

The Impact of Information & Communication Technology and Supply Chain Knowledge Management on Lead Time

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Abstract- The objective of the present study is to examine the impact of supply chain knowledge management and information and communication technology on lead time of the retail sector of Indonesia. Additionally, mediating role of Responsive Supply Chain is examined in the present study as well. For the present study, Data was collected in the form of questionnaire from the customers of retail sector of Indonesia. A total 340 questionnaire were distributed among the manufacturing firms in the Indonesia. The response rate of the current study is turned out to be 67.5 percent. For analysis of the data gathered, the Partial Least Squares (PLS) software was chosen for carrying out statistical analysis of the collected data, followed by the presentation of the outcomes. The results of the study support all of the proposed hypothesis. The current study is important for the policy makers and practitioners of supply chain and retail sector to use the supply chain knowledge management tactics and information and communication technology so the lead time can be improved.

Keywords; Information & communication Technology, knowledge management, Responsive Supply Chain, Lead Time, Retail sector, Indonesia

1. Introduction

It's been largely recognized by the researchers that the competition in the business is increasing day by day and the organizations cannot compete alone. On the other hand, failure or success of the organization is determined by the success or failure of the supply chain of organization. Organizations are using different measures in terms of supply chain to achieve optimum level of theory performance, market understanding and satisfaction of the consumer [1].

In the current volatile and global marketplace,

organizational response rate to the request of customers is the key and plays the competitive role. By this way organizations can create more demands, shorten the life cycle and increase the variety of products. The main objective of supply chain is to provide right product and services to the right target market or consumer. Organizations must have agile supply chain through more flexibility and speed of the supply chain. These mentioned agile plays very important role in the performance of the organization [2].

By giving quick response to the customers through the supply chain enables the organization to meet the demands of the customers is shorten time. moreover, supply is also synchronized to meet the troughs and peaks of the demand. For the survival and competitiveness of the organizations, quick response and responsive supply chain is key because the cost of producing goods is reduced. Though, in order to improve the accuracy and forecasting, a number of sophisticated approaches are being used including time series, there is a factor of uncertainty in demands which cannot be avoided. The services are improved by the inventories through supply chains as it helps in improving the deal with the uncertainty of the demand, minimize the cost and offer flexibility as well [3].

In last two decades, the information and communication technology also known as ICT and internet has grown over the time has increase the efficiency of information, data exchange, data sharing and timely access, supply chain management, logistics and interaction [4]. The cost and design of supply chain management (SCM) has been influenced by these advancements. Moreover, the relationship among customers, employees, vendors and suppliers is also impacted by this advancement of technology. Among different sectors and industries, the role of supply chain

management is very important. This role varies according to the industry as well. In the context of grocery store, supply chain is started when any product is ordered by the customer, which is then transported to the customer through the company which provide logistics which is received by the customers called a network. In the same way, a number of researchers have realized the ICT technology application in SCM. For the internationalization of distribution and productions ICT have played very important role [5].

In the business environment, which is very dynamic, organizations are participating in the supply chains which are mostly more than one. The tool of ICT is recognized by the decision makers by which organizations can develop and sustain competitive advantage to better compete in the market. As mentioned by researchers that businesses have increased the cost their investment on ICT by 40% in last 70 years. These ICT equipment's are being utilized in the area of supply chain including cloud-based services, connectivity through mobile, payments among stake holders, tracking of the shipment, management of inventory, and order placement within a supply chain [6].

The retailers and manufacturers in a number of countries are using the tools of ICT under the supply chain so the promptness of operations can be enhanced along with economic performance and efficiency. ICT is basically derived from the data processing of the operations to the operations that are information based for the knowledge base of the business, supply chain knowledge management (KM) is the basic need of the organizations. Business continuation and organizational success is dependent upon the one important factor known as supply chain knowledge management. The basic aim of KM is to handle the potential knowledge and knowledge [7].

Development of capabilities of organization is also involved under KM due to which organization will be able to distribute, transform, create and recognize the knowledge. It also involves external and internal value creation of the organization. As a result, KM should be exceeded beyond the boundaries of organization because of the needs of the organization so the resources of knowledge can be leveraged [8]. Therefore, it should be the part of SC. The retail sector of Indonesia is one of the dynamic sectors all around Asia. The projected growth in this sector is proposed to be 13.8% in next 5 years. This growth also highlights the intense competition which increase the need to minimize the lead of the product production [9].

Current study aims to discuss comprehensive literature regarding related constructs (Information & communication Technology, Supply chain knowledge management, Responsive Supply Chain, Lead Time). Present research owes the objective to explore the association between responsive supply chain and lead

time, information & communication technology and responsive supply chain, supply chain knowledge management and responsive supply chain. Also, main purpose of this research study is to explore responsive supply chain as a significant mediator between information & communication technology and lead time; supply chain knowledge management and lead time.

2. Literature Review

2.1 Lead Time

Against the random fluctuation in the demand of supply chain one way is to keep various inventories at various points as well as working with multiple suppliers, certain processes expedite having an option, transportation option using, or we have different routes for a unit through the supply chain. In modern the supply chain to respond rapidly, efficiently and effectively to workplace changes. Similarly, world class customer drive to achieve with minimum reasonable inventory of services levels coupled [10]. There are many companies today, that have created global strategies to raw material source, they have arranged the labor and other components from low-cost country, which are often located far. It means that they can have much option for selecting negotiate and supplies at low prices. In this way they hope well to achieve the secure supply source and competitive advantages. Strategies of influencing global operation for common business are, for example, aiming to scale of economies to manufacturing size by optimizing or border-cross mergers operations spreading over a large number of countries [11].

Organization of the World Trade states that, in much of countries growing world trade is faster than the gross national product and most probably continue to do the predictable future. Thereby, the expansion and complexity of companies continuously keep increasing as well. Due to globalization, the basic challenge being faced is the expansion in lead time of supply chain, unreliability of transit time, possibilities of consolidation and various modes of transportation that are causing an increase in costs [11]. Various reasons behind the cause of these challenges are the financials, ocean freight scheduling, special packaging and clearance from custom. However, he stated supply chain become flexible and less consistent due to longer lead times in supply chains [12].

2.2 Responsive Supply Chain

[13] has discussed responsiveness in the wider supply chain. they argue that the characteristics of the products like functional or innovative and needs of life cycle to be linked with functions and layout of the supply chain. He also points out need of reduce the lead time, to unpredictable demand which enable quick response to minimize the stockouts, obsolete inventories and markdowns [14] Recently, different conceptual modals in

supply chain responsive have been proposed. Studies discuss that product, volume and process are three basic factors to determine a system of supply chain responsiveness. It also gives guidelines for the alignment of supply chain strategy to maintain a balance between supply chain efficiency and customer demand. Conceptual management strategy is proposed by various scholars in order to improve supply chain responsiveness [15-21].

Responsiveness might be defined as the supply chain ability to respond the rapid change in demand, both in terms of products mix and volume. Furnishing the things timely with the basic lead time is known as responsiveness. It means that lead-time; filled rate, item defer, conveyance oversights, client reaction time, and grievances or client difficulties. [16] started the portraying responsive SC form in stage of most punctual starting; which are recognize the five essential activities, these activates are: (1) inbound logistic; (2) outbound logistic; (3) acquirement; (4) operation; (5) deals and advertising. These activities made rundown of following four efforts of legitimate coordinate those which need to exist in each responsiveness/swift association. These are following: (1) creative thing sketching out; (2) very fitting conveyance of cost sharing; (3) interconnected date; (4) dumbfounding thing, little stock.

2.3 Information & communication Technology

The uses of communication and information technologies (ICT) are integral part of the modern society. For all individual's, asset is the valuable for the regarded information. The gathered information helps to construct the knowledge and is by a vital survival skill is large scene. In the developed countries the immediate feature no one can deny that, and it is also dependent upon the transformation of society into knowledge based or information-based version where creation, supply chain knowledge management, and processing information are key features [22].

One of most important enablers of effective supply chain management are Information and communication technologies (ICT) [23]. In supply chain management a great deal of interest stems from the information availability to reach meaningful results. New opportunities exist as electronic business gain importance, and there is an increase in interests in information technologies due to widespread use of internet. For many companies' ICT tools are a source of competitive power. Big retailers like airlines industry, or especially for the service industries, information technology is an important part and usage of information technology is very wide due to which information technology plays a vital role is many of the organizations. It is very important in supply chain management to get the information and opportunities on time. To increase service level, timely and accurate information will enable the organization to increase

efficiency and decreases the lead time and cost of organization. In order to sustain long term relationship with customers and gain competitive edge, many companies are serving their customers by information technology-based services [19].

2.4 Supply chain knowledge management

From era to natural resource to era of knowledge, business world is transforming. The world is moving towards the era of knowledge away from the era of natural resources and this era of knowledge is based on skills and education, development and research. Knowledge is the basic economical resource and the previous economical resources such as natural resources and longer capital are no more basic economical resource. The most valued commodity and asset is considered as knowledge and it is valued highly [24].

In the peoples experience and mind, knowledge and understanding can be referred as possess of information. In decision making and taking actions at critical timings, all the information is contained by knowledge. Expertise, information and knowledge is contained by the knowledge claimed by [25]. The main purpose to make knowledge visible is knowledge sharing by showing the knowledge role in encouraging employees in the organization and to build the knowledge infrastructure and fostering the mechanism of knowledge sharing. Knowledge is useless and obsolete without a proper management system of this knowledge. Thus, to manage the organizational knowledge, the implementation of knowledge sharing is required by the organization [26].

Supply chain knowledge management is defined by multiple different researchers and experts in several ways. To manage the knowledge, capacity required is supply chain knowledge management such as organizational external and internal knowledge gathering and converting this organizational knowledge to new strategy and new idea with its implementation and protection. Supply chain knowledge management is defined as an explicit and systematic application of knowledge, helping the firms to enhance the knowledge-related efficiency of organizations and returns from the assets of knowledge. Supply chain knowledge management increases customer value enhances innovation and encourage new capabilities resulting to increase performance of the organization. The process of storing, using knowledge, sharing and capturing the knowledge, supply chain knowledge management is defined as the best process in the light of above discussion [27]. Besides this for the capturing of the both explicit and implicit knowledge of employees, supply chain knowledge management can be defined as the systematic process of communicating, gathering and organizing the employees' knowledge and it may be used and helpful in employees' later work [28].

2.5 Responsive Supply Chain and Lead Time

The lead time of supply chain is considered in management's responsiveness at different levels. The supply chain responsiveness is promoted due to reduction of lead time. It is done by providing the products to the users in the time which is less than normal time. The end time responsiveness is considered as the speed of supplying the product. The responsiveness of lead time is referred as the speed in which product is delivered to the end user. moreover, the organization can perform better when there is short lead time than the normal. Importantly, the lead time of the organization to deliver the product is short because the market is getting competitive day by day. Under the responsive supply chain, the lead time of production and distribution is shortened due to which the organizations can meet the demands and other changes of the environment [29].

H1: Responsive Supply Chain and Lead Time are significantly related to each other.

2.6 Information & communication Technology and Responsive Supply Chain

The retailers are better able to manage the raw material, track and improve the schedule of the business by using the ICT system. Through ICT, organizations can increase the responsiveness, data accessibility, validity enhancement, minimize the cost of staff which will minimize the human error as well, internal integration, improvement in the business processes and cost saving [30].

Researchers mentioned that organizations can get advantage in the business through bar codes. These benefits include saving the cost of the labor, reduction of cost of store, increase demand and distribution, limits handling which is unnecessary, minimize the responsiveness and turnaround time. According to studies, bar codes also offer the potential to gain several additional key business advantages including labor savings from eliminating manual bar code scanning or keypad entry, theft and loss prevention capabilities; streamlined inventories and cost reduction; reduced turnaround time and responsiveness; increased efficiency by minimizing unnecessary handling; potential for production adjustment to real-time downstream inventory level reports; and on-demand replenishment at the distribution center or retail store level [31]. Thus, Information technology is crucial for achieving efficient and responsive supply chains. Different supply chain members including customers, focal companies and suppliers are linked with each other through flow of the capital, materials and information. With the of information, supply chain of the organization works together with the aim of making a coordinated and integrated supply chain. Responsiveness of supply chain to the demand is unlocked through information. Moreover, for SCM, IT is very critical factor [32].

H2: Information and communication Technology and Responsive Supply Chain are significantly related to each other.

H3: Responsive Supply Chain mediates the relationship between Information & communication Technology and Lead Time.

2.7 Supply chain knowledge management and Responsive Supply Chain

The key success factors of the organization include reliable and fast channel of distribution, adaptability according to the demands of the customers, and the production scheme of the products which are cost effective. As the knowledge is flowed in different departments of organization like development of technology, improvement in the process of innovation and NPD along with transfer of knowledge among the organizations [33]. An effective strategy of KM starts with vision having strategy and definition with clarity of the reason for the reason of knowledge to be critical. Significance of organizations is mainly dependent upon the outside competencies of the organizations so they can respond to the demand of the market. If the organizations can create value and capability is developed, external knowledge is shared by the organization as well. For this reason, there must be a portal of knowledge through which the supply chain partners can share the information and view that as well. Researchers revealed that the organizations having capacity of KNM have the positive impact on the responsiveness of organization towards the external environment [34].

H4: Supply chain knowledge management and Responsive Supply Chain are significantly related to each other.

H5: Responsive Supply Chain mediates the relationship between Supply chain knowledge management and Lead Time.

2.8 Research Framework

Following research framework is developed from the above literature:

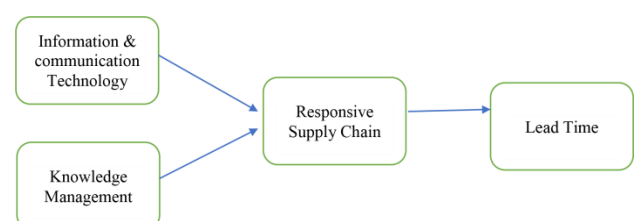


Figure 1. framework

3. Methodology

After completion of the data collection process, the researcher performed descriptive as well as inferential analyses to analyze the data collected for this study. In order to examine the hypotheses that were proposed on the

basis of literature, various technique was considered. Meanwhile, for data coding and analysis, the Statistical Package for Social Sciences (SPSS) v.23 and Smart PLS 3 were chosen. According to [35], data analysis techniques are generally selected based on the variables' characteristics and the study's research questions. Thus, the current study adopted structural equation modeling (SEM) approach for data analysis.

The SEM approach is considered as an effective tool having the ability to assess multifaceted relationships among the constructs. Several researchers have argued that structural equation models (SEM) are superior models since they provide better estimates as compared to regression estimates, particularly in case of moderating and mediating effects [36].

Specifically, the Partial Least Squares (PLS) software was chosen for carrying out statistical analysis of the collected data, followed by the presentation of the outcomes. The PLS software is preferred because it can flexibly estimate, develop and validate complex models. It is a second-generation multivariate technique and also works well among the models that involve multiple latent variables and cause-and-effect relationships, such as the structural equation models. A total 340 questionnaire were distributed among the customers of retail sector firms in Indonesia. The response rate of the current study is turned out to be 67.5 percent [37].

4. Results

Assessing models through PLS-SEM involves two steps, these are: measurement model estimation and the structural model estimation, similar is the case for covariance-based structural equation modeling (CB-SEM), which involves the assessment of Goodness-of-fit (GOF) and Goodness-of-Measure (GOM). The measurement model reflects the structural correlation between latent variables involved in the model and their indicators. Establishing the discriminant and convergent validities through average variance extracted (AVE) and composite reliability evaluation, thus lead to the determination of the measurement model. Furthermore, the present study also obtained outer loadings for each indicator and the cross loadings to determine the reliability of the indicators [38].

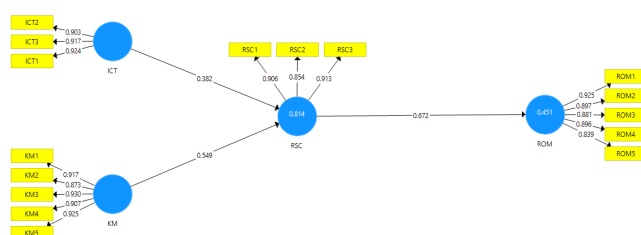


Figure 2. Measurement Model

According to [39], the individual item loadings must be equal or above 0.70 value, on the other hand, [40] proposed 0.40, as a threshold level, such that, if outer loadings fall below 0.40 level then it must not be included in the outer model. [39, 40] have argued that all those indicators whose outer loadings fall within 0.40 - 0.70 must not be retained in the scale, particularly, if the deletion of these items result in the increase in AVE or composite reliability (CR).

Table 1. Outer Loadings

	ICT	KM	ROM	RSC
ICT2	0.903			
ICT3	0.917			
KM1		0.917		
KM2		0.873		
KM3		0.930		
KM4		0.907		
KM5		0.925		
ROM1			0.925	
ROM2			0.897	
ROM3			0.881	
ROM4			0.896	
ROM5			0.839	
RSC1				0.906
RSC2				0.854
RSC3				0.913
ICT1	0.924			

For measuring the internal consistency of measures, composite reliability is suggested to be more robust internal reliability measuring technique. Based on [37], composite reliability criteria, it is argued that in order to be acceptable, the composite reliability (CR) value should essentially turn out to be greater or above 0.70, which can be relaxed to 0.60-0.70 range for exploratory research. Furthermore, internal consistency considers as scarce, if value for CR turns out to be less than 0.60 [36]. Initially, poor item loadings were obtained when PLS algorithm has been calculated for the first time, such as, resulting in the deletion of these items from the scale as suggested in above mentioned criterion. These three items were removed one by one which led to the improvement in the values of average variance extracted (AVE) and the composite reliability (CR) for the construct i.e. organizational leadership behavior.

Table 2. Reliability

	Cronbach's Alpha	rho_A	CR	(AVE)
ICT	0.902	0.903	0.939	0.837
KM	0.948	0.949	0.960	0.829
ROM	0.933	0.935	0.949	0.789
RSC	0.870	0.873	0.921	0.795

It thus shows the extent of uniqueness of a particular construct from other model constructs and whether indicators are the true representative of their respective construct [36]. Therefore, to determine the discriminant validity, [38] criterion was observed, which expects the average variance extracted (AVE) square roots to be greater than this construct's correlation with other constructs.

Table 3. Discriminant Validity

	ICT	KM	ROM	RSC
ICT	0.915			
KM	0.870	0.911		
ROM	0.671	0.649	0.888	
RSC	0.860	0.882	0.672	0.891

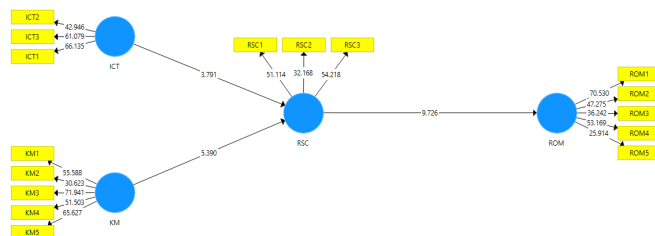


Figure 3. Structural Model

After successfully evaluating the PLS-SEM's measurement model, structural model was then analyzed, since it is an essential condition to carry out sequential analysis using the Smart PLS 3 software. In this section, structural model's measuring criteria, procedures and methods are presented, starting from the model's significance and relevance subject to its path coefficients values, standard errors and t-statistic.

Table 4. Direct Relationships

	(O)	(M)	(STDEV)	(O/STDEV)	P Values
ICT -> ROM	0.25 7	0.25 5	0.075	3.436	0.000
ICT -> RSC	0.38 2	0.37 7	0.101	3.791	0.000
KM -> ROM	0.36 9	0.37 3	0.077	4.777	0.000
KM -> RSC	0.54 9	0.55 5	0.102	5.390	0.000
RSC -> ROM	0.67 2	0.67 3	0.069	9.726	0.000

In this study, testing and evaluation of the established hypotheses were done on the basis of [34], recommended yardstick, that is, observing the effects of mediators, moderators and main constructs for both models, by performing a bootstrapping procedure in Smart PLS 3 software.

Table 5. Mediation

	(O)	(M)	(STDEV)	(O/STDEV)	P Values
ICT -> RSC -> ROM	0.25 7	0.25 5	0.075	3.436	0.000
KM -> RSC -> ROM	0.36 9	0.37 3	0.077	4.777	0.000

As suggested by [3-42], the coefficient of determination or R-square value is evaluated for obtaining the explained variance by exogenous variables in the model's endogenous variable.

Table 6. R-square

	R Square
ROM	0.451
RSC	0.814

5. Conclusion

The competition in the retail sector of Indonesia is increasing. Therefore, it is critical for the decision makers to apply ICT and supply chain knowledge management to enhance the supply chain responsiveness and impact the lead time to deliver the products. For this reason, the present study examined the impact of KM and ICT on lead time. Whereas, mediating impact of supply chain responsiveness among the mentioned variables is examined as well. The findings of the study revealed that firms dealing in retail sector can improve their lead time by focusing on the KM activities and using ICT. Through proper KM among all of the departments of the organization, the cost of doing business can be reduced. ICT can be also very effective for this purpose. As a result, the lead time to deliver the product will be reduced. It can later turn out to be the competitive advantage for the organization. The present study fills the gap of limited knowledge regarding application of ICT and KM in the supply chain sector. Moreover, this study also helps the organizations to implement different policies to minimize the lead time

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