*International Journal of Engineering & Technology*, 7 (4.15) (2018) 224-229

International Journal of Engineering & Technology

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# The Impact of Information Technology Capability on Supply Chain Technology Adoption and Supply Chain Operational Performance: a Resource based View

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**Abstract**

Organization increasingly relies on the supply chain technology to improve the supply chain operational performance. Yet, past evidence suggests that the adoption of supply chain technology does not guarantee enhanced supply chain operational performance. Drawing from the Resource Based View, this study found that information technology (IT) capability enabled supply chain technology adoption in achieving supply chain operational performance. Supply chain technology serves as a system in transforming IT capability into a higher value resources for an organization. The adoption of supply chain technology in managing supply chain deserved attention from researchers and practitioners, because business benefits from supply chain technology adoption improve firm's supply chain performances which enhance reliability, improve responsiveness, increase agility, and minimize cost in operation functions. This study provides a unique theoretical framework intended to aid researchers and practitioners develop a more thorough understanding of the linkages between information technology capability, supply chain technology adoption, and supply chain operational performance. The total of 201 questionnaires were sent to Malaysia's textile and apparel company that is listed in the Federation of Malaysian Manufacturers (FMM) and Malaysian External Trade Development Corporation (MATRADE) directory. The total of 121 usable responses were obtained and analyzed through Partial Least Square Structural Equation Modeling (PLS-SEM). The discussion of this study is followed by presenting the results of the survey on the relationship of IT capability on supply chain technology adoption and supply chain operational performance. The results shown that supply chain technology adoption is mediating the relationship between IT capability and supply chain operation performance.

***Keywords****: Information Technology Capability, Supply Chain Technology Adoption, Supply Chain Operational Performance, Textile and Apparel Industry.*

## 1. Introduction

In Asia, using technology in increasing organization performance and developing an efficient supply chain is not new in Asia's countries, especially in Malaysia. The common goal is to bring down the operation cost. However, the achievement of this goal is still a gap to be closed. As Li [1] advised, the used of technological functions can aid extraordinarily in this aspect. On top of that, it required collaborative efforts through an informal and formal form of collaboration in creating daily operations efficiency and cost savings [1,2]. From the above discussion, the effective supply chain management (SCM) should be able to apply technological functions. It is the key competitive factors for a firm, if the firm adopted the right technology on the right time [3]. However, it is complex and required high financial investment and time consuming [4]. Numerous of large organizations are conglomerations their business units and attainments across global [5] have consumed an inordinate length of time to incorporate the supply chain system [6]. The tremendous start up investment and risk to a great extent restricted the company to be competitive [7]. The large organization may have sufficient capitals and resources to adopt, but it would be a problem or challenged for small and medium enterprises (SMEs) since they have resources and negotiation power limitations [8]. As Ma and Zhang [4] noted, most of the enterprises in Malaysia's textile and apparel industry are SMEs. Based on the FMM directory (2017), approximately 75% of Malaysia textile and apparel companies are small and medium sizes. It is the similar situation faced by the textile and apparel supply chain in other countries [9]. The development of SMEs is an important growth engine and backbone of economic [10]. Thoo, Hamid, Rasli, and Baharun [10] revealed that the large companies in Malaysia are appreciated the benefits of SCM, but SMEs have insufficient knowledge and lagging behind in realizing the potential benefits of SCM.

Supply chain technology adoption is a major concern to developing efficient supply chain [1]. The role of supply chain technology adoption in SCM has not been fully agreed and thus, remain controversial. There is a relatively insufficient study that investigates the mediating role of supply chain technology adoption on supply chain operation performance. It extends the area of investigation, especially for the textile and apparel industries in the developing country [4,11]. The supply chain technology adoption is referred to the used and the usefulness of interconnected electronic applications to generate effective and

efficient supply chain operation. The supply chain technology adoption in textile and apparel industry is one of the critical success factor in supply chain performance [11,12]. Therefore, this study is expected the mediating role of supply chain technology in between IT capability and supply chain operational performance.

## 2. Literature Review

### 2.1. Information Technology (It) Capability

The power of IT in current decades is well known as a foundation of accomplishment in SCM and an important approach to enhanced supply chain performance [13,14]. Aral and Weill [15] found that IT capability drive differences in firm performance by strengthens IT assets and broadens their impact. The used of IT able to improved flexibility and optimized overall performance [16,17]. Nowadays, IT is extensively employed in the SCM to strengthen the weaknesses of the supply chain. The appropriately used of IT offers opportunities for the organization to improve performance of supply chain, productivity, and profitability [18]. However, numerous companies' personnel are lacked of IT skills and IT knowledge [19]. Hence, the support from the company in providing necessary IT training to their employees is required [20].

The Resource Based View (RBV) of IT mentions that the IT resources in the organization can be the competitive capability of the organization. Bharadwaj [21] points out that firm's IT infrastructure, employees' IT skills, and IT reconfigurability are firm's unique resources. Every single IT resource is exclusive and difficult to obtain. The mixture of the IT resources created a powerful organizational capability [21,22]. The relationship between IT capability and organization performance is becoming more complex than ever before [23]. Bharadwaj [21] points out that various IT capabilities could be sources of competitive advantage. However, there is only few studies have discovered the RBV of IT capability, and most of the analyses to data were conceptual nature.

### 2.2. Resource Based View and Supply Chain Technology Adoption

The broad used of supply chain technology enable organizations to improve or remodel their SCM and overall business performance [24]. The impacts of supply chain technology on SCM are numerous. The common impacts are supply chain planning and collaboration, transaction processing, and delivery coordination and order tracking [25]. Furthermore, the used of supply chain technology enable firms in reducing manual work and costs, speed up information transfer, and improve information quality [25], and make full use of and integrate the resources on the supply chain [26].

In today's global competitive environment, organizations faced multiple challenges and difficulties in business operations. The use of supply chain technology is considered as an effective tool in managing today's complex supply chains to stay in competitive [25,27]. The existing literature revealed that most of the organizations were adopted EDI and RFID technologies as part of their information supply chains [28]. The smart phone technology has been the real wireless technology as a part of our life. Advances in wireless networking are created opportunities for supply chain innovation at the organizational, regional, or national level. It holds the potential to improve the overall business activities [29]. The recent research indicated that the Internet improved connectivity and interaction between firms and customers tightly and virtually [19,30,31].

### 2.3. Supply Chain Operational Performance

In nature of RBV, performance can be divided into three categories, which are environmental, operational, and financial performance [32]. This study focused on the supply chain operational performance, since its characterized as having the huge impact for the performance [1]. Therefore, supply chain environmental and financial performance would not be emphasized throughout this study, since the supply chain operational performance would give positive impact to environmental and financial performance [32]. Supply chain operations often involve activities and processes associated with transforming raw materials or intermediate components into finished goods [33].

Supply chain performance is typically determined in terms of flexibility, reliability, cost, responsiveness, and asset management [34]. This study is focused on the supply chain operational performance, thus reliability, responsiveness, flexibility, and cost would become the dimensions in measuring the performance. However, asset management in the definitions of SCOR model is more to return on investment, and operational performance is focused on non-financial performance. Therefore, asset management is excluded in the measurement list of supply chain operational performance variables. Basically, the ultimate goal of a supply chain is to efficiently deliver goods and services to customers in minimum time, minimum total cost, and higher quality. Organizations are doomed to failure if they are not aware of the truth of the success factor in the supply chain which is low costs (i.e, supply chain costs), high quality (i.e., supply chain reliability), flexible (i.e, supply chain agility), and quick response (i.e., responsiveness) [35,36].

## 3. Hypotheses

### 3.1. Information Technology Capability and Supply Chain Operational Performance

IT capability is considered as one of the major factors in SCM and, which is a critical factor to improve supply chain performance. IT capability significant direct relationship with supply chain performance [14,37]. Specifically, several researchers observed that IT infrastructure was the most significant factor to minimize costs [38] and enhanced operational agility [39]. In organizational perspective, IT personnel acts as important enabler of key IT products and services for smoothen the business operation flow [40]. An appropriate technical solution is proposed by the IT personnel to solve business problems that related to IT applications [41]. Basically, IT personnel is utilized the flexibility of IT infrastructure in suggesting the solution to the management [42]. Therefore, IT personnel exhibit direct and positive effect on organization's agility performance [43]. Furthermore, the use of IT knowledge in managing the supply chain is one of the top three critical successes factors [44]. IT knowledge of users is important for fully utilize the adopted technologies in improving business operation [45]. In addition, IT reconfigurability positive and significant influenced on supply chain performance [46]. Particularly, it has the advantages of robustness, flexibility, and agility to business activities [47]. Surprisingly, the contradict finding of Liu et al. [48] found that IT capability did not direct influence to supply chain agility, but IT capability influence supply chains agility through mediating effect.

From the above literatures, the following hypothesis will be tested.
IT capability is positively related to supply chain operational performance.

### 3.2. Information Technology Capability and Supply Chain Technology Adoption

Technological capability is a standout among the most influential factors in supply chain technology adoption. The number of studies show that the characteristics of the technology itself possess the power to influence the adoption process [49–51]. It is intriguing to note that IT infrastructure is one of the factors that

strongly affected the adoption of supply chain technology [52]. Besides, Chandrasekaran [53] points out that availability of infrastructure and needs competence of implementation personnel are the factors that affect the choosing a supply chain technology solution. IT personnel is crucial in determining the right adoption and smooth use of all staff in the respective department [54]. As Harper [30] points out that an effective ERP system requires continuous support and maintenance by IT personnel. Several researchers observed that IT knowledge was one of the important factors that influence the organizations to adopt something new to their organization [52,55]. As of today, there is still limited literature that is examined the relationship between IT reconfigurability and supply chain technology adoption. However, this study found a real example from the study of Lim and Istook [56], the textile and apparel organization reconfigure the function of CAD system that is normally performed in producing mass production garments to automated pattern generation custom fit garment, also known as made-to-measure (MTM) garment significantly increase the adoption of CAD system in the organization.

Based on the aforementioned discussion, the following hypothesis is then proposed.

IT capability is positively related to supply chain technology adoption.

### 3.3. Supply Chain Technology Adoption and Supply Chain Operational Performance

Nowadays, supply chain technology is universally regarded as an essential tool in improving SCM and gained competitive advantages from competitors. Despite the number of research during the past two decades, the results on supply chain technology adoption towards supply chain performance are rather mixed and thus, there is still an ongoing debate about the impact of supply chain technology adoption towards the supply chain operational performance [57]. Operational benefits associated with supply chain technology adoption in SCM have proven to be an area of keen interesting by researchers and practitioners for recent decades [58,59]. Huisman and Smits [60] found that investments in network ability can lead to higher supply chain performance, but that organization success seems to depend on the type of technology investments. However, a technology alone did not provide significant relationship to supply chain performance, but observable effects can be realized if the supply chain technology widely spread and adopt [61,62]. Besides, supply chain technology impact on the performance of SCM are not equally [63]. For instance, some firms have reported that there is scarce or insignificant gain from the adoption of supply chain technology [64]. In the meantime, the study of Ramayah, Sang, Omar, and Dahlan [65] seemed to be contradictory with the result of [61,66]. The study of Ramayah et. al. [65] point out that the use of supply chain technologies had insignificant relationship with supply chain performance. Thus, it is critical to investigate the relationship between supply chain technology adoption and supply chain operational performance.

Based on above arguments, a hypothesis is thus stated.

Supply chain technology adoption is positively related to supply chain operational performance.

### 3.4. The Mediating Role of Supply Chain Technology Adoption

The study of Lu and Ramamurthy [39] which includes response from 128 organizations' information systems executive revealed that IT capability and supply chain technology adoption positive and significant impact on operational agility. The results of Udomleartprasert and Jungthirapanich [67], which includes 371 manufacturers in Thailand's estate industrial indicated that the relationship between supportive infrastructure and supply chain performance is mediated by supply chain technology adoption, namely SRM and CRM systems[68]. Moreover, IT personnel exhibit direct and indirect effect on firm's agility performance through the mediating effect of supply chain technology adoption [43].

These lead to the following hypothesis comprised.

H4.IT capability affect supply chain operational performance indirectly through supply chain technology adoption as a mediating variable.

## 4. Methodology

This study is using quantitative research method in testing the hypotheses [69]. Therefore, survey questionnaire was developed as the instrument for the researcher to collect data for analysis. All questions in the questionnaire were closed-ended with five-point Likert's scales used to measure independent variable and mediator; six-point Likert's scales used to measure the dependent variable. This study consisted of 68 items, 24 items used to measure supply chain operational performance, 21 items used to measure supply chain technology adoption, and 23 items used to measure IT capability.

The samples of 201 organizations of this study were drawn by using simple random sampling techniques from the total population of 423 organizations in the directory provided by Federation of Malaysian Manufacturers (FMM) [70] and Malaysian External Trade Development Corporation (MATRADE) [71,72]. The researchers were distributed the total of 201 the survey questionnaires to targeted organization through email and postage. Through proper followed of the data collection procedure [73,74], approximately 60.20% response rate was achieved, in which 125 survey questionnaires were returned; four were rejected due to the incomplete response, and the remaining 121 were certified to be complete and usable for the data analysis.

## 5. Data Analysis and Results

The total of 121 usable responses were used for the analysis through partial least square structural equation modeling (PLS-SEM) analytical technique with the aid of the application of SmartPLS. In PLS-SEM, the assessment is comprised of two elements, which is measurement model and structural model [75]. The assessment of the measurement model is to test the reliability and the validity of the outer model. Therefore, convergent validity and discriminant validity were performed.

As Hair, Black, Babin, and Anderson [76] recommended, the adopted threshold value of factor loading is 0.50 and above. The value of composite reliability (CR) above 0.70 is considered acceptable, and the value of average variance extracted (AVE) above 0.50 is considered appropriate [77]. Figure 1 and Table **1** show that all the factor loadings ranged from 0.768 to 0.964, which exceeding the threshold value of 0.50 [76]. In addition, composite reliability and the AVE statistics for every construct are considered good and accepted, since all composite reliability and AVE is above 0.70 and 0.50 respectively. The results of convergent validity revealed that all the constructs used are capable to measure the actual concepts of the study.

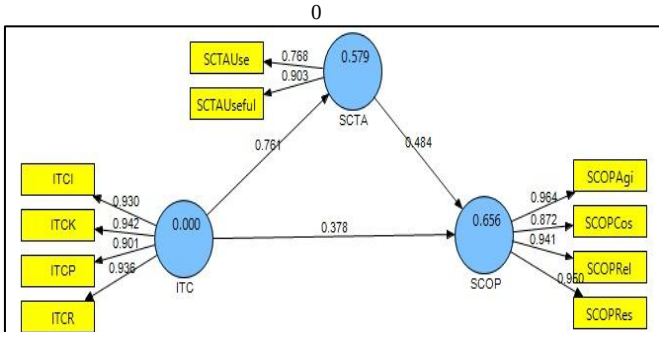

**Figure 1: .**Assessment of the Measurement Model

**Table 1:** Convergent validity

| Construct | Item Indicator | Loading | AVE | CR |
|---|---|---|---|---|
| IT Capability | ITCI | 0.930 | 0.860 | 0.961 |
| | ITCK | 0.942 | | |
| | ITCP | 0.901 | | |
| | ITCR | 0.936 | | |
| Supply Chain Operational Performance | SCOPAgi | 0.964 | 0.870 | 0.964 |
| | SCOPCos | 0.872 | | |
| | SCOPRel | 0.941 | | |
| | SCOPRes | 0.950 | | |
| Supply Chain Technology Adoption | SCTAUse | 0.768 | 0.703 | 0.824 |
| | SCTAUseful | 0.903 | | |

*Note*: AVE = average variance extracted; CR = composite reliability; Loadings > 0.50; AVE > 0.50; Composite reliability > 0.70

Besides, the assessment of discriminant validity was also undertaken to ascertain the external consistency of the model. Fornell and Larcker [77] noted that discriminant validity was confirmed when the square root of each construct higher than its highest correlation with any other construct. Table 2 presented the result of discriminant validity with the value of square root of AVE of each construct in which IT capability is 0.927, supply chain technology adoption is 0.838, and supply chain operational performance is 0.932. The results further revealed the true measures of their individual variables.

**Table 2:** Discriminant validity

| Construct | ITC | SCOP | SCTA |
|---|---|---|---|
| **ITC** | 0.927 | | |
| **SCOP** | 0.746 | 0.932 | |
| **SCTA** | 0.761 | 0.772 | 0.838 |

*Note*: Diagonals (bolded) represent the square root of the AVE and the off-diagonal represents the correlations.

The assessment of the structural model is begun after the completion of the measurement model examinations. It is to examine the assumption of regression and correlation of variables. Table 3 fully explained the path coefficients, beta, standard error, t-value, [75]. The results indicated that hypothesis H1, H2, and H3 were statistically supported with the significance level of 1%.

**Table 3:** Results of hypothesis testing

| Hypotheses | Relationship | Full Model | | | Decision |
|---|---|---|---|---|---|
| | | *Beta* | *Standard Error* | *t-value* | |
| H1 | ITC -> SCOP | 0.378 | 0.083 | 4.566*** | **Supported** |
| H2 | ITC -> SCTA | 0.761 | 0.040 | 18.839*** | **Supported** |
| H3 | SCTA -> SCOP | 0.484 | 0.080 | 6.072*** | **Supported** |

*Note*: *** = t-value > 2.33 (significance level = 1%); ** = t-value > 1.65 (significance level = 5%); * = t-value > 1.28 (significance level = 10%)

Having calculated the *t*-value of the mediation effect, the result of mediating effect of SCTA on the relationships between ITC and SCOP is presented in Table 4. The results indicated that there is an indirect effect on the relationships in the model. However, it is still significance as mediation. In that regard, the model shows mediation at *t*-value 13.352 were significant at 99% confidence intervals. Besides, Table 5 illustrates the results of direct effect, indirect effect, total effect, and VAF. The results indicated that partial mediation existed in the relationships between the independent variable and the dependent variable.

**Table 4:** Results of hypothesis testing (Mediation)

| Hypotheses | | Indirect Effect (*a*b*) | Standard Deviation (*S*) | *t*-value (*t*) | Decision |
|---|---|---|---|---|---|
| H4 | ITC > SCTA > SCOP | 0.587 | 0.044 | 13.352*** | Supported |

*Note*: t-values significant at 1.65 for 90% confident intervals, *t*-value 1.65 (*p<0.10), 1.96 (**p<0.05), 2.58 (***p<0.01)

**Table 5:** Direct, Indirect, Total Effect, and Variance Accounted for (VAF)

| Hypothesis | | *a* | *b* | *c'* | *c* | VAF | Results |
|---|---|---|---|---|---|---|---|
| H4 | ITC > SCTA > SCOP | 0.761 | 0.484 | 0.378 | 0.749 | 0.494 | Partial Mediation |

*Note.* VAF>0.80 (full mediation), 0.80>VAF>0.20 (partial mediation), VAF<0.20 (no mediation), a = the value of relationship between ITC and the SCTA, b = the value of the relationship between SCTA and the SCOP, c = the value of the relationship between ITC and the SCOP where the SCTA is not included in the model (total effect), c' = the value of the relationship between ITC and the SCOP where the SCTA is included in the model (direct effect)

## 6. Discussion and Conclusion

The findings of this study were contributed to the current body of knowledge pertaining to the supply chain operational performance. Furthermore, the contribution of this study can be categorized into two important implications, which is empirical and practical implications. The findings of empirical evidence have strengthened the research framework by confirming the path relations of the model under study. The findings also offer managerial implications to practitioners through exposed the IT capability on supply chain technology adoption and supply chain operational performance. As a conclusion, the relationship between IT capability and supply chain operational performance is partial mediating by the supply chain technology adoption.

Traditionally, the business competition is between firms. However, nowadays, the business competition is between the supply chains. The nature of business competition growing the focused on supply chain performance. This practice accentuated the need of IT capability and supply chain technology adoption to facilitate the SCM. The findings of this study provide considerable empirical support for the model under study. All the research hypotheses have been fully supported. These are further show the power of IT capability and supply chain technology adoption in improving the supply chain operational performance. However, this study was undertaken only textile and apparel industry in Malaysia. Therefore, the generalization for any other industries is not feasible and may not application in other countries.

This is a primary study that looking to the total supply chain in textile and apparel industry in Malaysia. The main element in the supply chain such as supplier, manufacturer, distributor, service provider, wholesaler, retailer, and customer in Malaysia's textile and apparel industry was involved in this study. Therefore, as a recommendation for future study, the researchers can focus on a particular supply chain element in Malaysia's textile and apparel industry to get deeper information on how IT capability and supply chain technology adoption influence supply chain operational performance. Besides, future research in other industries and different countries would be advisable.

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