MANAGINGTHE AGILITY OF SUPERMARKETS SUPPLY CHAIN USING ICT SYSTEMS APPROACH

SurahmanSurahman, [1] *and* ***Himanshu Shee***[2]
[1] *Lecturer at Politeknik Negeri Samarinda, Jl. Ciptomangun Kusumo Samarinda, Indonesia*
[2] *Senior Lecturer & Researcher at Victoria University of Melbourne, Australia*

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 responding customers through delivery of goods in full, and on time (DIFOT) is the key to customer satisfaction. Supply chain players therefore can collaborate together in this endeavor to make the chain more agile to support targeted service level.

Retailers play significant role in the retail business. Some of supermarkets uses 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 relyon traditional mode of manual operation of their activities with SME suppliers and small store retailers (Gunasekaran & Ngai, 2003). This is where the supply chain agility matters a lot. The supply chain agility (SCA) is defined as responsiveness of the organization to counteract demand variability both in volume and variety (Christopher, 2000).

Quick response by timely distribution is the focus of some select supply chain players in order to get competitive advantage in market. Supply chains have always been at the forefront of retail innovation. Retailers have recognized the need for involvement in the supply chain, got some benefits and achieved intended service levels and cost reduction.Management of logistics isvery imperative for supermarkets. However, logistics elements are costly when it is not managed effectively (Fernie and Sparks, 2009:4).Fernie and Sparks (2009:7) argue for five components of logistics mix that should be applied in the supermarket: storage facilities, inventory, transportation, unitization and packaging and communication.

Supermarket supply chain has inherent operational issues thatrequires its agility to overcome the issues. The agility of supermarket chain is a capability in their operation that responds to an increasing pressure of variability in customer demand in a changing market economy. The question is how quick the supermarkets and their supply chain partners can be in responding to customers needs. Therefore, the paper will examine the agility of supermarkets supply chains to manage the inventory issues in meeting the customer order fulfillment where ICT is perceived as an enabler.

The paper is organized as follows.The next section undertakes a literature review to explore the status quo of supply chain agility studies. The methodology section elaborates on the cross-sectional survey and the data analysis. The paper concludes with discussion and conclusion.

DEFINING SUPPLY CHAIN AGILITY

The agility is associated with uncertainty of market and customer demand. The agile mindset is related to production in manufacturing system and normally used in the supply chain management context (van Hoek et al., 2001).Agile is closely associated with ‘quick response’ (Stratton & Warburton, 2003) and more pragmatically. The agile supply chain needs to deliver the variety of products to customers quickly. Christopher (2000) identifies the characteristics of agile supply chain as (1) *Market sensitive,* that is the capability of reading and responding to real demand in the market; (2) creating a *virtual* supply chain that relies on shared information among the supply chain players; (3) *process integration* means partnership interrelationship between suppliers and retailers; (4) building *networking* means confederation of supply chain players linked together on networking; and (5) Measurement means quantity of productsfor retailer.

REVIEW OF SELECTED LITERATURE ON SUPPLY CHAIN AGILITY

Supply Chain Agility

Agarwal et al. (2006) have identified some variables that support agility of supply chain. They 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 (Crhistopher and Towill, 2002; Van Hoek et al., 2001). Theyused ICT tools, collaborative planning, and process integration (Yusuf et al., 2004). Meanwhile, the data accuracy and market sensitiveness will be improved if the variables are achieved. They state that customer satisfaction, quality improvement, cost minimization, delivery speed, new product introduction, service level improvement and lead-time reduction help to get the supply chain agile.

Inventory Management

Candra and Grabis (2006) 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 accuracyin the data entry.However, Mercier, Sirkin and Bratton (2010) 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 suppliersandretailers'can improve material flows through just-in time (JIT) system, making smaller and frequent distribution appropriate of transportation and stock replenishment.

Information Flow

Lee et.al (1997) define that information flow is essential mechanism to communicate with supply chain players as it provides direct 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 (Lee et al. 1997; Chen et al. 2000). 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 resulting in customer demand volatility.The consequences of this can be over-production, because the manufactures may double the production of material and finished goods. This gives rise toincreasing bullwhip effect (Lee et al. 1997).

Information and Communication Technology (ICT)

According to Narayanan et al. (2009), 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 (Lee et al. 1997; Cachon 1999; Narayaman, Marucheck & Handfield 2009). Non-adoption of these supply chain technologies may restrict the order flow impacting on demand variation, which then may lead to bullwhip effect (Lee et al. 1997; Metters 1997; Ingalls et al. 2005; Chandra & Grabis 2006). Others identified that demand signal processing may impact on order batching which in turn influences the bullwhip effect (Cachon 1999; Chen et al. 2000; Holland & Sodhi 2004; Chandra & Grabis 2005; Potter & Disney 2006; Quyang & Daganzo 2007). This research will identify the absence of supply chain technologies and IT infrastructure that presumably will generate the bullwhip effect in supermarkets.

Knowledge and ICT Application

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

1. Electronic funds transfer at Point of Sale (EFTPoS), with cash register device, is a barcodescanning at the checkout and thesold items are removed from the stock in the system.
2. Radio Frequency Identification (RFID) is a system that uses the radio waves toidentify the merchandise.
3. Electronic Data Interchange (EDI)is commonly used to interconnect suppliers with retailers for more efficientoperations.
4. Quick Response Delivery System (QRDS)supports 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, and communication technology systems that significant supports the supply chain agility in supermarkets supply chain.

A FRAMEWORK OF SUPPLY CHAIN AGILITY

Supply chain agility and ICT

Management of materials and related information flows are critical in supermarket operation (Jone and Towill, 1999). Gattona and Walters (1996) argue that agility of supply chain can accommodate the demand uncertainty in the market. So,getting the agility within the supply chain is a rightstrategy. Thisimplies materials and related information flows from factory to customers or vice versa. Retailers are the first supply chain player toface this volatility. So, inventory information (e.g. how many to order and when to order) needs to flow to the suppliers using right ICT infrastructure.

Apply integrated ICT between SC partners is the key to get distribution more agile. Information flow from supplier to retailers can be maintained effectively and efficiently only through collaboration among the partners. 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. (1997) suggests that the demand for innovative products have to be “market responsive”. It is the service process response emphasisingmore on speed and flexibility than the cost itself.

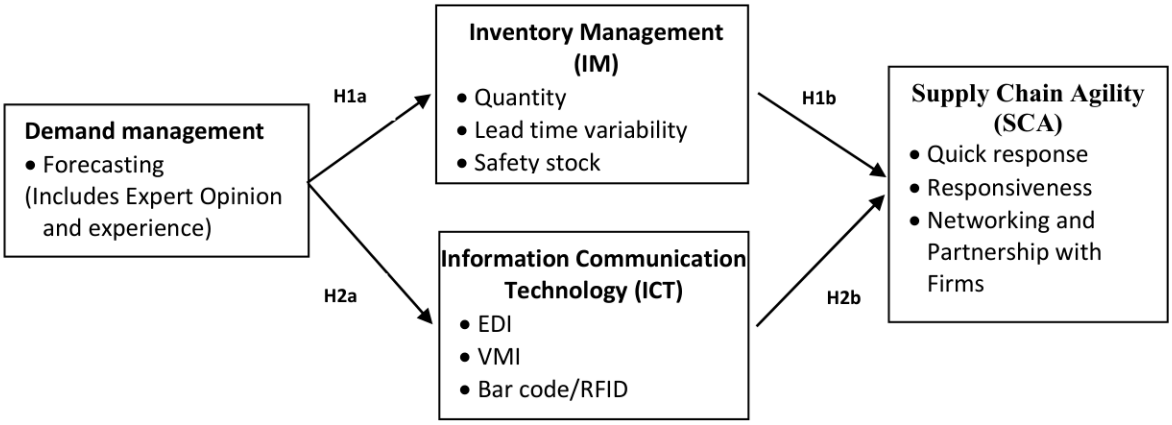

Figure 1: Conceptual framework of Retail Supply Chain Agility

The conceptual framework above comprises of four-part hypothesis: Hypothesis H1a, effective demand management has a positive effect on inventory management in supermarket supply chain. Hypothesis H1b,a well-managed inventory is positively associated with the supermarkets supply chain agility. Hypothesis H2b, effective 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.

METHODOLOGY

This study used cross sectional survey to explore the agility of supply chain in retail supermarkets in Indonesia involving Carrefour, LotteMart, Gyant 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.

The data was analysed using exploratory factor analysis (EFA) followed by confirmatory factor analysis (CFA) to confirm their reliability and validity. SEM modeling was used to explore the hypothesised relationships among the variables.

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) wascarried out to check the independent factor loading for all of the constructs. Confirmatory factors analysis (CFA) was then used to provide a confirmatory test of measurement model ensuring that all the fourvariables logically and systematically represent constructs involved in the theoretical model (Hair et al., 2010). In order to figure out the data fit, test the statistical model and hypothesis, SEM modeling was used with AMOS 20 software.

The mean, standard deviation (SD) and correlation coefficients 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 .76 to .86 indicating a good internal consistency.

Variable	Mean	Std. Deviation	DM	IM	ICT	SCA
DM	2.92	.92	*.87*			
IM	4.24	.51	*.165**	.72		
ICT	3.69	.60	.17*	*.30***	*.74*	
SCA	4.59	.48	.35**	.29**	*.60*	*.78*

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

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

Italicised values along diagonal are Cronbach alpha

We evaluated the path model separately for retailsupply chain to check data validity.The results indicate that better demand management (DM) has significant positive influence (.70, p<.001) on inventory policy. The inventory policy isa significant (.49, p<.001) predictor of the Supply Chain Agility (SCA). Similarly, demand management positively and significantly influences ICT system (.72, p<.001), that in turn is a significant predictor of the SCA (.57, p<.001).The results support the hypotheses H1a, b and H2a,b.
The path analysis reports thatthe overall fit of the model is good. The goodness of fit indicesare 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.

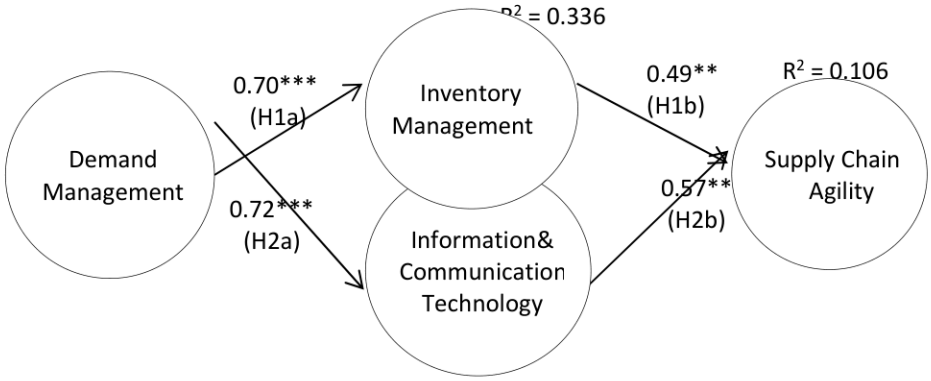

Figure 2: The path model of supermarket supply chain agility

Further, demand management and ICT together explain 10.6 percent variation in improving the supply chain agility in supermarkets.

DISCUSSION AND CONCLUSIONS

The paper examines the supply chain agility in supermarket operations where ICT is seen as an enabler.The results indicate a positive and significant influence of ICT and inventory management on supply chain agility. Though a series of research on supply chain agility is undertaken earlier, the investigation using cross-sectional data collection is novice. This contribution emphasises that effective demand management considers the strategic value of inventory management policy and role of ICT in logistics. 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 need to look at their current demand management practices further to make the chain more agile. Demand management needs further improvement atsupermarketlevel as the supermarketsare equally affected by their independent suppliers upstream and convenience stores downstream who need to consider and upgrade their ICT systems to make the whole chain agile.

Given the sample limitations, inclusion of more partners from other regions of Indonesia could help in generalising the result.

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