

# Managing The Agility Of Supermarkets Supply Chain Using Inventory Management And ICT Systems Approach

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**Abstract:** The purpose a significant amount of operation issues do exist in local supermarkets and their supply chains confirming the need for their operational agility. The agility of supermarket chain mostly was associated to the capability of operation that responds to the increasing pressure of variability in customer demand and changing customer buying behavior. The paper therefore examines the agility of supermarkets supply chains to manage the inventory issues in meeting the customer order fulfillment. Cross-sectional study included survey data from managers of supermarkets which is spread over the big cities in East Indonesia. This also included the manufacturers and small retailers as partners of the supermarkets chain. A total of 164 usable responses, representing 40 per cent responses rate, comprise of 60 supermarkets and 104 manufacturers and retailer together. SEM modeling was used to find out the hypothesized relationship among the variables in a conceptual framework. Results of the study show that information and communication technology (ICT) plays an important role in managing supermarket inventory through its supply chains agility (SCA). The results also show that the supermarkets suffer from quick response to their consumer need, inventory stock out, higher distribution lead-time and lack of order fulfillment. The finding can offer an insight to the operation managers about the ICT usage that can provide an agility to overcome their inventory issues there by maximizing service level. The supermarkets need to be quick in response to meeting their customers' requirement. Unfortunately, some supermarkets have too many issues in serving the customers. Limited use of ICT with the suppliers and retail customers results in inventory shortages, higher distribution lead time and low service level. The paper aims to fill this gap by investigating how managerial practices may increase the agility in the supply chains especially in managing the inventory using ICT as enabler.

**Keywords:** supply chain agility, supermarkets, inventory management, ICT

## 1 INTRODUCTION

Lately, researchers have been exploring and collaborating with industry practitioners to improving the agility of supply chain. Manufacturers, suppliers, distributors and retailers can contribute significantly to support an efficient distribution of merchandise. Improving distribution agility by quickly responding to customers by delivering goods in full and on time (DIFOT) is the key to customer satisfaction. So supply chain players can collaborate together in this endeavor to make the chain more agile that can support targeted service level. Retailers play significant role in the retail business. Some of the supermarkets use electronic devices, information and communication technology (ICT) system and excellent collaboration among the supply chain players. However, in traditional market, retailers still use manual ordering and goods distribution with limited ICT resources. They rely on traditional mode of manual operation of their activities with SME suppliers and small store retailers [14] Quick response by timely distribution is the focus on some select supply chain players in order to get competitive advantage in market. Supply chains have been at the forefront of retail innovation. Retailers have recognized the need for involvement in the supply chain, got some benefits and achieved service levels and cost reduction. Management of logistics is very imperative for supermarkets. All of the logistics elements are costly when it is not managed effectively [23]. Inventory stock within supermarket needs to be managed effectively.

Fisher and Hammond [12] argue for five components of logistics mix that should be applied in the supermarket: storage facilities, inventory, transportation, unitization and packaging and communication. A significant amount of operation issues do exist in local supermarkets and their supply chains confirming the need for their operational agility. The agility of supermarket chain is a capability in their operation that responds to the increasing pressure of variability in customer demand and changing customer buying behavior [4], [6]. The question is how quick response the supermarkets and their supply chain partner to customers need that can implement in their daily operation [5]. Therefore, the paper will examine the agility of supermarkets supply chains to manage the inventory issues in meeting the customer order fulfillment. The organisation of this paper is as follows. The following section undertakes a literature review to explore the status quo of supply chain agility studies followed by development of hypotheses. The methodology section elaborates on the cross-sectional survey and the data analysis. The next section is the results of research. The paper concludes with discussion and conclusion.

## 2 DEFINING SUPPLY CHAIN AGILITY

The supply chain agility (SCA) is defined as responsiveness of the organization to counteract demand variability both in volume and variety [9], [10]. The agility is associated with uncertainty of market and customer demand. The agile mindset is related into production in manufacturing system and normally used in the supply chain management context [31]. Agile is closely associated with 'quick response' [32] and more pragmatically. The agile supply chain needs to deliver the variety of products to customers quickly. Christopher [9] identifies the characteristics of agile supply chain as (1) Market sensitive, that mean reading and responding capability to real demand in the market; (2) creating a virtual supply chain that shared information among the supply chain players; (3) process integration means partnership

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interrelationship between suppliers and retailers; (4) building networking means confederations of supply chain players linked together on networking; and (5) Measurement means quantity of products for retailers.

### 3 REVIEW OF SELECTED LITERATURE ON SUPPLY CHAIN AGILITY

#### 3.1 Supply Chain Agility

Agarwal et al. [1] have identified some variables that support agility of supply chain, there are: market sensitive (MS), delivery speed (DS), data accuracy (DA), new product introducing (NPI), centralisation and collaboration planning (CCP), process integration (PI), use of IT tools (UIT), lead time reduction (LTR), service level improvement (SLI), cost minimization (COM), customer satisfaction (CS), quality improvement (QI), minimizing uncertainty (MU), trust development (TD), minimising resistant to change (MRTC). The agility of supply chain is influenced by lead-time reduction, service level improvement, cost minimization and quality improvement [9]; [29]. The variable applied ICT tools, collaborative planning, and process integration [31]. Meanwhile, the data accuracy and market sensitiveness will be improved if the variables are achieved. They also found that satisfaction of customer, improvement to the quality, minimization of cost, speed of delivery, introduction of the new product, service level improvement and lead-time reduction will help to agile the supply chain.

#### 3.2 Inventory Management

Candra and Grabis [3] have observed some variables in inventory management such as ordering frequency, supply source, demand type and lead time. Inventory should be tight and updated regularly and attempt should be made to reduce quantity and accuracy in the data entry. However, Mercier, Sirkin and Bratton [24] state that inventory management is driven by demand variability, manufacturing and replenishment lead time. It is important to develop an agile of supply chain distribution. Developing trust between suppliers and retailers' can improve material flows through just-in time (JIT) system, making smaller and frequent distribution, appropriate of transportation and over stock replenishment.

#### 3.2 Information Flow

Lee et.al [19] define that information flow is essential mechanism to communicate with supply chain players as it provides impact on production scheduling, inventory control and delivery plan. On the other hand, in the situation of declining consumer demand, they will tend to diminish or stop orders to suppliers. Consequently, this demand can be transformed to expand the variations of stock in every part of the supply chain. There are some common obstacles related to packaging and transportation when retailers want to order frequently [7], [8], [18]. As a consequence, the bullwhip effect may occur when retailers suspend their orders until they have a maximum order quantity, and place orders in large size or proportions. This study observes distortion of demand information backward from small store to supermarket/distributor and retailers to suppliers/manufacturing as a result volatile of customer demand. Response to market demand should be carefully and based on market research. An inaccurate observation of the market will be giving some tendency to perceptions of the

actual customer demand. The consequences of this can continue to production, because the manufactures may double in production of material. As a result, they will increase the bullwhip effect [18].

#### 3.4 Information and Communication Technology (ICT)

According to Narayanan et al. [26], application of Electronic Data Interchange (EDI) has some benefit to companies. Application of Radio Frequency Identification (RFID), Vendor Managed Inventory (VMI) and other technology applications will assist companies to achieve real-time, transparent and visible supply chain management. The purpose of the ICT applications, such as EDI, is to reduce inventory levels, improve customer services, increase productivity, data accuracy, reduce paperwork, and response quickly to market trends [19], [2], [26]. Non-adoption of these supply chain technologies may restrict the order flow impacting on demand variation, which then may lead to bullwhip effect [20], [25], [16], [3]. [27], [28]. This study will identify the absence of supply chain technologies and IT infrastructure that presumably will generate the bullwhip effect in supermarkets.

#### 3.5 Knowledge and ICT Application

The extent and efficiency of the following ICT application as below:

1. Electronic Point of Sale (EPoS), with cash register device, a barcode on a product is scanned and the system removes some items from stock figure to the inventory tracking and management.
2. Radio Identification Frequency Devise (RFID) is a system uses the radio waves that will connect among supply chain players or partner through digital information in order to improve the inventory management.
3. Electronic Data Interchange (EDI) commonly uses to interconnection between suppliers and retailers for more efficiency their distribution of goods.
4. Quick Response Delivery System (QRDS), to support customer services and communicate the information for quick and accurate (point of sale) replenishment.
5. Decision Support System (DSS) is the application program to help decision maker to more easily make right decision.

In this study, we observed four variables such demand management, inventory management, information and communication technology systems that significant supports the supply chain agility in supermarkets supply chain.

### 4 A FRAMEWORK OF SUPPLY CHAIN AGILITY

#### 4.1 Supply chain agility and ICT

Management of materials and related information flows are critical in supermarket operation [33] argue that agility of supply chain can accommodate the demand uncertainty in the market. So, getting the agility within the supply chain is a right strategy [11], [13]. This implies materials and related information flows from factory to customers or vice versa is an important consideration where customer demand is quite volatile [30]. Retailers are the first supply chain player to face this volatility. So, inventory information (e.g. how many to order and when to order) need to flow to the suppliers using right ICT infrastructure. Apply integrated ICT between SC

partners is the most valuable to get distribution more agile. Information flow from suppliers' distributor to retailers will be maintained effectively and efficiently with collaboration among the partner. Given this considerations this paper begin developing the conceptual framework of retail supply chain agility.

To counteract unpredictable demand in the market, Fisher et al. [12] suggests that the innovative products demand have to be "market responsive" it is concept of responds that service processes emphasizing (i.e. speed and flexibility) is more critically rather than cost.

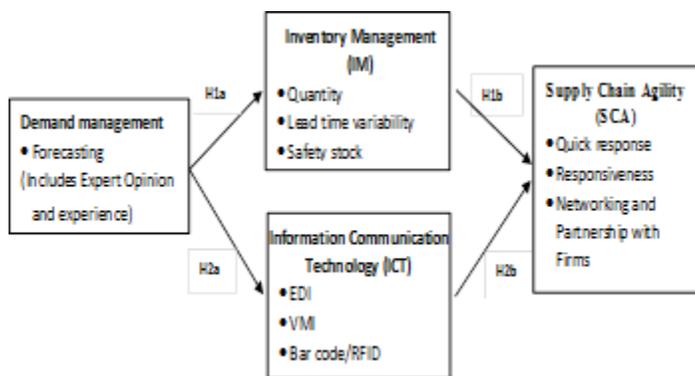


Figure 1: Conceptual framework of Retail Supply Chain Agility

The conceptual above leads to the development of a four-part hypothesis: Hypothesis H1a, demand management is positively associated with inventory management in supermarket supply chain. Hypothesis H1b, inventory management is positively associated with the supermarkets supply chain agility. Hypothesis H2a, demand management is positively associated with ICT logistics systems in supermarket supply chain, and Hypothesis H2b, ICT logistics systems is positively associated with supermarkets supply chain agility.

5 METHODOLOGY

This study used cross sectional survey to explore the agility of supply chain in retail supermarkets in Indonesia involving Carrefour, LotteMart, Giant supermarket, Matahari, Alfamart and Indomaret supermarket. Supply chain managers of these supermarkets are the key persons to take decision about the demand planning and procurement of goods from suppliers. Investment decision on ICT also comes under their role and responsibility. Other respondents were manufactures / suppliers and small stores as partners of these supermarkets. The questionnaire items addressed demand management, inventory management, ICT systems and supply chain agility. The survey questionnaire was conducted between April – May 2016. Exploratory factor analysis (EFA) was used to analyze the data than followed by confirmatory factor analysis (CFA) to confirm their reliability and validity [21], [22]. SEM modeling was also used to explore the hypothesized relationships among the variables.

6 RESULTS

The cross-sectional data collected from the surveys were screened for any errors and checked for completeness before being entered into the statistical package PASW. Initial

estimation of non-response bias, multicollinearity, and internal consistency (Cronbach alpha) was checked for the data set. Exploratory factor analysis (EFA) was carried out to check the independent factor loading for all of the constructs. Confirmatory factors analysis (CFA) was then used to afford a confirmatory test of measurement model ensuring that all the four variables logically and systematically that signify constructs involved in the theoretical model [15]. In order to figure out the data fit, test the statistical model and hypothesis, SEM modeling was used with AMOS 20 software. The mean, correlation coefficients and standard deviation (SD) are presented in Table 1 Pearson correlation coefficients suggest a significant relationship between the variables. However, no significant correlation was found between ICT and supply chain agility (SCA). The Cronbach alpha varies from .72 to .87 indicating a good internal consistency.

Table 1: Mean, SD and Correlation coefficient (N=164)

Variable	Mean	Std. Dev.	DM	IM	ICT	SCA
DM	2.92	.92	.87			
IM	4.24	.51	.65*	.72		
ICT	3.69	.60	.47*	.30**	.74	
SCA	4.59	.48	.35**	.29**	.60	.78

\*.p<.05 \*\* .p<.01

Italicized values along diagonal are Cronbach alpha We evaluated the path model separately for retail supply chain to check data validity. The results indicate that better demand management (DM) has significant positive influence (.65, p<.001) on inventory management policy. The inventory management policy is a significant (.29, p<.001) predictor of the Supply Chain Agility (SCA). Similarly, demand management and ICT system are significantly associated (.47, p<.001) that in turn is a significant predictor of the SCA (.35, p<.001). Further, though we did not state a formal hypothesis, the result shows a significant and positive relationship between IM and ICT (.30, p<.001). It suggests that managers perceived ICT applications helping in inventory efficiency. The results support the hypotheses H1a, b and H2a, b. The path analysis reports that the overall fit of the model was good. The goodness of fit indices are  $X^2 = 16.722$ ,  $df = 14$  (0.271),  $X^2/df = 1.194$ ,  $RMSEA = 0.035$ ,  $RMR = 0.021$ ,  $GFI = 0.974$ ,  $NFI = 0.965$ ,  $NNFI/TLI = 0.991$ ,  $CFI = 0.994$ . All specified factor loadings for four variables were within the permissible limits.

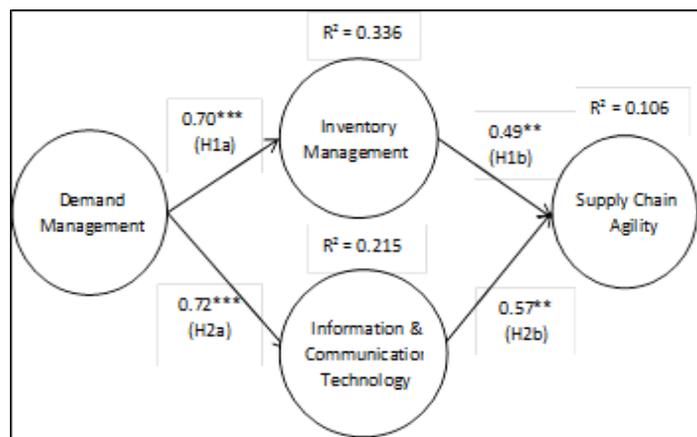


Figure 2: The path model of supermarket supply chain agility

In terms of the relationship between demand management and information and communication technology and the supply chain agility, result of the correlation analysis for supermarkets and regression analysis reveal that Pearson's  $r = 0.762$  while  $R^2 = 0.215$ , with  $F = 13.460$  and  $p < 0.001$ , implying that significant positive relationship exist and that both of demand management and information and communication technology simultaneously accommodates 21.5% of the variation in the supply chain agility. Hence, H1a is well supported, i.e., demand management and information and communication technology are significantly related to improving the supply chain agility in supermarkets.

## 7 DISCUSSION AND CONCLUSIONS

To achieve a good strategy and succeed of agility all supply chain players should be apply the mutual cooperation. Successful of agility strategy means higher inventory turn and always improve return of investment with tight in inventory, right decision in margin pricing, appropriate in mode of transportation and also always keep the market research. The use of cross-sectional data collection in this research is novice as previous research used either a longitudinal research or simulation technique to measure the SCA. It attempted to collect managers' perception on extra inventory while ordering upstream and used for further explanation. This contribution emphasizes that accurate demand management considers the strategic value of inventory management policy and role of ICT in logistics. All supply chain managers, especially supermarkets and suppliers, need to become more aware of managing extra orders that directly affect the level of their safety stock which is the root cause of overstock and decrease the agility of supermarket supply chain. On practical side, the study looked at retail practices on order management in Indonesia. While the chains have experienced the existence of the SCA, Supermarket managers do practice a robust demand management as evident from the causal relationships. Demand management needs further improvement compared to supermarket managers though are affected equally from their independent suppliers and convenience stores who need to upgrade their ICT systems within their limitations. On methodology side, given the sample limitations, inclusion of more partners from other regions of Indonesia could help in generalising the result. The results show that Inventory Management and ICT plays an important role in managing inventory to maximise the SCA. In order to maintain the role and availability of inventory including current sales product items, new product items, consumables goods, household product, out of date products and others supplies; inventory level needs to be manage in proportional and effective ways. Furthermore, management of developing inventory, value and services in order to improve inventory management, should maintain the inventory in the most efficient balance the requirement of customer demand and availability of stock. Items product movement in stores can be very vociferous and the aim must be to create improved inventory management systems. It cannot be understand that a significant reason for retailers expected returns on investment (ROI) which is driven by speed of inventory turnover. The successful ROI requires an inventory management system that enables both effective product replenishment and product shelf placement.

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