010)
α	≥ 0.80 (good)	0.85-0.92	George and Mallery (2010)

Source: GoF Testing results by the authors.

Confirmatory factor analysis (CFA) results

It has been suggested that when analysing a SEM, the internal and external variables are investigated in separate steps (Anderson et al., 1994), from which the model's data overall fit and construct interrelationships are examined and confirmed (Byrne, 1998; Diamantopoulos and Siguaw, 2000; Jöreskog et al., 2016) (Tables 4 and 5).

Table 4. External variable CFA analysis for KAC.

Latent variables	α	AVE	critical ratio	Measured manifest items	Factor loading	R^2
Knowledge Absorption Capability (KAC)	0.92	0.76	0.90	Knowledge creation (x1)	0.76	0.58
				Knowledge application (x2)	0.96	0.92
				Knowledge sharing (x3)	0.88	0.78

α = significance level. Source: Authors' CFA analysis

Table 5. Internal variable CFA analysis for SI, TC, PI, and PC.

Latent variables	α	AVE	critical ratio	Measured manifest items	Factor loading	R^2
Service Innovation (SI)	0.85	0.67	0.86	New service development (y10)	0.85	0.73
				The speed of service innovation development (y11)	0.82	0.68
				Continuous service innovation (y12)	0.75	0.56
Technology Capability (TC)	0.92	0.70	0.87	Using information technology for management (X4)	0.87	0.75
				Technology leadership (X5)	0.79	0.62
				Technological innovation development (X6)	0.85	0.73
Product Innovation (PI)	0.91	0.61	0.83	New and advanced products (Y4)	0.79	0.62

				Fast product development (Y5)	0.68	0.46
				New product development (Y6)	0.87	0.75
Process Capability (PC)	0.89	0.65	0.85	Standardized management systems (Y7)	0.77	0.60
				Service improvement evaluation (Y8)	0.78	0.61
				Listening to suggestions and comments (Y9)	0.87	0.76

α = significance level. Source: Authors' CFA analysis

Questionnaire Latent Variable Analysis

Table 6 shows the questionnaire's analysis results of the five latent variables, with KAC ranked most important by the survey respondents ($\bar{x}$ = 5.19), with TC second ($\bar{x}$ = 5.12), followed closely by PC ($\bar{x}$ = 5.11).

Table 6. Latent variables descriptive analysis.

Latent Variable	Part	Items	$\bar{x}$	S.D.	Level	Skewness	Kurtosis
KAC	2	6	5.19	.77	Slightly agree	-.73	.63
PI	3	5	4.96	.84	Slightly agree	-.63	.38
SI	4	5	5.01	.83	Slightly agree	-.68	1.20
PC	5	6	5.11	.76	Slightly agree	-.13	-.24
TC	6	6	5.12	.80	Slightly agree	-.47	-.10

S.D. = standard deviation, $\bar{x}$ = mean, Source: Author's questionnaire.

SEM reliability results

Table 7 further supports the reliability of the SEM's results, as all latent variables indicated good internal consistency with their construct reliability [CR] from 0.84 and 0.90 (Ratner, 2009). Figure 2 then presents the final SEM for the Thai road industry logistics PC, while Table 9 and Figure 2 detail the results of the hypotheses testing.

Table 7. Latent variables correlation coefficients (under the **bold** numbers), CR, and AVE.

Latent variables	KAC	SI	TC	PI	PC
KAC	**1.00**				
SI	.81**	**1.00**			
TC	.75**	.71**	**1.00**		
PI	.81**	.87**	.72**	**1.00**	
PC	.70**	.77**	.83**	.65**	**1.00**
ρ_v (AVE)	0.64	0.69	0.75	0.70	0.67
ρ_c (Construct Reliability)	0.84	0.87	0.90	0.87	0.86
$\sqrt{AVE}$	0.80	0.83	0.87	0.84	0.82

**Sig. ≤ .01. Source: The authors' analysis

Effect Decomposition

Total effect (TE) decomposition values are detailed in Table 8 (Bollen, 1987). Additionally, from the analysis, all the SEM's causal variables had a positive effect on PC, which can be combined to explain the variance of the factors affecting PC (R^2) by 81%. Strength is determined by the larger absolute value of the coefficient, which for PC is shown to be KAC (TE = 0.90), TC (TE = 0.81), PI (TE = 0.30), and SI (TE = .010).

Table 8. Standardized coefficient results from the SEM analysis for PC (*n*=483).

Dependent variables	R^2	Effect	Independent variables			
			KAC	SI	TC	PI
Service Innovation (SI)	.88	DE	0.94**			
		IE	-			
		TE	0.94**			
Technology Capability (TC)	.74	DE	0.76**	0.10		
		IE	0.10	-		
		TE	0.86**	0.10		
Product Innovation (PI)	.82	DE	0.62*	0.04	0.29*	
		IE	0.29	0.03	-	
		TE	0.91**	0.07	0.29*	
Process Capability (PC)	.81	DE	-	-	0.73**	0.30*
		IE	0.90**	0.10	0.08*	-
		TE	0.90**	0.10	0.81**	0.30*

*Sig. ≤ .05, **Sig. ≤ .01, R^2 = coefficient of determination, KAC = Knowledge Absorption Capability., direct effect (DE), indirect effect (IE), and the total effect (TE), Source: Authors' SEM results

SEM results

Table 9 and Figure 3 show the results from the analysis on Thai road logistics PC. Key elements included χ2= 16.93 (not statistically significant), df = 13, *p*-value = 0.20239, and RMSEA= 30.27.

Table 9. Hypotheses testing results.

Hypotheses	Loading	t-test value	Results
H1: KAC directly influences SI.	0.94	20.37**	consistent
H2: KAC directly influences TC.	0.76	3.37**	consistent
H3: KAC directly influences PI.	0.62	2.60*	consistent
H4: SI directly influences TC.	0.10	0.46	inconsistent
H5: SI directly influences PI.	0.04	0.22	inconsistent
H6: TC directly influences PI.	0.29	2.32*	consistent
H7: TC directly influences PC.	0.73	5.68**	consistent
H8: PI directly influences PC.	0.30	2.36*	consistent

*Sig. ≤ .05, **Sig. ≤ .01. Source: Authors' LISREL 9.1 SEM analysis

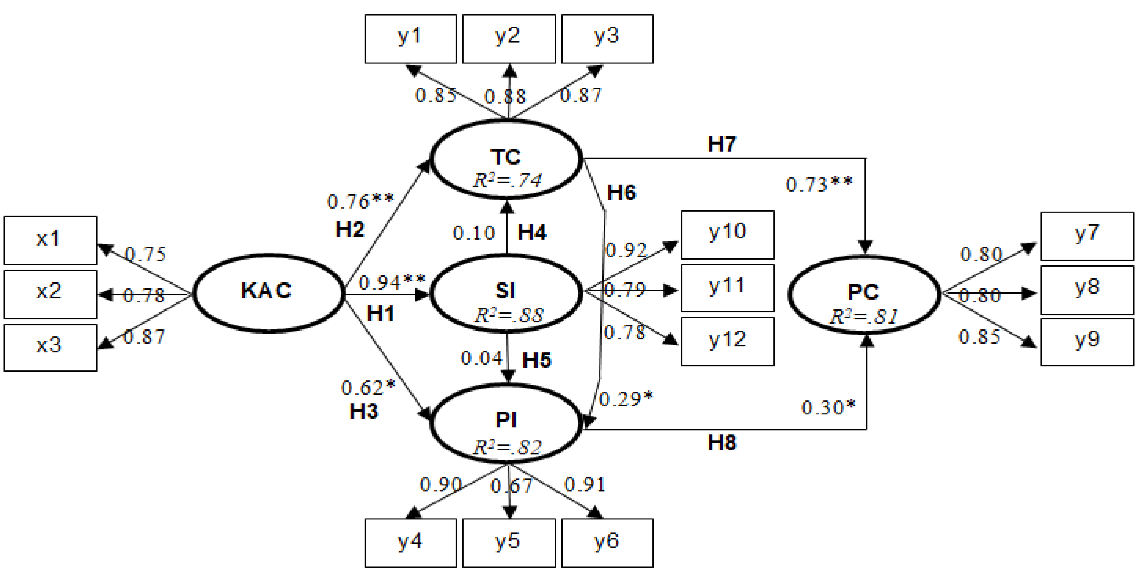

Figure 3. Final Results of the Eight Hypotheses SEM for PC. Source: The authors' LISREL 9.1 analysis.

Discussion

A logistics firm's process capability (PC) and performance entail a multiplicity of factors, with a country's infrastructure and logistics systems development playing a crucial role in building a competitive advantage (Ojala and Çelebi, 2015; Li et al., 2006). The following five sections detail the discussion of the results.

Knowledge Absorption Capability (KAC)

The relationships between KAC and SI (H1), KAC and TC (H2), and KAC and PI (H3) were all found to be direct and positive. Additionally, H1 was determined to have the strongest of the three conceptualized relationships as the standardized coefficient $r = 0.94$, t-test value = 20.37, and $p \leq 0.01$ (Table 8). However, H2's relationship was determined to be moderate, as $r = 0.76$, t-test value = 3.37, and $p \leq 0.01$. Finally, the relationship in H3 was also determined as moderate, as the $r = 0.62$, t-test value = 2.60, and $p \leq 0.05$.

The study's results are consistent with other authors in whom it was stated that knowledge management effectiveness is essential as organizations attempt to gain greater competence and an economic edge. Also, KAC helps organizations achieve their goals while simultaneously creating value and greater competitive advantage (Tiwana, 2001). Finally, strategic and human management processes play an essential role (Hsieh, 2007).

Service Innovation (SI)

Concerning SI, the relationships between SI and TC (H4) and SI and PI (H6) were both found to be unsupported as H4's $r = 0.10$, t-test value = 0.46, and H5's $r = 0.04$, t-test value = 0.22.

In many organizations, a critical determinant of competitive advantage is innovation (Omar et al., 2016). Although these results might seem surprising, a recent McKinsey report on SI suggests otherwise, as the authors articulate the difficulty of firms at mastering new environments. The study goes on to suggest that SI comes from R&D product focus and intensity. Additionally, SI involves the ability to personalize a customer's experience while helping them do things themselves with simplified and automated service delivery (D'Emidio et al., 2015), with services important to the global economy representing 65% of global GDP, which is expected to increase to 75% over the next decade. Therefore, in a smartphone-enabled, Internet-connected, social media world, SI needs to work hand-in-hand with 'technological innovation,' so Thai road service organizations need to marry these processes together to ensure a competitive advantage and their survivability.

Technology Capability (TC)

The relationships between TC and PI (H6) and TC and PC (H7) were both found to be direct and positive, with H6's relationship determined to be the weakest of the two hypotheses, as the $r = 0.29$, t-test = 2.32, and $p \leq 0.05$. However, the relationship in H7 was determined to be strong, as the $r = 0.73$, t-test value = 5.68, and $p \leq 0.01$.

Hypothesis H7 also was shown to be consistent with research from Taiwan in which a firm's performance was determined to be positively affected by their logistics capabilities, with TC in information technologies being the most critical element to a firm's logistics capability (Lin and Lai, 2017).

Competitive advantage also comes from Internet-based systems which assist with the streamlining of processes, reducing costs, increasing customer retention (Unhelkar & Lan, 2011).

Product innovation (PI)

Concerning H8 and the hypothesized relationship between PI and PC, the study confirmed it. However, it was determined to be weak as the $r = 0.30$, t-test = 2.36, and $p \leq 0.05$.

This is consistent with reporting from the OECD, in which it was stated that creating innovation requires the ability to find, create, and design ideas (OECD, 2018). Also, a developing country's innovation is as important as it is in the developed world (Fagerberg et al., 2004).

In another examination of PI on firm performance, it was reported that firm resource allocation of enhances PI, while at the same time gaining leverage in competitiveness and performance (Tung, 2012). It was also concluded that PI is critical for organizational performance and survival. Later, it was determined that organizational and process innovation is more critical to performance and innovation within an organization than innovation for products and marketing (Tuan et al., 2016).

Process capability (PC)

Process capability was investigated using three manifest variables, including *standardized management systems* (y7), *service improvement evaluation* (y8), and *listening to suggestions and comments* (y9). Results showed that y9 was most significant to the respondents, which is consistent with ideas put forth in Six Sigma literature, where brainstorming is used in the initial definition phase (Mijajlevski, 2013). Additionally, during the 'Define phase,' contact must be made with customers to understand better their process requirements, which is also known as the "Voice of the Customer."

Regarding the results for y7 and y8, standardization of management systems and service improvement were viewed as almost equal in importance. This is because business achieves minimum logistics costs by using effective operations while simplifying an organization's workflow while proving consistent low-price and high-quality services for customers (Annan et al., 2016).

Conclusion and implications

Although Thailand has made rapid advances in its' global logistics rankings, it has much work to do. With the study confirming the critical importance of both KAC and TC, the need for a digitally enabled, 21st-century knowledge worker becomes even more crucial. However, companies find obtaining these workers a difficult task, with Thai educational systems hard-pressed to deliver them. As a result, Thailand needs to educate and train a new generation of workers in the transportation and logistics sectors (NESDP, 2017). Although infrastructure development is an essential focus within the logistics industry, one must examine the costs and methods involved to reach the goals stated. Innovation, technology, and ISO standards are also crucial elements, as well as the legal framework of the needed changes.

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