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RESEARCH BRIEF

Assessing the Influence of Supply Chain Management, New Product Development and Competitive Advantage in Thailand's Electronics and Hard-Disk Drive Component Industry

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According to Thailand's Board of Investment (2018), Thailand's electronics industry is a core element of the Thai manufacturing sector's success. In 2017, Thailand's overall trade (import and export) in the electronics industry was worth US$71 billion. Furthermore, Thailand has 1,060 electrical appliance factories, contributing to its rank as the second largest air-conditioner producer and fifth largest washing machine producer in the world (Board of Investment, 2017). In 2016, Thailand exported an additional US$16.7 billion in electrical appliances alone.

In the electronic hardware component sector, which includes hard disc drives (HDD) and integrated circuits (IC), Thailand became the second largest HDD exporter and producer in the world (208 million units in 2016). Globally recognized manufacturers such as Fujitsu, LG Electronics, Seagate, Sony, Samsung, and Western Digital contributed to these numbers. Also, the primary markets for these exports were the USA (21%), Hong Kong (16%), China (11%), Japan (9%), and the Netherland (6%), contributing to the sector's export value of US$36.75 billion in 2017.

At the moment, however, HDD devices are being displaced by the much faster solid state drives (SSDs). These SSDs use solid-state memory chips and are used in products such as tablets and ultra-thin laptops. SSDs are lightweight, have swifter data access speeds, and are fast becoming a popular choice with a skyrocketing annual growth of over 34% (Kasikorn Bank Research, 2015).

Additionally, the evolution of cloud computing and the general "Internet of Things" [IoT] trend has augmented the demand for enterprise data storage, consumer electronics, as well as other electronic equipment for daily use. With such demand, especially for business and retail consumers, growth potential should still be evident in the HDD industry.

Also, to ensure a sustainable path, innovations must not be limited to large companies. Encouraging innovations among Thai SMEs is crucial to uplift the growth potential (Amornvivat, 2014). As Thailand climbs up the ladder of economic development, the country naturally has moved away from an over-reliance on labor-intensive industries to a more tech-savvy, knowledge-based economy. To further support this move towards a high value-added economy, the government has prioritized the development and promotion of science, research and development, technology and innovation, and has stated its intention to increase R&D expenditures to 1% of total GDP (Jones & Pimdee, 2017; Thai Office of Science and Technology, 2015).

Within this highly complex environment discussed above, supply chain leaders struggle to align corporate and supply chain strategy and drive improved performance. This difficult balancing act involves the process of balancing growth, profitability, cycle, and complexity within a company's supply chain operations (Mayer, 2014). Manufacturers of semiconductors and HDDs have been successful in a challenging downstream position, while cost pressures from OEMs (original end manufacturers) has not (as of yet) cut into the margin with growth levels remaining strong during the move to mobile.

Product innovation is also a major driver of growth and is the lifeblood of the semiconductor and HDD industries. Strong planning processes enable adaptation in the face of extreme supply and demand volatility. Manufacturers in these industries are also disadvantaged as well because of their downstream position in the supply chain. However, rising complexity and outsourcing bring new supply chain challenges, but the good news is that the supply chain capabilities within this industry are strong and ready to meet the challenge (Mayer, 2014).

In the above short discussion of Thailand's electronics and hard disk drive manufacturing sector, we see an industry on the precipice of great change. From all directions, we hear government leaders and corporate CEOs (chief executive officers) bang the drum for the advancement of R&D and testing facilities that are up to international standards, along with higher investment in innovation to increase Thailand's competitive advantage. We, therefore, have decided to undertake a study on how competitive advantage is affected by technology capability, new product development, and supply chain management.

Hypothesized Framework

Based on the review of the literature and theory, we have developed the conceptual framework and the related five hypotheses (Figure 1), which includes the causal relationships between technology capability (TC), supply chain management (SCM), new product development (NPD), and competitive advantage (CA), of the Thai electronics and HDD component industry.

H1: Technology Capability (TC) has a direct

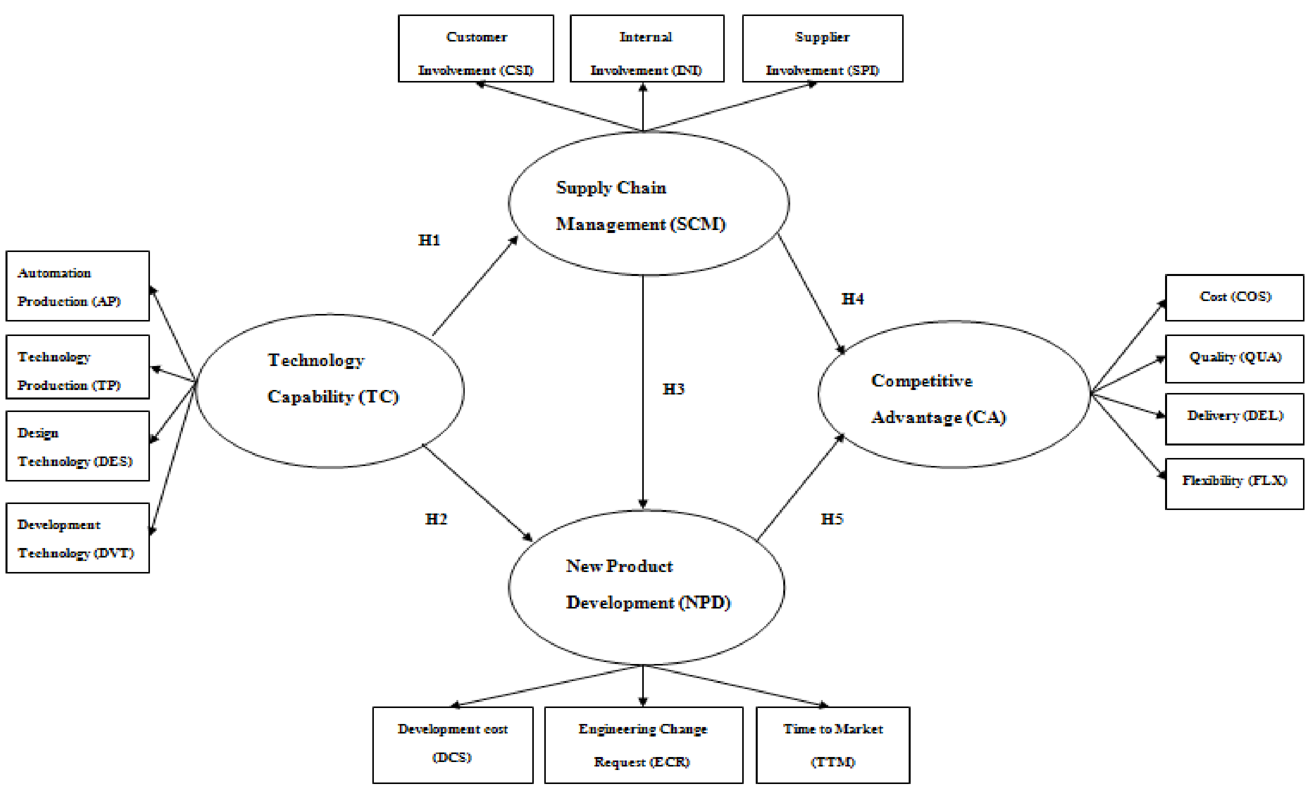


Figure 1. Hypothesized framework.

and positive influence on Supply Chain Management (SCM).

H2: Technology Capability (TC) has a direct and positive influence on New Product Development (NPD).

H3: Supply Chain Management (SCM) has a direct and positive influence on New Product Development (NPD).

H4: Supply Chain Management (SCM) has a direct and positive influence on Competitive Advantage (CA).

H5: New Product Development (NPD) has a direct and positive influence on Competitive Advantage (CA).

Methods

The sample population or unit of analysis for this research included questionnaires obtained between March to July 2017 from 280 Electrical and Electronics Institute (EEI) members (Hair, Hult, Ringle, & Sarstedt, 2016).

Sample and Data Collection

The population of this study was 556 Thai electronics and HDD professionals who were members of the Electrical and Electronics Institute in 2017. This included executive directors, managers, and department heads with at least five years experience in the electronics and hard-disk components industry.

The research method used a 67-item instrument to assess the four constructs of the CA model. All questionnaire items used a 7-point response format (Likert, 1932). Five experts in their fields determined the reliability of the questionnaire to ensure that the responses collected through the instrument were reliable and consistent. The five authorities included a production and cost control manager, an engineering manager, and three academic management scholars. Questionnaire reliability was assessed using Cronbach's alpha (Cronbach, 1990), to ensure whether there was internal consistency within the items. Therefore, for the research questionnaire to be considered "excellent," Cronbach's coefficient of reliability (α) must be at least 0.9. According to the pre-test, Cronbach's alpha (α) ranged between 0.970–0.972, so the questionnaire items were deemed to be very reliable (Hair et al., 2016).

Furthermore, the questionnaire was divided into two parts, with Part 1 consisting nine items concerning the general and personal information while Part 2 consisted of the actual questionnaire concerning the elements which make up competitive advantage within the electronics and HDD components industry. For this, Part 2 measured 58 items divided into four parts, with technology capability consisting of 17 items, supply chain management with 12 items, new product development with 12 items, and competitive advantage with 17 questions. Respondents were required to determine the degree to which each statement reflected the degree of their competitive advantage using a Likert type agreement scale (Likert, 1932) ranging from 1 (strongly disagree) to 7 (strongly agree). Scale interpretation was conducted using the following formula:

$$\text{Interval} = \frac{\text{the highest score} - \text{the lowest score}}{\text{the number of interval}}$$

A 0.86 (rounded) interval level for the seven levels of frequency was used and is detailed in Table 1.

Statistical Analysis

Table 1
Likert Scale Interpretation

Mean range	Likert Scale Responses	Interpretation
6.14 – 7.00	7- strongly agree	I think this is extremely important.
5.28 – 6.14	6 - agree	I think this is very important.
4.42 – 5.28	5 - somewhat agree	I think this is important.
3.56 – 4.42	4 – undecided	I am not sure about its importance.
2.70 – 3.56	3 - somewhat disagree	I think this has an insignificant effect.
1.84 – 2.70	2 - disagree	I think this is not too important.
0.00 – 1.84	1 - strongly disagree	I think this is really unimportant.

The hypotheses were examined using LISREL 9.1 from the collected data (Jöreskog, Olsson, & Fan, 2016). Measurement and data collection imply an evaluation of the measurement model. The measurement model in this research was analyzed in three stages: 1) the individual item reliabilities, 2) the model's convergent validity, and 3) discriminant validity.

Reliability

An initial trial assessment of 30 questionnaires was used to test the reliability of the planned survey. Reliability was ascertained from the use of Cronbach's α (Cronbach, 1990) to ensure internal consistency within the items. George and Mallery (2010) indicated the value of Cronbach's α as $\alpha \geq 0.9$ = excellent, and ≥ 0.8 = good. As Cronbach's α was α is 0.958, the questionnaire items were determined to reliable.

Qualitative Data Analysis

Structural equation modeling (SEM) uses a variety of models to show the relationships between observed variables (Table 2). Therefore, from a review of the theory, a ratio of 20:1 was deemed to be reliable. Thus, the study's 280 individuals for 14 observed variables (14x20=280) was deemed to be sufficiently reliable (Schumacker & Lomax, 2010).

Confirmatory Factor Analysis

To access the measurement models, a confirmatory factor analysis (CFA) followed by structural equation modeling (SEM) were carried out to determine the fit of the proposed model with data, and to identify the overall relationships among these constructs (Jöreskog et al., 2016). Wong (2012) also noted that, for marketing research, a significance level of five percent, a statistical power of 80%, and R^2 values of at least 0.25 are considered normal. Standard modelling accepts the proposed model if the *p*-value is higher than 0.05, and if the x^2/df ratio is less than two (Byrne, Shavelson & Muthén, 1989). Hair et al. (2016) likewise pointed out that R^2 values should be more than 0.25.

Results

Characteristics of the Respondents

From the final sample of 280 individuals (Table 3), it was determined that 78.22% were male, and 21.78% were female. From this, 61.78% were between 41–50 years of age, while 70.12% had obtained at least a bachelor's degree. The majority of the individuals surveyed (72.85%), indicated they were working for a manufacturer of parts and components and were managers (75.71%).

Table 2
Dependent Latent Variable and the Independent Latent Variables and their Observed Variables

Latent Variables	Observed Variables
Competitive Advantage (CA)	Cost (COS) Quality (QUA) Delivery (DEL) Flexibility (FLX)
Technology Capability (TC)	Automation Production (AP) Technology Production (TP) Design Technology (DST) Development Technology (DVT)
Supply Chain Management (SCM)	Customer Involvement (CSI) Internal Involvement (INI) Supplier Involvement (SPI)
New Product Development (NPD)	Development Cost (DCS) Engineering Change Request (ECR) Time to Market (TTM)

Table 3
Respondents Characteristics (n=280)

Gender	Frequency	Percent
Male	219	78.22
Female	61	21.78
Total	280	100.0
Age		
Between 21-30	3	1.07
Between 31-40	87	31.08
Between 41-50	173	61.78
Over 50 years old	17	6.07
Total	280	100.0
Education Level		
Undergraduate	24	8.57
Bachelor	196	70.00
Masters	58	20.71
PhD	2	0.72
Total	280	100.0
Business Type		
Distributors of raw materials	3	1.07
Parts Distributors	2	0.72
Parts manufacturers	71	25.36
Manufactures parts and components.	204	72.85
Total	280	100.0
Position		
Director	8	2.85
Manager	212	75.71
Department head	60	21.44
Total	280	100.0
Experience		
Less than 11 years	70	25.00
11-15 years	41	14.64
16-20 years	77	27.50
Over 20 years' experience	92	32.86
Total	280	100.0

Respondent's Information

Table 4 shows that the factors that affect Thai electronics and HDD components industry's CA which includes TC, SCM, and NPD. Interpreted results from the 7-point survey ranged from 4.44–5.34.

Confirmatory Factor Analysis (CFA) Results

After a review of relevant literature, a CFA analysis was used to test the interrelationships of the observed and latent variables (Table 5). By analyzing the CFA items with LISREL 9.1, $\chi 2$ was determined not to be statistically significant: ($p \geq 0.05$), χ^2/df was ≤ 2.00, RMSEA ≤ 0.05, and standardized root mean square residual (SRMR) ≤ 0.05. The goodness-of-fit statistic (GFI) was also indicated to be 0.99, which shows a good fit as it is higher than 0.90. The value for the adjusted goodness-of-fit index (AGFI) was 0.98, which indicates a well-fitting model as its value is also

Table 4
Mean and Standard Deviation and Thai Electronics and Hard Disk Drive Component Survey Interpretation

Latent Variables	mean	S.D.	Questionnaire Interpretation
Technology Capability (TC)	4.44	1.088	I think this is important.
Supply Chain Management (SCM)	5.20	0.892	I think this is important.
New Product Development (NPD)	4.95	0.852	I think this is important.
Competitive Advantage (CA)	5.34	0.796	I think this is very important.

Table 5
CFA and Observed Variables for the Latent Variable TC. CA, SCM, and NPD

Dependent Variable	α	CR	AVE	Observed variables	loading	R^2
Technology Capability (TC)	0.918	0.939	0.75 4	Technology Production (TP)	0.96	0.79
				Automation Production (AP)	0.80	0.67
				Design Technology (DST)	0.60	0.54
				Development Technology (DVT)	0.82	0.78
Competitive Advantage (CA)	0.937	0.921	0.74 5	Cost (COS)	0.78	0.39
				Quality (QUA)	0.91	0.17
				Delivery (DEL)	0.80	0.36
				Flexibility (FLX)	0.50	0.74
Supply Chain Management (SCM)	0.941	0.933	0.77 6	Customer Involvement (CSI)	0.89	0.74
				Internal Involvement (INI)	1.00	0.85
				Supplier Involvement (SPI)	0.62	0.85
New Product Development (NPD)	0.923	0.941	0.76 2	Development Cost (DCS)	0.59	0.74
				Learning and Development (ECR)	0.62	0.79
				Time to Market (TTM)	0.53	0.69

greater than 0.90. Concerning the CFA examination of the dependent latent variable for TC, chi-square = 0.00, df = 0, *p*-value = 1.00, and RMSEA = 0.00. For the independent latent variables CA, SCM, and NPD, chi-square =3.94, df =11, *p*-value = 0.97, and RMSEA = 0.00.

Convergent Model Analysis

From the LISREL 9.1 analysis of the data, and the measurement of the four latent variables and their hypotheses, it was found that there was a good model fit with the empirical data (Table 6). Also, to assess the validity of a test, convergent validity and discriminant validity were used. In structural equation modelling (SEM), CFA is commonly used to access construct validity (Jöreskog et al., 2016). Hair et al. (2016) and Byrne et al. (1989) indicated that factor loadings or regression weight estimates of latent to observed variables should have values greater than 0.50, to indicate that all the constructs conform to the construct validity test and validity convergence.

Results showed that the χ^2 value was 9.66, which had 15 degrees of freedom (df). Therefore, the ratio between $\chi 2$ and the df was equal to 0.64 when tested, which showed statistical significance as it was > 0.05 (Byrne et al., 1989), which confirms the model's hypotheses are not different from the empirical data (Table 7). Further confirmation was established as the

Table 6
The Correlation Coefficient between Latent Variables (below the diagonal), Reliability of Latent Variables (ρ_C) and the Average Variance Extracted (AVE).

Latent Variables	SCM	NPD	CA	TC
Supply Chain Management (SCM)	**1.00**			
New Product Development (NPD)	.695	**1.00**		
Competitive Advantage (CA)	.880	.812	**1.00**	
Technology Capability (TC)	.785	.814	.794	**1.00**
ρC (Construct Reliability)	0.893	0.603	0.850	0.877
ρV (AVE)	0.743	0.337	0.596	0.646
$\sqrt{AVE}$	0.862	0.581	0.772	0.804

*Note. *Sig. ≤ 0.01*

Table 7
Results of Hypotheses Testing

Hypotheses	Coef.	t-value (C.R.)	Results
H1: *Technology Capability* (TC) has a direct and positive influence on *Supply Chain Management* (SCM).	0.79	16.90**	Supported
H2: *Technology Capability* (TC) has a direct and positive influence on *New Product Development* (NPD).	0.70	8.23**	Supported
H3: *Supply Chain Management* (SCM) has a direct and positive influence on *New Product Development* (NPD).	0.15	2.01*	Supported
H4: *Supply Chain Management* (SCM) has a direct and positive influence on *Competitive Advantage* (CA).	0.61	4.40**	Supported
H5: *New Product Development* (NPD) has a direct and positive influence on *Competitive Advantage* (CA).	0.39	3.06**	Supported

*Note. *Sig. < 0.05, **Sig. < 0.01 Critical ratios (t-values) more than 1.96 are significant at the 0.05 level. S.E. = standard error, CR = critical ratio (t-value).*

Table 8
Direct Effect (DE), Indirect Effect (IE), and Total Effect (TE) of the SEM Analysis

Dependent variables	Independent Variables				
	Effect	R^2	TC	NPD	SCM
Competitive Advantage (CA)	DE		-	0.39**	0.61**
	IE	0.85	0.79**	-	0.06*
	TE		0.79**	0.39**	0.67**
New Product Development (NPD)	DE		0.70**	-	0.15**
	IE	0.67	0.11*	-	-
	TE		0.81**	-	0.15**
Supply Chain Management (SCM)	DE		0.79**	-	
	IE	0.62	-	-	
	TE		0.79**	-	

*Note. *Sig. ≤ 0.05, **Sig. ≤ 0.01, TC= Technology Capability* results of the GFI equaled 0.99 (Jöreskog et al., 2016), and the AGFI equaled 0.97. The root-mean-square error of approximation (RMSEA) was equal to 0.000, and the SRMR was equal to 0.01. As SRMR is an absolute measure of fit, a value of zero indicates a perfect fit with a value of < 0.05 indicating a good fit.

Table 8 shows the *direct effect, indirect effect, and the total* effect of each construct Arshinder & Deshmukh (2011). CA is influenced by the direct and positive contribution of supply chain management the most, due to the value of 0.61. TC also has a direct and positive influence on SCM, as the total effect was shown to be 0.79.

Structural Equation Modeling Results

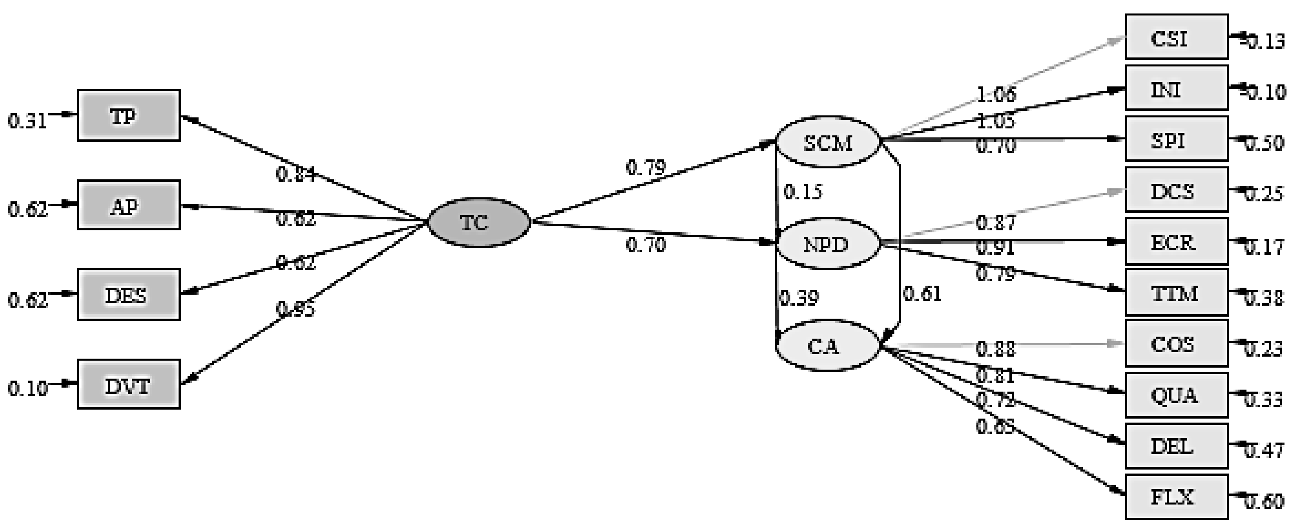
The SEM results (Figure 2) shows that all models meet the required criteria at 9.66 χ^2 value, with χ^2/df (9.66/15) at 0.644, *p*-value at 0. 84, GFI at 0.99, AGFI at 0.97, SRMR at 0.01, and RMSEA at 0.00.

It was, therefore, determined that the causal factors all have a positive influence on the Thai electronics and HDD component, with 85% of the variance of the factor affecting the competitive advantage (R^2). Ranked in importance, the three latent variables were TC, SCM, and NPD, with a total score of 0.79, 0.67, and 0.39, respectively.

Discussion

Results from the study showed that TC was determined to have a direct (0.79) and positive effect (p ≤0.01) on SCM, which supports hypothesis H1 (Table 7). Support for this study's result also comes from Jin, Vonderembse, Ragu-Nathan, and Smith (2014), which indicated that ICT infrastructure enables superior firm performance. Furthermore, ICT-related sharing capability is associated with flexibilities in a manufacturer′s supply chain, which in turn are associated with the firm′s competitive performance.

Concerning H2's relationship between TC and NPD, this was also supported as there was a direct (0.70) and positive influence (*p* ≤0.01) on NPD. Support for this comes from Rasiah (2004) who discussed the importance of foreign firms in TC building and economic performance in developing countries. From his research, it was determined that although foreign firms tend to enjoy higher human resource and process technology capabilities in the most underdeveloped economies, in the more advanced nations this comparative advantage is significantly eroded. Also, domestic and regional markets, infrastructure, incentives, natural resources, and human capital are important factors in stimulating significant R&D investment by foreign firms.



Note. Chi-Square = 9.66, df = 15, p-value = 0. 84, RMSEA = 0.00

Figure 2. Final model with values from estimates (n=280).

In H3's hypothesized relationship between SCM and NPD, SCM was shown to also have a direct (0.15) and positive influence ($p \leq 0.01$) on NPD. Support for this comes from Tolonen, Haapasalo, Harkonen, and Verrollot (2017) who stated the importance of both creating and developing solutions and products that not only secure customer satisfaction but also enable cost-efficient supply chain processes. They also determined that the supply chain capability creation process can be seen as the sub-process of the NPD process that extends the NPD process governance models, targets, key performance indicators, tasks, milestone criteria, and roles.

In H4, SCM was shown to also have a direct (0.61) and positive influence ($p \leq 0.01$) on CA. This is consistent with the study of Hsu, Tan, Kannam, and Leong, (2009) which stated that SCM stresses the seamless integration of value-creating activities across organizational boundaries. It enables firms in a supply chain to eliminate waste, leverage synergies, and compete more effectively in an intensely competitive global market. Abdallah, Obeidat, and Aqqad (2014) also tested the impact of SCM practices on supply chain performance in terms of supply chain efficiency and supply chain effectiveness on 104 Jordanian manufacturing companies. The results indicated that three supply chain management practices, including internal integration, information sharing, and postponement significantly and positively affected supply chain efficiency performance. This was also supported by Feng and Wang (2013) who stated that the success of new products relies on supply chain involvement. Time to market and development cost are also affected by supply chain coordination and new product development.

Finally, H5's relationship between NPD and CA also had a direct (0.39) and positive influence ($p \leq 0.01$), as success depends on the ability of organizations to develop new products and constantly and consistently bring these products to market. Trainor, Krush, and Agnihotri (2013) also examined how an organization's behavioral tendencies and their existing business resources contributed to the creation of NPD capability. Findings suggested that a company's marketing intelligence competency and its tendency to engage in partner-style relationships affect NPD capability. This is consistent with Feng and Wang (2013) who found that internal involvement is important in improving NPD speed, while customer and supplier involvement have significant effects on NPD cost and NPD speed.

Finally, Hayes and Wheelwright (1984) suggested that companies compete in the marketplace by virtue of one or more of the following competitive priorities: quality, lead-time, cost, and flexibility. This is consistent with Li, Ragu-Nathan, Ragu-Nathan, and Rao (2006) who stated that in SCM-related studies, the identification of price/cost, quality, delivery, and flexibility are consistently ranked important. Additionally, study results indicated that higher levels of SCM practice can lead to enhanced competitive advantage and improved organizational performance with competitive advantage having a direct, positive impact on organizational performance. This was supported by the study's survey (Table 9) which indicated that product delivery was overwhelmingly stated (items 48–51) to have the greatest importance in CA on Thai electronics and HDD component manufacturing (mean = 5.63).

Table 9
Survey Results Concerning Thai Electronics Competitive Advantage (n=280)

	Delivery (DEL)	Mean	S.D.	Interpretation
48.	Your company can deliver on time. (DEL1)	5.70	0.83	I think this is very important
49.	My company delivers a quality product on time and to our customers. (DEL2)	5.78	0.91	I think this is very important
50.	My company delivers our products on time and according to the amount of the customer. (DEL3)	5.77	0.92	I think this is very important
51.	My company has the ability to reduce time in pre-production. (DEL4)	5.28	1.01	I think this is very important

Conclusion

This study examined the interrelationships of SCM, NPD, TC, and CA. From the test results of SEM model, the results showed that delivery (DEL) was viewed as the most important aspect concerning CA (mean = 5.63), which was only slightly ahead of the quality (mean = 5.57), and flexibility (mean = 5.31). Cost (mean = 4.83), however, had minimal importance, with the overall results showing TC (0.79) was most important, followed by SCM (0.67), and NPD (0.39). These results are interpreted to mean that as SCM efficiency increases, the better the CA will be.

Ethical clearance:

This study was approved by the institution.

Conflict of interest:

None.

References

Abdallah, A. B., Obeidat, B. Y., & Aqqad, N. O. (2014). The impact of supply chain management practices on supply chain performance in Jordan: The moderating effect of competitive intensity. *International Business Research*, *7*(3), 13–27. doi: 10.5539/ibr.v7n3p13

Amornvivat, S. (2014, October 22). *Devising strategies for Thailand's lasting growth*. SCB (Siam Commercial Bank) Economic Intelligence Center. Retrieved from http://tinyurl.com/hev6ttn

Arshinder, K., Kanda, A., & Deshmukh, S. G. (2011). A review on supply chain coordination: Coordination mechanisms, managing uncertainty and research directions. In T.M. Choi & T.C. Edwin Cheng (Eds.), *Supply chain coordination under uncertainty* (pp. 39-82). Berlin, Heidelberg: Springer-Verlag.

Board of Investment. (2017). Thailand's electric and electronics (E&E) industry has rapidly evolved. Retrieved from https://tinyurl.com/y97jzjnk

Board of Investment. (2018). *Thailand electrical and electronics industry*. Thailand Board of Investment. Retrieved from https://tinyurl.com/y8vygnbp

www.boi.go.th/upload/content/BOI_Smart%20Electronics_W1_5b6bb13a126e9.

Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin, 105,* 456–466. Retrieved from http://tinyurl.com/jjxcxb6

Cronbach, L. J. (*1990*). *Essentials of psychological testing* (5th ed.). New York, NY: Harper Collins Publishers.

Feng, T., & Wang, D. (2013). Supply chain involvement for better product development performance. *Industrial Management & Data Systems*, *113*(2), 190–206. doi: 10.1108/02635571311303532

George, D., **&** Mallery, P. (2010). *SPSS for Windows step by step: A simple guide and reference 17.0 Update* (10th ed.). Boston, MA: Pearson.

Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Thousand Oaks, CA: Sage.

Hayes, R. H., & Wheelwright, S. C. (1984). *Restoring our competitive edge: Competing through manufacturing*. New York, NY: John Wiley and Sons.

Hsu, C-C., Tan, K. C., Kannam, V. R., & Leong, G. K. (2009). Supply chain management practices as a mediator of the relationship between operations capability and firm performance. *International Journal of Production Research, 47*(3), 835–855. doi: 10.1080/00207540701452142

Jin, Y., Vonderembse, M., Ragu-Nathan, T. S., & Smith, J. T. (2014). Exploring relationships among IT-enabled sharing capability supply chain flexibility and competitive performance. *International Journal of Production Economics, 153*, 24–34. doi: 10.1016/j.ijpe.2014.03.016

Jones, C., & Pimdee, P. (2017). Innovative ideas: Thailand 4.0 and the fourth industrial revolution. *Asian International Journal of Social Sciences, 17*(1), 4–35. doi: 10.29139/aijss.20170101

Jöreskog, K. G., Olsson, U. H., & Fan, Y. W. (2016). *Multivariate analysis with LISREL*. Berlin, Germany: Springer.

Kasikorn Bank Research. (2015). *Grim prospects for 2015 hard-disk drive exports; Business adjustment needed*. Retrieved from http://tinyurl.com/hffa8g4

https://www.kasikornbank.com/.../KBank_Investor_Presentation_3Q17%20(Econ%20U...

Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Rao, S. S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, *34*(2), 107–124. doi: 10.1016/j.omega.2004.08.002

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology, 22*(140), 1-55.

Manomaivibool, P., & Vassanadumrongdee, S. (2011). Extended producer responsibility in Thailand: Prospects for policies on waste electrical and electronic equipment. *Journal of Industrial Ecology*, 15(2), 185-205.

Mayer, A. (2014). *Supply chain metrics that matter: Semiconductors & hard disk drives*. Supply Chain Insights LLC. Retrieved from http://tinyurl.com/hqugdxf

Rasiah, R. (2004). *Foreign firms, technological capabilities and economic performance*. Cheltenham, UK: Edward Elgar Publishing. doi: 10.4337/9781845423551

Schumacker, R. E., & Lomax, R. G. (2010). *A beginner's guide to structural equation modeling* (3rd ed.). New York, NY: Routledge. Retrieved from http://tinyurl.com/z2sdwtr

Thai Office of Science and Technology. (2015). Tech-savvy Thailand. *Thailand Investment Review,* 25(2). Retrieved from http://tinyurl.com/htjk59z

Tolonen, A., Haapasalo, H., Harkonen, J., & Verrollot, J. (2017). Supply chain capability creation – The creation of the supply chain readiness for a new product during product development process. *International Journal of Production Economics*, *194*, 237–245. doi: 10.1016/j.ijpe.2017.09.007

Trainor, K. J., Krush, M. T., & Agnihotri, R. (2013). Effects of relational proclivity and marketing intelligence on new product development. *Marketing Intelligence & Planning, 31*(7), 788–806. doi: 10.1108/MIP-02-2013-0028

Wong, S. K. (2012). The influence of green product competitiveness on the success of green product innovation: Empirical evidence from the Chinese electrical and electronics industry. *European Journal of Innovation Management, 15*(4), 468-490. doi: 10.1108/14601061211272385