

The Mediating Role of Technology Competences, Supply Chain Technology between Supply Chain Management, Total Quality Management and Firms Supply Chain Performance in Indonesian Textile Sector

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Abstract- The prime objective of this study is to investigate the association among the practices of supply chain management (SCM), total quality management (TQM), through the information technology (IT) competencies and the adoption of innovation in SCM with the firm's supply chain performance (FSCP). Moreover, this study similarly tries to find out the mediating role of the IT competencies and the adoption of SC technology in the association between SCM, TQM and the FSCP. This study is based on a sample of firms related to the textile industry of Indonesia. Smart PLS-3 is used for data analysis that is gathered from Indonesia's textile firms, in order to attain the objective of the research. The results of the study are consistent with the hypotheses. With respect to the association among TQM, SCM and supply performance, the IT competencies and SC technology mutually act as mediators. The conclusion reached will be beneficial for the policymakers and researchers especially with regard to the implications of IT in the area of strategic and operations management.

1. Introduction

Practitioners and researchers show their interest in the management of SC. This is a globally recognized mechanism across various industries as it addressed the issues such as shared planning procedures, inventory control, logistic management and supplier consumer relationship. SC management brings benefit to the organization once it applied successfully, the benefit would be in terms of enhanced product quality, reduced re-order, delivery and cycle time, and this will result in improved customer satisfaction. A small number of resources will be utilized in implementing SC across the organization [1-4].

Companies can proceed further to share information and structural collaboration. The information which companies shares comprise on delivery, inventory control and management techniques. In the meantime, structural collaboration may additionally encompass supplier-controlled stock, outsourcing, and just-in-time [5]. The

goal of a company is to maximize shareholder return in order to achieve this they should minimize cost [6]. Technology allows additional supportive measures and logistics which are physical in nature and reliant on the IT. As the firms expand their operations, consequently its dependence increases in terms of technology innovation and external process [5]. As a consequence, the SCM becomes critical for the firms, therefore, in the changing conditions of the business world, the firms are greatly depended on effective SCM for better decision making. Therefore, SCM and TQM can be seen as competitive business strategies [7].

According to the academia, various researchers have found SCM and TQM as the most significant contributing factors in order to determine the firm's performance. TQM always focuses on continuous improvement, to improve quality from every perspective in the organization, it aims to fulfil customer needs in terms of quality, quantity, price and delivery. SCM in the past few years have risen as one of the most significant strategies of manufacturing businesses. In recent studies, innovation in technology is considered as an important factor, when conducting research on SCM and supply performance [7]. Innovation proceeds to the adoption of SC technology, therefore, the current study has considered a different aspect of technology associated with SC and IT capabilities. Based on the above discussion, the current study has the following.

1. To find out the association among TQM, SC management and FSCP.
2. Whether IT competence and SC technology mediates the association among TQM, SC management and FSCP?

As far as the author's knowledge is concerned, the study of this is unique amongst previous studies. This study has taken IT competence and SC technology as a mediating variable, these variables are ignored in the previous literature.

2. Literature Review

2.1. Firm Supply Performance

Once the procedures of SC management practices are being adhered the overall long term objectives can be achieved, it connects all suppliers, customers, manufacturers & distributors [8]. Sharing of information is necessary and the key to SC integration, whereas, SCM has some common goals and interest on which every researcher that focuses on theoretical or empirical research have agreed [9]. [10] states the main objective of SC management is the removal of communication barriers. Additionally, [11] states that the goals of SC management are delivery performance, quality management, and flexibility in production. [12] also confirmed the findings of [11] but it further the goals of SC management which are customer satisfaction, cost-benefit analysis, inventory management together with the supplier relationship. SC management also involves other activities which have a significant influence such as audit and leadership activities. Therefore over the past few decades, SC management has evolved into an integrated approach, which includes waste reduction, synchronized operations, distribution efficiency, quality management, flexibility, customer satisfaction, time, cost, warehouse and long-term supplier relationships [13] in order to attain advantage over competitors and to increase the profitability and performance [14].

Primarily the two models have been used in SC literature in order to measure SC performance.

- (1) Cost model that is based on operating and inventory cost.
- (2) The second model is based on the combination of cost and customer response which includes freight costs, inventory cost and the operating cost. Cost, relationship, operating time, customer response and flexibility all these have been used as SC performance measures either individually or collectively [15-17]. The cost (CT), flexibility (FL), relationship (RL) and responsiveness (RS) as the main parameters for the success of SC management.

Inventory stock carries a large proportion of the firm's net operational cost. In order to measure the cost efficiency of relevant product activity or anything, the inventory cost is the most important variable to determine the performance of SC. The business aim is to provide customers with the best quality products at a lowest possible price, in order to sell goods at low price business focus to keep their cost as low as possible, therefore, cost control is one of the elementary and basic measures to quantify the performance. So the manufacturing, outsourcing and delivery cost has become one of the major competitive forces in today's competitive market and businesses pay their attention to reduce this cost in order to compete in the market [18]. Once goods are delivered to customer on time i.e., speedy shipping, this

will reduce the inventory handling cost and chances of inventory deterioration or damage will also reduce, but there is a need to balance the shipping charges with time because there is an impact of currency fluctuations, effective decision will not only results in saving cost but also making it be more competitive [15]. To measure the financial performance of any SC there is a need to consider the total logistic cost, otherwise, it cannot be measured, and sharing of information through the whole organization is therefore essential for effective strategic decision making.

Long-distance shipping poses an ongoing threat to cost management decisions, as it volatilizes stock price and contributes to very high or low stock levels, which ultimately leads to high administrative and opportunity cost. Today the opinion of buyers and vendors is of great importance to products and services. Dealers have the most important role to play in the distribution channels [19]. To reach the maximum production, brief comprehension and a wise strategic decision is a precondition.

The benefit of the SRM is illustrated by the fact that the poor coordination between suppliers is one of the main concerns in the American pharmaceutical industry and reflects a loss of almost 40 billion dollars each year in which 70-80% of the total output is outsourced [20].

[21] specify partnership as a purpose of information sharing, improvisational gains, long term relationship, growth, product development and mutual goals between trading partners. While discussion on management conflicts and effective communication in the literature about the partnership, nevertheless, other scholars later studied aspects of SC relationship governance which relates to partnership between businesses. [22] explained the and defined as characteristics of partnership management integrated activities, shared information, joint relationship initiatives, committed investments and relationship performance. [23] analyzed the performance of the Indonesian companies from two separate collaboration viewpoints, as important determinants of partner SC management, they found confidence, shared information, joint relationship management, and asset-specific relationships, and they further argued strategic partnership as an important determinant of success. Their conclusions have mirrored [23] prior observations. According to [21] market, complexity and creativity have a significant impact on supplier efficiency and may affect SC management selection significantly.

A significant qualification in terms of supply efficiency is fulfilment output through shipping networks, warehousing venue, and distribution style and vehicle preparation. The performance of delivery depends on specific factors such as supply channels, location policies

and scheduling and can be enhanced by an appropriately selected factor mentioned above [24]. As an important measure of deliverable output which is important to supply-chain efficiency, [25] discovered the good relationship among the performance of the SC and delivery to the requested date, order fills lead time and delivery to oblige date.

For every single SC strategy, customer satisfaction is an important factor which should not be compromised, organization performance measurement is not possible without considering customer satisfaction either they are satisfied with the goods or services provided by the organization [15, 26]. Customers need and want should be unified with the feedback the organization gets by its delivery methods and product design. As with growing environmental volatility and fragmentation, SC businesses use SC as a strategic weapon for achieving a competitive advantage [27]. Flexibility can more widely be described as the capacity of a business to change or react to constantly changing environmental factors, i.e. market demand and client needs. Therefore, the following hypotheses can be developed.

H1: The SC management practices of a firm have an important positive effect on FSCP.

2.2. Firm's Supply Performance & T.Q.M Practices

To reach the best performance level and the customer satisfaction (TQM and SCM) are the common practices which management thinks of to use it.[21]. Nonetheless the traditional way of improving product quality and quality control techniques focused on the performance of product's specification, the aim is to make zero defect products in order to achieve customer satisfaction mentioned above [21, 28]. SC management's main goal is to supply good quality products, as once customer will be satisfied this will result in an increase in organization revenue [21, 28]. The change in view of SC management is one of the reasons that traditionally it only focused the logistics.

Earlier studies are based on the overview that the focus of SCM research is timing. Additionally, they said that keeping the cost as low as possible and on-time delivery of product or service is the symbol of SC management performance. While, [29] discover customer satisfaction by the means of fast response towards their needs and how it gets changed, customer demand is more important and meeting these demands with minimum cost is SC management goal all the time. Previous studies discovered behavioral patterns of TQM which are similarly recognized as base ideas of TQM which is of great significance to measure organization performance and these are resource focus, leadership, customer and human resource focus. Most of the preliminary studies by researchers in the SC claims that SC management as a

system through which the flow of information and materials can be directed towards the final destination. There are risks that quality will be compromised at the cost of production, obviously with more focus on delivery. Yet customer satisfaction can be generally useful and eventually aimed at allying the two goals [29]. Previous findings similarly recommended significant association amongst TQM and FSCP. The results of a study conducted by [28] besides the qualitative factors shows that TQM practices that directly make it possible to implement SC management and improve supply performance directly. Therefore, through SCM practices and TQM practices will indirectly enhance the distribution performance of the company. A significant association between SC Management Practice, TQM Practice and FSCP was revealed based on the primary data collected from 292 Singapore automotive industry managers [15, 28].

H2: There is a significant and positive influence of T.Q.M practice on Firm Supply Performance.

2.3. Information technology capability, SC management practice, TQM practice

In order to improve SC performance, IT abilities are being taken as a key factor in the SCM. IT competency has a significant association with SCM [15]. In particular, many researchers have discovered that IT infrastructure is the most important factor to keep the cost as low as possible and increasing efficiency in operations. However, IT technology has a positive effect not only on accountability but also on corruption as it aims to focus on governance issues relates to internal controls. Embedding of strong internal controls, where there is a need in an organization leads to improve accountability in operations. IT workers serve as an essential facilitator in the corporate sector regarding key IT products and services to facilitate smooth business activities [30]. The IT personnel propose a suitable technical solution to solve IT-related business problems through enterprise resource planning software (ERP) [31]. Mainly workers in IT department can only recommend the best solution when the need of IT department gets fulfilled effectively in a dynamic environment so the workers will share their extent of knowledge and experience [32]. Thus, the workforce in the IT department demonstrated uninterrupted and progressive effect on the swiftness of organization performance. Moreover, the usage of IT knowledge is considered as one of three critical success factors in the management of SC. IT user's knowledge is important for the use of the technological developments adopted to enhance business operation. Moreover, IT re-configuration significantly impacted SC performance. In particular, it has the benefits of soundness, stability and versatility for the company. Bundle modular production

system (BMPS), for example, resulting from a new configuration of the bundling system and modular production system allows manufacturers to quickly respond to volatile and rapidly changing market in a cost-effective and time-efficient manner.

Technology and advancement have become a requirement in human life, whereas SC technology has become a need in order to achieve effective business operations. Besides the business activities, the provision of the effective medium for high-quality information delivery is largely dependent on the technical mechanisms. Thus, SC technology will be even more important than ever in the textile and apparel industries. [33] findings stated that the level of information shared among companies has a beneficial and significant impact on the performance of the SC and the relationship is intermediated by apps of extranet technology, namely EDI, VMI, and POS, respectively. Furthermore, the results of a study by [34] which includes 295 manufacturers at Taiwan's industry, suggested that SC practices such as SRM and CRM systems mediated the relationship between supportive infrastructure and SC efficiency. In addition, IT workers have a direct and indirect influence on organization resilience through the management of SC technology. For example, IT experience and IT re-configuration learned from training are intended to provide more convenient environments for consumers to use the programs. Several reports have shown that IT competence is an important factor for rising the application of development and innovation in the SC. One of the key factors in adoption processes is IT human resources. Therefore, adequate IT is required to maintain a continuous application process in the organization to enhance the role of technology in business operations. The study by [35] reported that much penetration of IT by workers suggests a higher degree of technical acceptance of the SC. Although employees with skills to work in a dynamic environment accept new technologies and challenges benefit the entire organization. This showed that textile and clothing companies need skilled people to operate the technology they pursue in today's business activities. It is therefore suggested that higher IT capacity should lead to higher levels of technology utilization in SC. The current situation tells that organizational culture is seen as a major factor for implementing SC technology and advancement also. Based on the above arguments following hypotheses can be developed.

H3: The ITC significantly and positively impacts the FSCP through the ITC.

H4: The TQM significantly and positively impact the FSCP through the ITC.

H5: The SCM significantly and positively impact the FSCP through the ITC.

2.4. TQM, Firm supply performance and Technology adoption relationship

In addition, three specific variables have an impact on the technological innovation, that is operational, technical and external circumstances influence the implementation of technological advancement [36]. Technology is a major contractual force which often maintains trade agreements. Supplier and organization collaboration is effective, efficient and reliable for implementing appropriate technology. There are also important components of implementation not only operational capacities but also IT capability and company culture. Several scholars have proved to be an essential factor influencing adoption of SC technology in a supplier partnership, customer relationships, information sharing and information quality. Thus, [37] have found that before the SC system is implemented the level of information sharing requires evaluation. While the judgment is based on the quality of information so that the users can make informed decisions and must be focused on knowledge sharing styles. In addition, Gertler's analysis of the implementation of Ontario's advanced technologies showed that the close relationships between consumers and large-scale service providers are keys to success. The means that the adoption of technology in the SC is linked to higher interpersonal capacities. In the technology perspective, the explicit and accumulating technology, [36] argued that there are two forms of technology that can have a significant influence on the adoption of the SC technology.

Several studies have demonstrated a significant association among organizational culture and the implementation of new ways of manufacturing technological development, cellular machining practices and current way of production practices. In contrast, lack of user participation is one of the key elements in implementing the SC technology. In fact, the effective application of SC technologies requires that both parties must share their cultural values [38]. [39] states that the need for personal advancement in technology is essential to lead to an adoption method. Therefore, organizationally based culture not only allows the use of technologies throughout the SC but also attempts to maintain the significance of the SC equipment used. From the above perspective, organizational culture has the ability to affect the implementation of SC technology. This can be factually supported by [37] research with a substantial moderating influence on the implementation of SC technology. [26] emphasized that the adoption of SC technology is influenced significantly by environmental, technological and organizational attributes and implementation has further enhanced the SC performance of the company. For the statement described above, once SC technology is implemented it has the capacity to act as a mediator in the association among SC capabilities and

SC operational performance. Based on the above arguments following hypotheses can be developed.

H6: There is a significant and positive influence of SC technology on FSCP.

H7: There is the significant and positive influence of TQM practices (TQMP) on FSCP through SC technology.

H8: There is the significant and positive influence of SC management practice (SCMA) on FSCP through SC technology.

3. Methodology

The most critical area of any research is perhaps the analysis process. The preference of an effective research method should be compatible with the hypotheses. This study is based on the primary data that is collected from the survey method. A review of the data collected by an e-logistics client in Indonesia was performed. For data collection, the seven-point Likert scale was used. A sample was chosen, and questionnaires were circulated using the basic randomized method of sampling. The sample size was selected for inferential statistics series given by [40]. Therefore, a sample with a population of 300 is selected in this research. Initially, customers e-mail id will be collected through electronic systems. Subsequently, each customer with his own e-mail id will have the form filled with questions. Two hundred and twelve forms acknowledged in this survey and the feedback rate is 57%. For the analysis, the information gathered through the survey SEM is used.

4. Data analysis, results and discussion

Two key aspects of the are examined in this study. Section 1 evaluates the reliability and validity based on an outer model assessment. Section 2 of an internal model assessment to test the hypotheses of the study [41]. The first step discusses convergent and discriminant validity. Composite reliability (CR) and average variance explained (AVE) are the tools to test convergent validity. The value should be greater than .4 for every item associated with factor loading [42], and for CR it should be higher than .7 and AVE must not below 0.5. The results of the outer model are given in Table 1.

Table 1. Outer Table Model Results

Construct	Indicators	Loading	Cronbach's alpha	Composite Reliability	AVE
Supply chain	SCM3	0.92412	0.81804	0.82314	0.6222
management	SCM5	0.89046	0	0	0

nt (SCM)					
	SCM7	0.90474	0	0	0
	SCM9	0.74358	0	0	0
Total quality	TQM1	0.79968	0.81498	0.81702	0.59976
management (TQM)	TQM2	0.8517	0	0	0
	TQM3	0.48858	0	0	0
	TQM4	0.75582	0	0	0
	TQM5	0.87108	0	0	0
	TQM6	0.86292	0	0	0
IT capability (ITC)	ITC2	0.89148	0.92106	0.94452	0.64158
	ITC3	0.90168	0	0	0
	ITC4	0.90576	0	0	0
	ITC5	0.91494	0	0	0
	ITC11	0.81702	0	0	0
Supply chain	SCMA5	0.88434	0.7293	0.72114	0.57528
management	SCMA6	0.88944	0	0	0
Technology adoption	SCMA8	0.74766	0	0	0
(SCMA)	SCMA10	0.78744	0	0	0
Firm Supply	FSP1	0.78744	0.7395	0.80376	0.5916
performance (FSP)	FSP2	0.77928	0	0	0

	FSP6	0.81 702	0	0	0
	FSP7	0.80 682	0	0	0
	FSP8	0.82 518	0	0	0
	FSP9	0.78 846	0	0	0

Discriminant validity is shown in Table 2. Evaluation of discriminant validity via AVE was suggested by [43]. Variations are shown in Table 2.

Table 2. Square root of AVE

	FSP	ITC	SCM	SCMA	TQM
FSP	0.8007	0	0	0	0
ITC	0.4488	0.8863 8	0	0	0
SCM	0.4324 8	0.4090 2	0.7854	0	0
SCMA	0.4375 8	0.4386	0.6344 4	0.7405 2	0
TQM	0.4386	0.4753 2	0.4110 6	0.4324 8	0.729 3

The inner model was used to identify the association among the variables of the study. This is the part belongs to the testing of the hypotheses. In this, both direct and indirect association including the mediating relationship were tested.

Table 3. Direct Effect Results

	Original		Sample Mean (M)	Standard Deviation (STD DEV)	T Statistics (O/ST DEV)	P Values
	Sample (O)					
ITC → FSP	0.22 1	0	0.21522	0.076 5	2.9702 4	0.00 4
SCM → FSP	0.16 8	0	0.17136	0.077 52	2.2042 2	0.03 2
SCM → ITC	0.26	0	0.2652	0.067 32	3.9096 6	0
SCM → SCMA	0.55	0	0.54876	0.064 26	8.6883 6	0
SCMA → FSP	0.15 1	0	0.14994	0.075 48	2.0481 6	0.04 6
TQM → FSP	0.20 4	0	0.21012	0.094 86	2.1879	0.03 3

TQM → ITC	0.37	0	0.36924	0.070 38	5.4009	0
TQM → SCMA	0.21 1	0	0.21522	0.065 28	3.2813 4	0.00 1

The t-value of 1.96 is the minimum acceptable level. Table 3 demonstrates that all the related hypotheses have respective t-value higher than 1.96 that results in the acceptance of all direct hypotheses. Such results demonstrate the significant positive association among SCM, TQM, IT competencies, adoption of SC technology with FSCP.

Table 4. Indirect Effect

	Original	Sample Mean	Standard Deviation	T Statistics	P	
	Sample (O)	(M)	(ST DEV)	(O/ST DEV)	Values	
SCM → ITC → FSP	0.137 7	0.14	0.04 692	2.9661 6	0.00 408	0
TQM → SCMA → FSP	0.112 2	0.11	0.04 182	2.7438	0.00 714	0

Table 4 discloses indirect effects. The mediating role of IT capacity among SCM and FSCP is significantly based on the indirect effects. In addition to this, the mediating role of the implementation of SCM among TQM and FSP is also significant. It demonstrates that the adoption of IT increases the significant effect of SCM on FSP. Furthermore, the implementation of SCM will also act as a mediating variable that enriches enhances the influence of TQM on FSCP. With this research, shows evidence that information technology act as a mediating role in SC literature [44]. Nonetheless, new research by [45] finds that IT competencies have a significant positive impact on SC and is one of the mediating factors in SCM literature.

Table 5. Variance Explained

Firm Supply Performance	0.3212
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5. Conclusion

The main objective of this research is to examine the association among SCM, TQM, SCMP, IT competencies, SCT implementation and FSCP. Moreover, this research aims to find out the mediating role of technology associated with supply chain and IT. The conclusion of this research is consistent with the hypotheses. IT and SC

technology are key factors in TQMP, FSP and SCMP. Technology is necessary for an organization especially in the area of SCM to effectively conduct the business operations. While the sample of this study is based on the Indonesian textile sector, therefore, the generalization of the results is the main limitation of the study. Moreover, the policymakers should encourage the implementation of the technology in Indonesian manufacturing sectors to improve the efficiency of the operations of the business.

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