The Analysis of Direct and Indirect Effects of Information Management Capabilities and Logistics Capabilities on Firm Performance

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Abstract **- The collaboration of firm capabilities is critical to the success of the business, IT and logistics are among those capabilities which support for superior firm performance (FP). This is a cross disciplinary research on logistics and IT management with an objective to analyse the direct and indirect effects of the information management capabilities (IMC) on logistics integration capabilities (LIC) and supply management capabilities (SMC). The results indicate that there are positively direct relationships between LIC and SMC with FP, it is also found that IMC positively affects LIC and SMC. There is no direct relationship between IMC and FP, but has indirect effect through logistics capabilities. The implications of the research is that IT and LIC have improved firm performance both directly and indirectly of which cross functional coordination effort will need to be implemented.**

Keywords **- Information Management Capabilities, Logistics Capabilities, Firm Performance**

I. INTRODUCTION

An increasing of competitive condition in current global economy forces companies to adjust their working practices. Various studies have emphasized the collaboration of firm's capabilities. IT and logistics capabilities have been a topic of interest in strategic management. The effective use of IT has either direct or indirect effect on firm's functional competencies [1]. The concept of LIC contributes greatly towards the achievement of firm superior performance. Mentzer, et al. [2] suggested that logistics integration capabilities should be considered and implemented in an appropriate approach for competitive advantage and differentiation. Therefore, firm must be strategically employing logistics capabilities.

The motivation of this study is to analyse direct and indirect effects of IMC and LIC on FP. A conceptual framework has been developed based on literature review on multi-disciplinary researches. The scope of this study was with the food processing industry in Thailand.

II. LITERATURE REVIEWS

A. Information Management Capabilities (IMC)

IMC is known as firm's productivity tools which simultaneously improve firm capabilities and keep firm's total operational cost down. Firms can deploy, implement and leverage their IMC in combination with other resources and capabilities as to enhance distinctive competencies [3]. IMC provides accurate, timely, and reliable information for firms to configure their other capabilities to improve their overall performance. It is necessarily to encourage IT staff to learn the new knowledge [4]. Tsang and Kwan [5] suggested that IT capabilities allow firms to

provide necessary coordination with their customers and suppliers and improving efficiency in the supply chain process.

B. Logistics Capabilities Defined

Li [6] referred logistics as a flow management from origin to end for physical items and abstract items, such as time, information, and energy, common motivation in logistics is to minimize the use of resources. Bowersox, et al. [7] conceptualized logistics operational scope as the flow of interrelated system: inventory and information. The definition of logistics capabilities has been defined by Morash, et al. [8] to be the level of efficiency, effectiveness, and differentiation which relate to the implementation of firm's logistics activities.

C. Supply Management Capabilities (SMC)

Supply management strategies are valuable source of competitive advantage which collaborate suppliers' operations with supply management function [9]. Supply management is a significant business performance enhancer [10]. Supply management focuses on strategic relationships [11, 12] and cooperation, and the transfer of key resources, knowledge, and capabilities between firm and its supplier [12]. The development of supply management capabilities helps to create long-term collaboration among partnering firms.

D. Logistics Integration Capabilities (LIC)

LIC indicates the level of efficiency, effectiveness, and differentiation of firm's logistics activities and LIC develops connection that crosses the boundary of activities between departments and firms. Lambert, et al. [13] asserted that LIC improves competitive performance and profitability of a firm. Bowersox, et al. [14] discussed elements of integration to include cross-functional unification, structural adaptation and process standardization, simplification, and compliance. Andraski and Novack [15] suggest that superior logistics performance can be achieved when all relevant functional areas work closely. Arguably, the different in values, norm and culture might be challenges [16], therefore, firm needs to develop effective integration. LIC reflects a major role of logistics strategic management in utilizing, integrating resources, competencies and skills. LIC is an intervening variable in the business organization which leads to an improvement of firm's competitiveness [17]. LIC is source of competitive advantage and allows firms to access expertise and synergies from the combined operations.

E. Firm Performance (FP)

The concept of firm performance is the measurement of multivariate effectiveness of the business organization and commonly divided into financial and non-financial measurement indexes. Venkatraman [18] assumed that financial performance includes return on investment, sales growth rate, and organizational revenue and the non-financial performance includes customer's perception and satisfaction, quality and product innovativeness, and marketing effectiveness. Santos and Brito [19] include the dimension of business growth, market share, profitability, market value, customer loyalty and employees' satisfaction.

To analyse the effects of latent variables on FP, the following hypotheses have been set forth:

H1: There is a positive relationship between IMC and FP

H2: There is a positive relationship between LIC and FP

H3: There is a positive relationship between SMC and FP

H4: IMC positively affects LIC

H5: IMC positively affects SMC

III. RESEARCH METHODOLOGY

A. Population and Sampling

The study is aimed for respondents from the field of IT and logistics who are considered having adequate knowledge about IT and

logistics capabilities. The study focuses on one industry which allows a more control of extraneous variables. The ten groups of population based on the guidelines of industrial clustering, has been assigned. The sample size is calculated according to [20] which proposed the lowest possible ratio for sample size to the number of free parameters to be 5:1 ratio, the calculated sample size for this study is 145 samples from Thai food processing industry.

B. Data Collection

This study adopted the key informant survey research methodology, the key informants were deemed especially qualified because of their position, experience, and specialized knowledge [21]. The mail survey methodology is used and collected through combination approaches where the respondents are provided with options to return the questionnaires: through a pre-postage paid mail; by fax; or through web-based. The final respondents are 177 from 1,000 companies mailed.

C. Latent Variables and Observed Variables

The latent variables for this study are based on literature review which comprises of: IMC which measured by IT infrastructure, and human IT resource; LIC which measured by standardization, cross-functional integration, and customer integration; SMC which measured by strategic supplier alliances, communication and relationship; and the firm performance which measured by profitability, market share, and customer satisfaction as observed variables.

*D. Reliability and Validit*y

The validation of the measurement on content validity is evaluated by using Index of Item-Objective Congruence (IOC) method to evaluate content validity of the items used in the questionnaire. The IOC's overall assessment score is 0.97 and considered valid.

The test of the reliability of the variables used in the model by using Cronbach's alpha as mean to measure internal consistency. The variables used have the alpha values all higher than .8 (from .885 to .896). The data are found to be distributed within the Kurtosis value between -2 to +2, which is within normal distribution. The testing of Multi-collinearity for the non-relationship between variables, through Variance Instruction Factor (VIF) ranges from 2.08 - 4.02, indicates no multi-collinearity among all variables.

E. Convergent Validity and Discriminant Validity

The convergent validity is measured with confirm factor Analysis, if the factor loading values are greater than .6 and the average variance extracted (AVE) are higher than .5, the model is considered converged. The loading factors ranges from .63 to .95 while the AVE values from the study ranges from .62 to .81.

The assessment of discriminant validity was done by comparing the AVE value with squared correlation between variables [22]. Fornell and Larcker [23] suggested that the values of squared root AVE should be higher than squared correlation values as to be valid. The result as shown on table I, indicates that the all the values have supported the discriminant validity. The AVE values from each latent variable were greater than the level of correlation involved.

Table1. The squared correlation between variables

	Information Management Capabilities	Logistics Integration Capabilities	Supply Management Capabilities	Firm Performance
Information Management Capabilities	0.900			
Logistics Integration Capabilities	0.71	0.795		
Supply Management Capabilities	0.64	0.60	0.803	
Firm Performance	0.44	0.49	0.44	0.840

The squared root AVE in diagonal

F. Measurement of Model Fit

The results of the measurement model indicated the Normed Chi-Squared fit index derived from Chi-Square/degrees of freedom (χ^2/df) is 1.969, indicating a good model fit between the data and hypothetical model. The Goodness of Fit (GFI) value is .930 and the Adjusted Goodness of Fit (AGFI) value is

.875. The Value of Root Means Square Error of Approximation is .074. The Normed Fit Index (NFI) and Comparative Fit Index (CFI) value are .942, and .970 respectively. All of the data mentioned above demonstrate an acceptable model for this study.

Table2. Standardized Direct, Indirect and Total Effects

	Standardized Direct Effect				Standardized Indirect Effect				Standardized Total Effects			
	IMC	LIC	SMC	FP	IMC	LIC	SMC	FP	IMC	LIC	SMC	FP
IMC	-	-	-	-	-	-	-	-	-	-	-	-
LIC	.650	-	-	-	-	-	-	-	.650	-	-	-
SMC	.728	-	-	-	-	-	-	-	.728	-	-	-
FP	.064	.284	.288	-	.395	-	-	-	.459	.284	.288	-

IV. THE ANALYSIS OF STRUCTURAL EQUATION MODEL

Structural Equation Model (SEM) has been constructed for the test of the proposed hypotheses. To determine the presence of standardized direct effect, the hypotheses has been developed that there is a positive relationship between IMC and FP (H1), there is a positive relationship between LIC and FP (H2), there is a positive relationship between SMC and FP (H3) and the results indicate that IMC does not has positive relationship with FP, however,

LIC has positive relationship with FP at .284 ($p<0.01$), and SMC has positive relationship with FP at .288 ($p<0.05$). Further, the result also indicates that LIC is affected by IMC at .650 ($p<0.001$) and SMC is affected by IMC at .728 ($p<0.001$), which supports hypotheses H4 and H5. In considering the presence of standardized indirect effect between the IMC and FP, it is found that there is an indirect effect at .395.

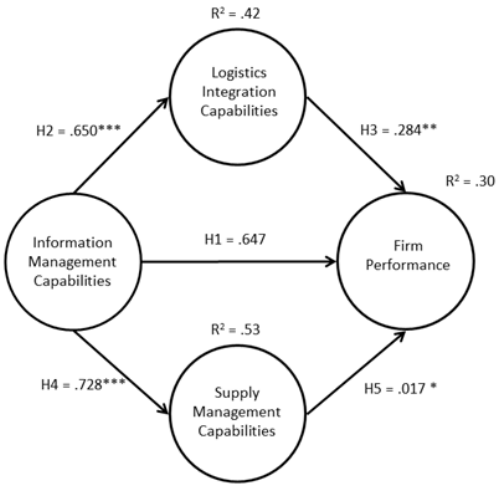

Fig. 1 Research Model Results

The model exhibits reasonable predictive ability as it explains 42 percent of the variance in LIC, 53 percent of the variance in SMC, and 30 percent of the variance in FP.

V. CONCLUSIONS AND DISCUSSIONS

The effective use of IT is a key factor for firm success [24], the synergy of IT resources with other resource enhances competitive advantage and provides support for firm's superior performance. This study is analysing direct and indirect effects of IMC and LIC on firm performance. The findings indicate that IMC positively and highly affects LIC and SMC at $\beta = .650$ ($p<0.01$) and $\beta = .728$ ($p<0.01$) respectively. IMC contributes greatly to the standardization and customer integration dimensions of LIC, as well as, support the supplier communication dimension of SMC. This supports the previous study that IT enhances supply chain logistics efficiency by providing real-time information regarding product availability, inventory level, and shipment status and production requirements [25] and affirms the work of Sauvage [26] that IT is a significant tool to differentiate logistics services. IMC contributes greatly to the standardization and customer integration dimensions of LIC. The empirical results also indicate no direct relationship between IMC and FP ($p>0.05$), this is congruent with the study of Zahra and Covin [27] which found no direct technology-performance connection and Zhao, et al. [28] also reported that

information-focused capabilities are not directly relating to firm performance. These findings suggest that despite the potential of IT as productivity tool to improve firm performance, it is necessary to synergize and combine IT resources with firm's other resources as to enable the effective usage of IT. With regard to the relationship between LIC, SMC and FP, the results indicate the two latent variables have positive relationship with FP at .288 ($p<0.01$) and .284 ($p<0.05$) respectively. This demonstrates the direct effect of LIC and SMC on FP. This complement prior literatures that organizations increasingly rely on logistics capabilities that superior logistics capabilities help to improve performance of organizations and the focus on logistics capabilities enables firms to achieve competitive advantage and differentiation. As for the analysis of the indirect effect, there is an indirect effect of IMC on FP at $\beta = .395$. This indicates that IMC affects the LIC with an impact on FP this results expand on earlier research works which asserted that the effective use of IT has either direct or indirect effect on firm's functional competencies and IMC facilitates LIC and contributes to the supply chain success.

VI. MANAGERIAL IMPLICATIONS

The results from the study affirm the significant impact of IMC and LIC both directly and indirectly on firm performance. Under the challenging competitive environment, it is necessary for the entrepreneurs to improve the way they operate their business. IT and LIC have exhibited crucial roles in improving firm performance. Firm's interdepartmental effort and coordination should be adopted as the implementation of competencies separately by each department will not be enough. Entrepreneurs must also recognize the potential of IMC as critical factor in supporting other competencies which also leads to firm superior performance. It would be necessary to synergize IT resources with other capabilities to enable the effective usage of IT.

REFERENCES

(Arranged in the order of citation in the same fashion as the case of Footnotes.)

[1] Karagöz, I.B. and Akgün, A.E. (2015). "The Roles of it Capability and Organizational Culture on Logistics Capability and Firm Performance". Journal of Business Studies Quarterly, Vol. 7, pp. 23.

[2] Mentzer, J.T., Min, S., and Michelle Bobbitt, L. (2004). "Toward a unified theory of logistics". International Journal of Physical Distribution & Logistics Management, Vol. 34, pp. 606-627.

[3] Zhang, Q., Vonderembse, M.A., and Lim, J.-S. (2005). "Logistics flexibility and its impact on customer satisfaction". The International Journal of Logistics Management, Vol. 16, pp. 71-95.

[4] Jaturat, N. (2011). "The Relationship Between IT Investment and Firm Performance with the Context of the 'Sufficiency Economy' Philosophy".

[5] Tsang, E.W. and Kwan, K.-M. (1999). "Replication and theory development in organizational science: A critical realist perspective". Academy of Management review, Vol. 24, pp. 759-780.

[6] Li, X. (2014). "Operations Management of Logistics and Supply Chain: Issues and Directions". Discrete Dynamics in Nature and Society, Vol. 2014.

[7] Bowersox, D.J., Closs, D.J., and Cooper, M.B. (2013). "Supply Chain Logistics Management". (4th Ed). Vol. 2, McGraw-Hill New York, NY.

[8] Morash, E.A., Droge, C.L., and Vickery, S.K. (1996). "Strategic logistics capabilities for competitive advantage and firm success". Journal of Business Logistics, Vol. 17, pp. 1.

[9] Boon-itt, S. and Paul, H. (2006). "A study of supply chain integration in Thai automotive industry: a theoretical framework and measurement". Management research news, Vol. 29, pp. 194-205.

[10] Ofori-Amanfo, J. (2014). "Supply management capabilities and operations

performance of UK manufacturing small and medium sized enterprises (SMEs)". University of Leeds.

[11] Cousins, P.D. (1999). "Supply base rationalisation: myth or reality?". European Journal of Purchasing & Supply Management, Vol. 5, pp. 143-155.

[12] Lamming, R. (1993). "Beyond partnership: strategies for innovation and lean supply". Prentice Hall.

[13] Lambert, D.M., Cooper, M.C., and Pagh, J.D. (1998). "Supply chain management: implementation issues and research opportunities". The International Journal of Logistics Management, Vol. 9, pp. 1-20.

[14] Bowersox, D.J., Closs, D.J., and Stank, T.P. (2000). "Ten mega-trends that will revolutionize supply chain logistics". Journal of Business Logistics, Vol. 21, pp. 1.

[15] Andraski, J.C. and Novack, R.A. (1996). "Marketing logistics value: Managing the 5 P's". Journal of Business Logistics, Vol. 17, pp. 23.

[16] Kuntonbutr, C. (2011). "A comparative study between Thai and American subordinates' perception of managerial values in the banking industry". Journal of Global Business Review, Vol. 1, pp. 67-73.

[17] Wook Kim, S. (2006). "Effects of supply chain management practices, integration and competition capability on performance". Supply Chain Management: An International Journal, Vol. 11, pp. 241-248.

[18] Venkatraman, N. (1991). "IT-induced business reconfiguration". The corporation of the 1990s: Information technology and organizational transformation, pp. 122-158.

[19] Santos, J.B. and Brito, L.A.L. (2012). "Toward a subjective measurement model for firm performance". BAR-Brazilian Administration Review, Vol. 9, pp. 95-117.

[20] Bentler, P.M. and Chou, C.-P. (1987). "Practical issues in structural modeling". Sociological Methods & Research, Vol. 16, pp. 78-117.

[21] Venkatraman, N. (1987). "The Concept of Fit in Strategy Research: Towards Verbal and Statistical Congruence". in Academy of Management Proceedings, pp. 51-55.

[22] Hair, J.F., Anderson, R.E., Babin, B.J., and Black, W.C. (2010). "Multivariate data analysis: A global perspective". Pearson Upper Saddle River, NJ, Vol. 7.

[23] Fornell, C. and Larcker, D.F. (1981). "Structural equation models with unobservable variables and measurement error: Algebra and statistics". Journal of Marketing Research, pp. 382-388.

[24] Bharadwaj, A.S. (2000). "A resource-based perspective on information technology capability and firm performance: an empirical investigation". MIS quarterly, pp. 169-196.

[25] Radstaak, B. and Ketelaar, H. (1998). "Worldwide Logistics: The Future of the Supply Chain Holland International Distribution Council: The Hague".

[26] Sauvage, T. (2003). "The relationship between technology and logistics third-party providers". International Journal of Physical Distribution & Logistics Management, Vol. 33, pp. 236-253.

[27] Zahra, S.A. and Covin, J.G. (1993). "Business strategy, technology policy and firm performance". Strategic Management Journal, Vol. 14, pp. 451-478.

[28] Zhao, M., Dröge, C., and Stank, T.P. (2001). "The effects of logistics capabilities on firm performance: customer-focused versus information-focused capabilities". Journal of Business Logistics, Vol. 22, pp. 91-107.