Research Report

The Causal Relationship Models for Adoption of Efficient Consumer Response (ECR) by Retailers in Bangkok

By

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Acknowledgement

Firstly, I would like to take this opportunity to thank Assc. Prof. Dr. Upatham Saisangjan (how nice he suggested me) and Assc. Prof. Dr. Sorachai Pisanbud (how kind he treated me) for their ideas and guidance in producing this research. I am very grateful to Dr. Chintanai Praisont (my fabulous boss) for his support during my doing research. I would like to thank my father (I love you, dad), mother (I love you, too, mom), younger sister (you are a great doctor) and On (you always stay along my side) who have always encourage me to complete this research.

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บทคัดย่อ

การวิจัยนี้มีจุดประสงค์เพื่อกำหนดแบบจำลองความสัมพันธ์เชิงสาเหตุของลักษณะผู้ประกอบการ ระดับ กิจกรรมโลจิสติกส์และโซ่อุปทาน และการรับรู้ปัจจัยกลยุทธ์ Efficient Consumer Response (ECR) ที่มีผล ต่อการยอมรับกลยุทธ์ ECR ของผู้ค้าปลีก ข้อมูลจากแบบสอบถามโดยวิธีการสุ่มได้รับจากผู้ค้าปลีก (ประเภทขายสินค้าอุปโภคและบริโภคทั่วไป) จำนวน 179 ราย ในกรุงเทพมหานคร

วิธี Confirmatory Factor Analysis (CFA) ใช้วัดความตรงของตัวแปรสังเกตได้ (Observed Variable) ผลลัพธ์ จากวิเคราะห์ปัจจัย (Factor Analysis) โดยโปรแกรม LISREL 8.8 แสดงให้เห็นว่าแบบจำลองการวัดและตัว แปรสังเกตได้เข้ากันได้พอดี นอกจากนี้ วิธี Structural Equation Modeling (SEM) ถูกนำมาใช้เพื่อสร้าง แบบจำลองความสัมพันธ์เชิงสาเหตุ เพื่อแสดงให้เห็นถึงอิทธิพลทางตรง (Direct Effect) และทางอ้อม (Indirect Effect) ของลักษณะผู้ประกอบการ ระดับกิจกรรมโลจิสติกส์และโซ่อุปทาน และการรับรู้ปัจจัยกล ยุทธ์ ECR ที่มีผลต่อการยอมรับกลยุทธ์ ECR ผลลัพธ์ที่ได้จาก LISREL 8.8 แสดงให้ห็นว่าสมมติฐาน 6 ตัว (จาก 7 ตัว) สนับสนุนสมมติฐานที่ได้ตั้งไว้ ระดับกิจกรรมโลจิสติกส์และโซ่อุปทานมีอิทธิพลทางตรงมาก ที่สุดต่อการยอมรับกลยุทธ์ ECR โดยมีสัมประสิทธิ์ของเส้นทาง (Path Coefficient) เป็น 0.398 (p < 0.01) การรับรู้ปัจจัยกลยุทธ์ ECR มีอิทธิพลทางตรงต่อการยอมรับกลยุทธ์ ECR โดยมีสัมประสิทธิ์ของเส้นทาง เป็น 0.397 (p < 0.01) ขณะที่ลักษณะผู้ประกอบการ และระดับกิจกรรมโลจิสติกส์และโซ่อุปทานมีอิทธิพล ทางอ้อมต่อการยอมรับกลยุทธ์ ECR โดยมีสัมประสิทธิ์ของเส้นทางเป็น 0.115 (p < 0.05) และ 0.196 (p < 0.01) ตามลำดับ

Abstract

The aim of this research is to determine the causal relationship models among enterprise characteristics, level of logistics and supply chain and perceived factors of efficient consumer response (ECR) toward ECR adoption. Data in completed questionnaire were collected from 179 Thai retailers, dealing with general consumer goods, in Bangkok by methods of random sampling. The confirmatory factor analysis (CFA) was used for construct validity. The results of factor analysis by LISREL 8.8 confirmed that measurement model and observed variables are fitted well. Next, structural equation model (SEM) was used for constituting the relationship model that demonstrated the direct and indirect effects of enterprise characteristics, level of logistics and supply chain and perceived factors of ECR on ECR adoption. The results by LISREL 8.8 showed that six out of seven hypotheses were supported, one of them was rejected. Then, level of logistics and supply chain had the most influential effect on ECR adoption in direct way where its path coefficient was 0.398 ($p < 0.01$). Perceived factors of ECR had direct effect on ECR adoption with path coefficient of 0.397 ($p < 0.01$). Also, enterprise characteristics and level of logistics and supply chain had indirect effects on ECR adoption with path coefficient of 0.115 ($p < 0.05$) and 0.196 ($p < 0.01$), respectively.

Chapter 1

Introduction

1.1 Overview and Research Problem

Over the past decade, companies spanning a wide spectrum of industries have been focusing their competitive strategies on leveraging the competencies and innovative capabilities to be found within the clusters of customers and suppliers constituting their business supply chain (Ross, 2003). When increase of enterprise levels, information flows and physical flows in business process become complicated, the logistics and supply chain management then is remarkably constructed. Logistics is necessary for moving purchased goods from the supplier to the buying organization, moving finished goods to the customer, and storing these items the way (Wisner, Tan and Leong, 2008). According to Molina, Flores and Rodriguez (2001), supply chain management is the total manage of a network of facilities and distribution options in a partnership between a consumer, distributor and manufacturer, with the purpose of transfer and exchange of information and physical goods for the supplier's suppliers to their customer's customers, ensuring the right goods, in the most efficient manner, are reached accurately wherever they are required in a company and beyond. Generally, supply chain operation is driven by customer orders. It requires communication to all members in the chain of the customer's needs and wants, as well as how well these needs and wants are being met. To cope with it, one of the supply chain strategies, namely efficient consumer response (ECR), has been emerged. ECR, predominantly in the grocery industry, encourages trading partners to work closely together to satisfy the changing demands of the grocery industry and to fulfill consumer wishes better, faster and at less cost (Vogt, Pienaar and De Wit, 2002).

Retail industry (equivalent to grocery industry) has been considered as one of the remarkable drivers in Thai economy. According to Thai Retail Association in 2009, total current values of Thai retail industry were approximately 1.77 trillion baht or twenty percent of nation's GDP. Over the past three decades, retail business has been dramatically changed in aspects of store format and internal operations in organization, including an increase of a number of stores due to such external factor as economic growth, consumer lifestyle, advent of new technology (e.g. internet), and intense competition.

Currently, there has explicitly been no research associated with models of causal relationship in ECR. Therefore, the author has tremendous intension to investigate the adoption of ECR by retailers influenced by enterprise characteristics, level of logistics and supply chain and perceived factors of ECR.

In this study, structural equation modeling (SEM) is established, and LISREL (statistics software for SEM) is used for analyzing confirmatory factor analysis (CFA) and path analysis in relation to various variables. Also, SPSS, generally recognized statistics software, is used for analyzing for descriptive research such as mean and standard deviation.

1.2 Objective

The principal aim of this study is to explore the relationship among four latent variables through a variety of observed variables toward the patterns of ECR adoption. To complete such an aim, the following objectives are apparently stated:

➢ To investigate the relationship between level of logistics/supply chain of the retailer and the ECR adoption, including perceived factors of ECR

➢ To investigate perceived factors of ECR influencing on decision of retailer concerned with ECR adoption

➢ To investigate the characteristics of retailer associated with the adoption of ECR, including perceived factors of ECR

1.3 Research Hypothesis

The causal relationship models of ECR adoption by Thai retailers in Bangkok related to three main parts (i.e. enterprise characteristics, level of logistics and supply chain and perceived factors of ECR) is illustrated by Figure 1.1.
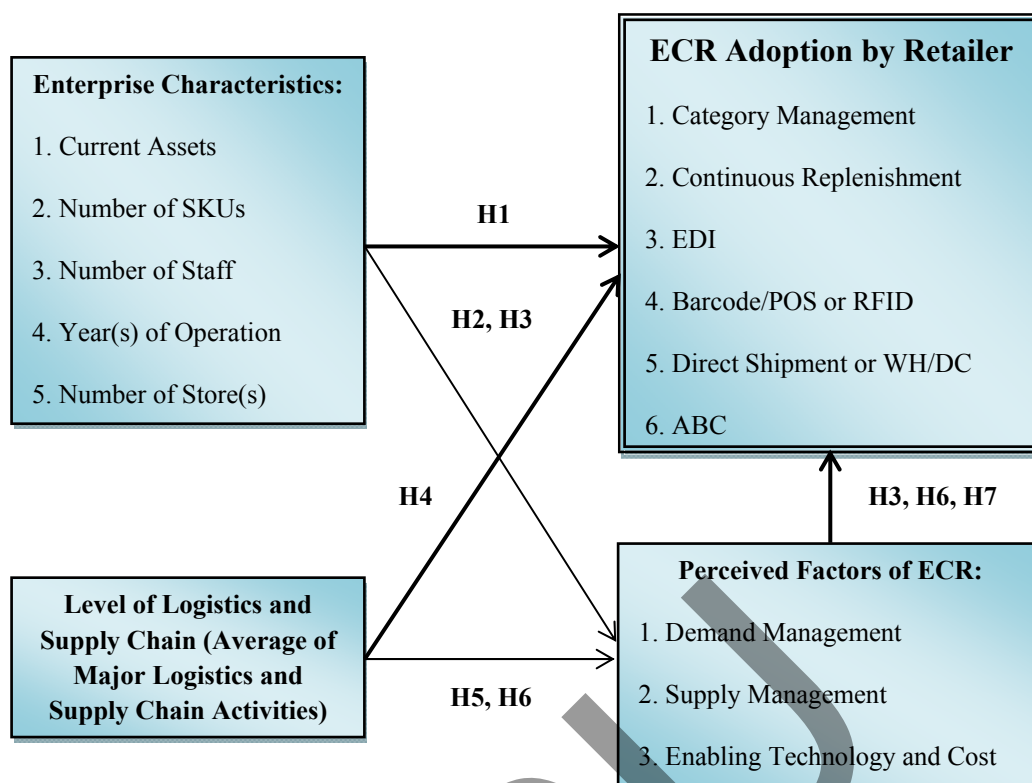
Figure 1.1: The Causal Relationship Models of ECR adoption

Based on the relationship between variables in the models of ECR adoption by retailers in Bangkok, the following hypotheses are clearly revealed:

H1: Enterprise characteristics have *direct effect* on ECR adoption.

H2: Enterprise characteristics have *direct effect* on perceived factors of ECR.

H3: Enterprise characteristics have *indirect effect* on ECR adoption.

H4: Level of logistics and supply chain has *direct effect* on ECR adoption.

H5: Level of logistics and supply chain has *direct effect* on perceived factors of ECR.

H6: Level of logistics and supply chain has *indirect effect* on ECR adoption.

H7: Perceived factors of ECR have *direct effect* on ECR adoption.

1.4 Terminology

Some selected definitions are initially explained; the rest of it is specifically described more in literature review of chapter 2.

➢ *Efficient customer response (ECR)* is a joint trade working toward making the grocery industry (or retail industry) as a whole more responsive to consumer need and promotes the removal of unnecessary inventories and costs from the supply chain.

➢ *Logistics* is the flow of goods, information and other resources between the point of origin and the point of consumption in order for meeting the demands of consumers.

➢ *Supply chain* is system of firms, people, technology, activities, information and resources involved in moving a product or service from upstream to downstream.

➢ *Retailer* is the one who buys goods/products in large quantities from manufacturers either directly or through a wholesaler, and then sells individual items or small quantities to the general public or end user customers, usually in a shop, also called a store.

➢ *Asset* is the ownership of value that can be converted into cash.

➢ *Stock keeping unit (SKU)* is a unique identifier for each distinct product.

1.5 Scope of the Study

1.5.1 Scope of Population

The total population of this study is 550 retailers (brought from database of Ministry of Commerce, Thailand) with relation to general consumer goods in Bangkok area.

1.5.2 Scope of Variables

The models of casual relationship consist of latent and observed variables in endogenous and exogenous as follows:

➢ Endogenous variables:
  ▪ ECR adoption constructed by 6 observed variables (applied from Figure 2.5 in literature review of chapter 2) as follows:
    - Category management
    - Continuous replenishment
    - Electronic data interchange (EDI)
    - Barcode/point of sale (POS) or Radio frequency identification (RFID)
    - Direct shipment or warehouse (WH)/distribution center (DC)

- Activity-based costing (ABC)
  - Perceived factors constructed by 3 observed variables (illustrated in Figure 2.6 in literature review of chapter 2) as follows:
    - Demand management
    - Supply management
    - Enabling technology and cost

- Exogenous variables:
  - Level of logistics and supply chain (shown in page 8 in literature review of chapter 2) constructed by 1 observed variable which is itself. The restriction of observed variables run by LISREL 8.80 (student version) causes the average of these variables compiled by SPSS 19.0.
  - Enterprise characteristics constructed by 5 observed variables (viewed as general profile of any retail enterprise) as follows:
    - Current assets
    - Number of SKUs
    - Number of staff
    - Years of operation
    - Number of store (s)

1.6 Expected Benefits

The expected benefits from this research are:
- To understand what factors influencing on ECR adoption (both direct and indirect effects).
- To understand what factors influencing on perceived factors of ECR (both direct and indirect effects).
- To prepare appropriate resources e.g. staff, equipment, IT system when implementing ECR as a strategic tool of enterprise.
- To assist in reducing unnecessary inventory in supply chain system of retailer.
- To reduce operation cost both demand and supply sides of retailer.
- To track down customer requirements and then have stock availability for them at the right time.

Chapter 2
Literature Review

2.1 Introduction

As significant change related to customer needs has directly affected business operation since 1990, an integrating mechanism is vital to connect supplier, manufacturer, distributor and retailer along the supply chain. By responding to this, chain operations need to concentrate on shared resources and information, eliminating excessive inventory, and reducing operations cost.

To understand this clearly, literature review of logistics and supply chain management, together with method of efficient consumer response (one of supply chain strategies) is necessary to reveal basic implications of how important its operations concerned with demand and supply sides, including enabling technology.

2.2 Logistics Management

2.2.1 What is Logistics Management?

The Council of Supply Chain Management Professionals (CSCMP) (2011) has defined logistics management as follows:

"Logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements".

According to above definition, Vogt et al. (2002) have broken into four fundamental issues as follows:

➢ *The processes associated with flow and storage*

This means that it is the total ability to move and store goods and provide services as an integrated process.

➢ *Efficiency and effectiveness*

Efficiency means doing all the activities in the process using the least possible resources, whether these are people, equipment or the inventory. For effectiveness, the processes must also add the most value possible by either increasing revenue or reducing costs or both.

➢ *From point-of-origin to point-of-consumption with information*

To expedite movement, to manage inventory, and to be able to choose between chains and improve existing chains, accurate information is required.

➢ *The purpose is to conform to consumer requirements*

It requires an understanding of the customers' needs or requirements, so that the process is efficient and effective.

The materials and information flows are illustrated by flowchart of simplified logistics process in Figure 2.1.
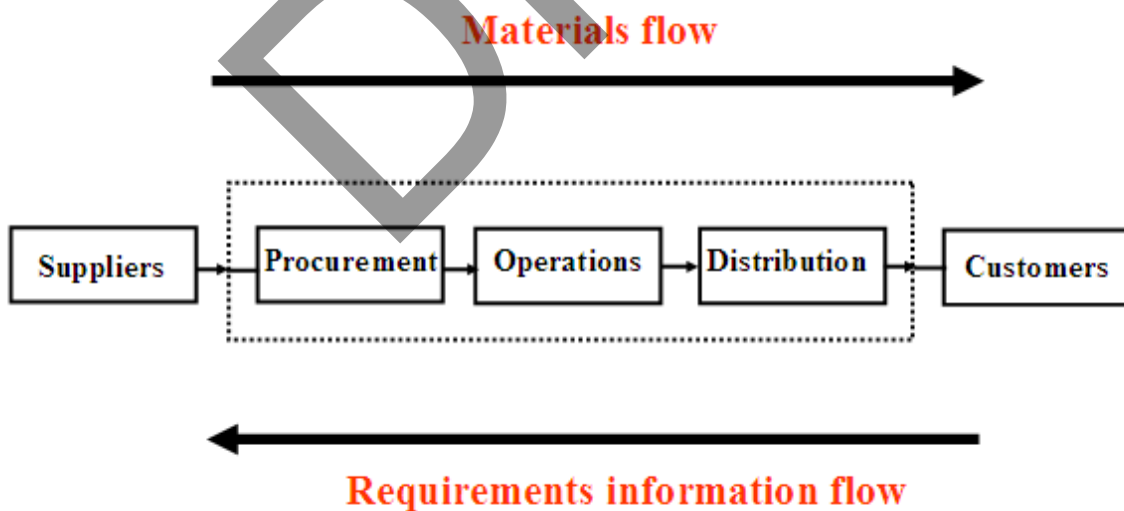
Figure 2.1: Flowchart of Simplified Logistics Process

2.2.2 Logistics Activities

The major logistics activities, involved in flow of product from origin to consumption point, are described as followed (Stock and Lambert, 2001):

- *Customer service* involves successful implementation of the integrated logistics management concept in order to provide the necessary level of customer satisfaction at the lowest possible total cost.

- *Demand forecasting* involves determining the amount of product and accompanying service that customers will require at some point in the future.

- *Inventory management* involves trading off the level of inventory held to achieve high customer service levels, with the cost of holding inventory, including capital tied up in inventory, warehousing costs and obsolescence.

- *Logistics communications* are the vital link between the entire logistics process and the firm's customer.

- *Material handling* is concerned with every aspect of the movement or flow of raw materials, in-process inventory and finished goods within a plant or warehouse.

- *Order processing* relates to triggering the logistics process and directing the actions to be taken in satisfying order demand.

- *Packaging* serves a dual role in logistics – protecting the product from damage while being stored or transported and making it easier to store and move products.

- *Plant and warehouse site selection* involve assisting firms in improving customer service levels and lowering volume-related transportation rates in moving product.

- *Procurement* includes the selection of supply source locations, determination of the form in which the material is to be acquired, timing of purchases, price determination and quality control.

- *Reverse logistics* involves removal and disposal of waste materials from the production, distribution or packaging processes.

- *Traffic and transportation* involves managing the movement of products and includes selecting the method of shipment, choosing the specific path, complying with various transportation regulations and being aware of both domestic and international shipping requirements.

- *Warehousing and storage* involve the management of the space needed to hold or maintain inventories.

2.3 Supply Chain Management

2.3.1 What is Supply Chain Management?

CSCMP (2011) has also defines supply chain management as follows:

"Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies".

2.3.2 The Supply Chain Structure

As shown in Figure 2.2, the supply chain structure ranges from simple chain to extended chain according to characteristics of chain participants. The following five chain participants are categorized by Hugos (2003).

1) *Producers or Manufacturers:* These are organizations that make a product. They include companies that are producers of raw materials and companies that are producers of finished goods.

2) *Distributors:* These are companies that take inventory in bulk from producers and deliver a bundle of related product lines to customers.

3) *Retailers:* These stock inventory and sell in smaller quantities to the general public.

4) *Customers:* These are organizations that may purchase a product in order to incorporate it into another product that they in turn sell to other customers, or a customer may be the final end user of a product who buys the product in order to consume it.

5) *Service Providers:* These are organizations that provide services to producers, distributors, retailers and customers. Service providers have developed special expertise and skills (i.e. logistics, finance, information technology, product design and market research) that focus on a particular activity needed by a supply chain.

The Simple Supply Chain

The Extended Supply Chain
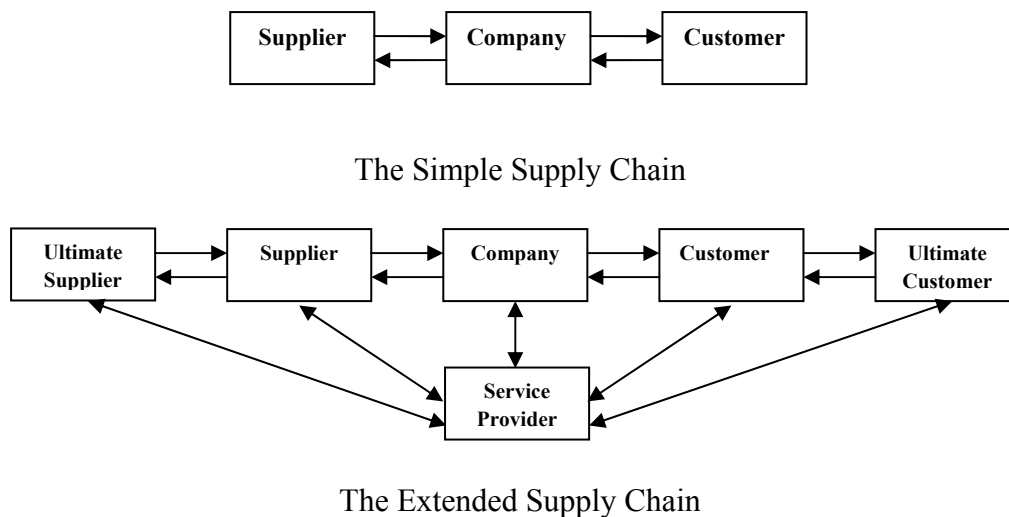
Figure 2.2: Supply Chain Structure (Source: Hugos, 2003)

2.3.3 The Supply Chain Drivers

2.3.3.1 Inventory

Inventory is defined as quantity of raw materials, supplies, components, work in progress (WIP) and finished goods that appear at various points throughout the supply chain. Aschner (as cited in Gattorna and Walters, 1996) suggests a number of necessities to hold inventory:

- ➤ *Demand/supply fluctuations:* Safety stocks, buffer stocks or just reserves are held to absorb variations in demand and supplier performance uncertainty.

- ➤ *Anticipation:* Inventory allocations are made to meet seasonal demand and sales promotion, and to meet customer requirements during periods in which the production facility is inoperable.

- ➤ *Hedging:* This is the issue of procurement economies and the cost of holding inventories versus the impact of price increases or perhaps taking advantage of price offers or some other form of speculation.

- ➤ *Lot size:* This refers to the attempt to purchase in volumes which exceed immediate demand/consumption rates in order that economies may be obtained from lower transportation rates or perhaps larger buying discounts.

2.3.3.2 Transport

Transport in supply chain operation is referred to as the process of inventory transfer from one place to another. While transport has directly affected organizational performance and customer needs, Gattorna and Walters (1996) comment that the decisions influenced by transportation considerations include:

- *Customer Communication:* For suppliers and distributors who share an integrated ordering communications system, it follows that a minimum of delay is likely in the order cycle time period. It is possible for order cycle time to be reduced using electronic transfer and this may enable the use of an alternative transportation mode or perhaps the increased utilization of existing methods. Increasingly, as IT becomes more sophisticated and as suppliers and distributors see more benefits from closer cooperation, increased efficiencies in transportation may be expected.

- *Market Coverage:* Transportation costs have a large influence in the size of the markets covered. However, cost is but one influence; other characteristics include flexibility, reliability and, of course, frequency of availability. The characteristics of the product will influence the economics of the decision. Clearly, a low volume/weight high value product will be able to support higher costs and therefore extended delivery distances and, perhaps, increased delivery frequencies.

- *Sourcing Decisions:* The geographical dimensions of source markets can be influenced by the availability of low cost, relevant transportation.

- *Processing/manufacturing:* Clearly, transportation costs have a large influence on the location of the manufacturing/market centre decision. Typically, extraction-based industries will process close to their source of raw materials, while those products for which the value added activity occurs closer to the point of customer satisfaction are likely to be located near the customer.

- *Pricing Decision:* For many businesses, transportation is a large component of total product costs. Accordingly, the selection of transportation mode will have an impact on transportation, and consequently product pricing. This relationship may be more predominant in export pricing.

- *Customer Service Decision:* Transportation decisions are factors to be taken into account when customer service policy is being considered.

2.3.3.3 Facilities

The fundamental facilities of production related to supply chain are factory and warehouse. Factories can be built to accommodate one of two approaches to manufacturing (Hugos, 2003):

1) *Product Focus:* A factory that takes a product focus performs the range of different operations required to make a given product line from fabrication of different product parts to assembly of these parts.

2) *Functional Focus:* A functional approach concentrates on performing just a few operations, such as only making a select group of parts or only doing assembly. These functions can be applied to the making of many different kinds of products.

A warehouse is a place to receive and temporarily store inventories in order to fulfill supply chain management. Three main approaches are generally used:

1) Stock keeping unit (SKU) storage is used when the same type of products are stored together.

2) Job lot storage is used when a variety of products related to the needs of a particular job or related to the needs of a certain group of customers are stored together.

3) Cross docking is an approach which occurs when goods arriving from a vendor already have a customer assigned to them, so operators need only move the shipment from the inbound truck, break down goods into small lots and load them on the outbound truck bound for the appropriate store.

In addition, Gattarna and Walters (1996) mentioned that the essential functions formed by facilities are:

➢ To create stockholding from which to service the needs of production and consumers

➢ To act as assurance against production failures

➢ To absorb the benefits of economic production runs

➢ To provide buffer stocks to meet fluctuating and uncertain sales demands

➢ To maximize the benefits of procurement economies

➢ To provide support for marketing and sales activities

2.3.3.4 Information

Information is composed of raw data and analytical data which are directly associated with management of inventory stocks and flows with regard to order processing and handling, through electronic transfer, in order to meet the demands of customers. It also links to transport system, facility, warehouse and other supply chain participants.

Furthermore, Hugos (2003) has suggested that information is used for two purposes in any supply chain:

1) *Coordinating daily activities* related to all supply chain functions. The members in a supply chain use available data on product supply and demand to decide on weekly production schedules, inventory levels, transportation routes and stocking locations.

2) *Forecasting and planning* to anticipate and meet future demands along supply chain. Available information is used to make tactical forecasts to guide the setting of monthly and quarterly production schedules and timetables. Information is also used for strategic forecasts to guide decisions about whether to build new facilities enter a new market or exit an existing market.

2.4 What is Efficient Consumer Response (ECR)?

Introduced in the United States, the term "Efficient Consumer Response (ECR)" came into general usage at the Food Market Institute Conference in January 1993 (Robins, 1994). ECR is primarily related to strategic partnerships in the distribution channels of the grocery industry to increase the performance of the consumers (Kotzab, 1999). Over the last two decades, ECR has been considerably referred to in aspects of supply chain management. Some definitions of it are described below:

Efficient consumer response is a grocery industry strategy in which distributors, suppliers and brokers jointly commit to work closely together to bring greater value to the grocery consumer (Kurt Salmon Associates, 1993).

Efficient consumer response is a strategy in which the grocery retailer, distributor and supplier trading partners work closely together to eliminate excess costs from the grocery supply chain while improving consumer value (Joint Industry Project on Efficient Consumer Response, 1995).

ECR is an attempt to increase the velocity of inventory in the packaged goods industry throughout the supply chain of wholesalers, distributors and ultimately to customers. To be successful, the ECR approach will have to eliminate most of the forward buying practices of large wholesalers and retailers, which have led to large inventory accumulations in that industry (Coyle, Bardi and Langley, 1996).

Efficient consumer response is a commitment to the belief that sustained business success stems only from providing consumers with products and services that consistently meet or surpass their demands and expectations (ECR Europe, 1997).

Efficient consumer response is a grocery industry supply chain management strategy aimed at eliminating inefficiencies, and excessive or non-value-added costs within supply chain, thus delivering better value to grocery consumers (Kurnia, Swatman and Schauder, 1998.)

In addition, Kurt Salmon Associates (1993) have pointed out that the ultimate goal of ECR is to produce a responsive, consumer-driven system which allows distributors and suppliers to work together in order to maximize consumer satisfaction and minimize cost (shown in Figure 2.3)
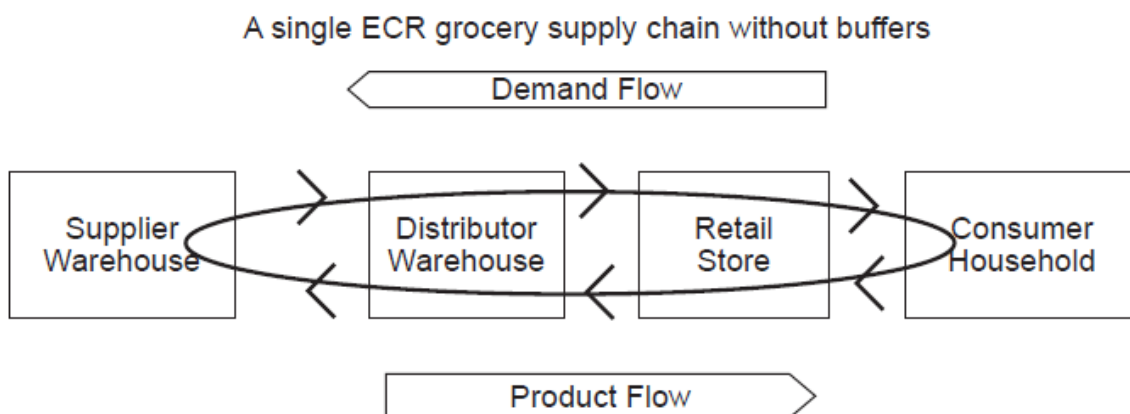
Figure 2.3: Vision of ECR Model (Source: Kurt Salmon Associates, 1993)

Therefore, ECR working related to manufacturer, warehouse, retail store and customer can be illustrated in Figure 2.4.
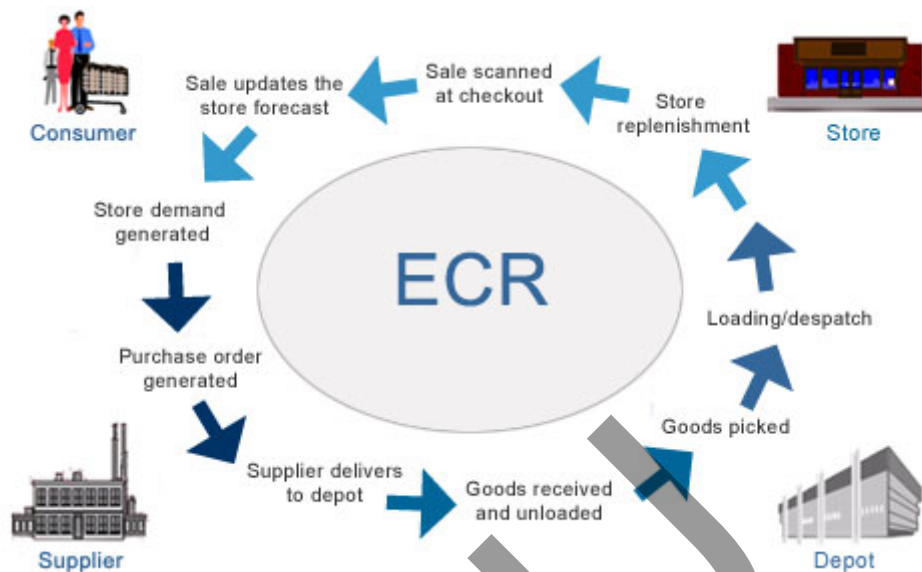
Figure 2.4: Diagram of ECR Working

(Source: www.igd.com/images/Factsheets/modern-supply-chain.jpg)

Moreover, Casper (1994) has mentioned that ECR includes the following strategies:

1) Widespread implementation of electronic data interchange up and down the supply chain, between both suppliers and distributors, and distributors and customers

2) Greater use of point-of-sale data obtained by greater and more accurate use of bar coding

3) Cooperative relationships among distributors, suppliers and customers

4) Continuous replenishment of inventory and flow-through distribution

5) Improved product management and promotions

Then, it is the view of Hines (2004) that clear supply chain themes emerging from ECR are:

➢ Better value and efficiency in the total supply chain

➢ Profitable business alliances are key to managing the total supply chain

➢ High-quality information is needed to ensure supply chain are responsive to customer demands

➢ Bottlenecks must be identified and removed from the supply chain and activities that add value and lower cost for the consumer must be pursued vigorously

> Better performance measures that indicate effectiveness of the whole supply chain rather than focusing upon elements of it must be used if the total system is to respond better to market demand and better measurement is required for equitable reward sharing by those that added value to the system

2.4.1 ECR and its Strategies
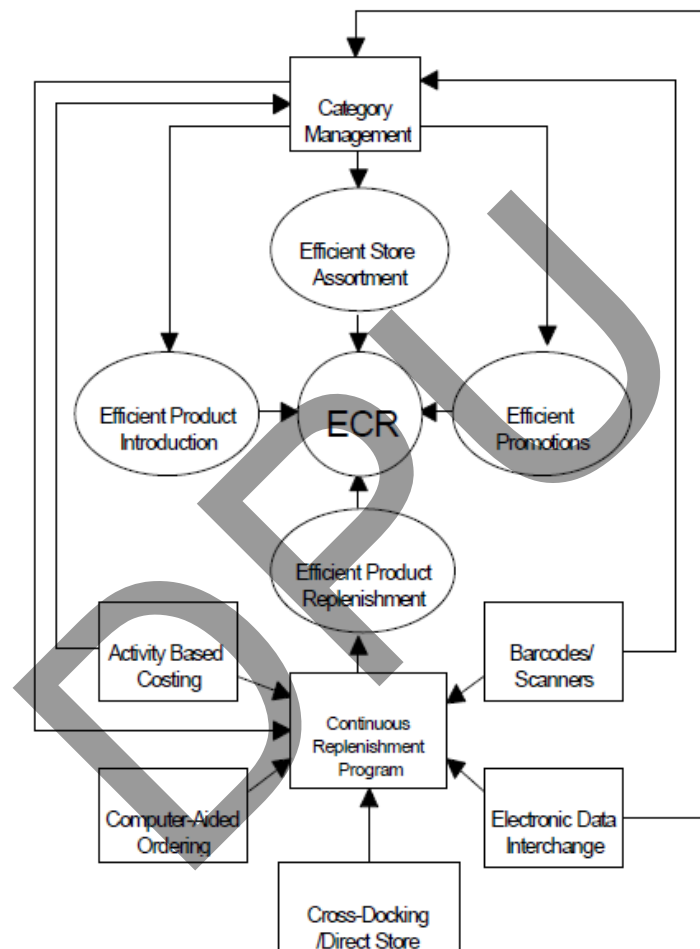
Figure 2.5: ECR Components and Their Relationships

(Source: Kurnia, Swatman and Schauder, 1998)

Strategic components of ECR are based on the four areas (Kurt Salmon Associates, 1993) as follows:

1. *Efficient store assortment* ensures that the range of products carried by a retail store satisfies the consumer and that store space is utilized efficiently to increase retailer and supplier profitability.

2. *Efficient promotions* ensure that trade promotions and consumer promotions used by members of the supply chain are more cost efficient.

3. *Efficient product introduction* ensures that manufacturers, wholesalers, retailers and consumers work together closely to develop better products quicker and cheaper.

4. *Efficient product replenishment* aims to provide the right product, to the right place, at the right time, in the right quantity and in the most efficient manner possible.

As demonstrated in Figure 2.5, the first three areas (i.e. efficient store assortment, efficient promotions and efficient product introduction) are supported by category management. Hines (2004) has noted that category management puts products together in different ways that customers buy products rather than simply grouping products by band and/or within ranges. In order to manage categories effectively and improve volumes and profitability retailers need to be able to combine different pieces of information together to obtain an informed view of customer behavior patterns (Hines, 2004). Kurnia et al. (1998) have suggested that category management has to employ EDI, barcodes and scanners to accurately capture information on customer demand on each category and to share the information between trading partners.

Then, in order for supporting efficient product replenishment, continuous replenishment program is provided and defined by Thayer (1995) as the practice of partnering among distribution channel members that changes the traditional replenishment process from distributor-generated purchase order to one based on actual or forecast consumer demand. With continuous replenishment program, orders are transmitted electronically and are made more frequently and in smaller quantities (Mathew, 1994). However, the following enabling technologies may efficiently sustain program of continuous replenishment:

➢ *Barcodes / Scanners / Radio Frequency Identification (RFID)*

The use of barcodes and scanners is a fundamental element for ECR implementation in the grocery industry as it allows accurate and faster information capture to be obtained, which in turn can be shared with trading partners (EAN Australia, 1997). With limitation of storing information of goods, RFID may be replaced barcodes in the near future. RFID is an eventual successor to the barcode for tracking individual units of goods (Wisner et al., 2008). By applying it at retail store, an RFID tag reader can be placed on the store shelf to trigger automatic replenishments when an item reaches its reorder point (Wisner et al., 2008). In addition, Wisner et al. (2008) have

mentioned that inventory status can be updated automatically in real time at any stage of the supply chain, and hand-held tag readers can be used to assist in cycle counting.

➤ *Electronic Data Interchange (EDI)*

According to Gourdin (2006), EDI is the inter-organizational, computer-to-computer exchange of business documentation (e.g. customer order, invoice and shipping notice) in a standard, machine-processable format. EDI is intended to allow the receiving computer to read and process data without additional human intervention (Emmelhainz, 1993).

➤ *Computer-Aided Ordering (CAO)*

CAO is defined by ECR Central (as cited in Kurnia et al., 1998) as a retail-based system that automatically generates orders for replenishment when the inventory level drops below a pre-determined reorder level.

➤ *Cross-Docking / Direct Store Delivery*

Cross-docking is a continuous replenishment logistics process at a distribution center, where incoming goods are stored and/or consolidated, and then shipped out to their final destination, without the need to store the goods (Wisner et al. 2008). Direct store delivery occurs when a firm delivers its products directly to the retailer in order to eliminate warehousing.

➤ Activity-Based Costing (ABC)

ABC is a costing system based on identifying activities that cause cost (Hines, 2004). The goal of it is to ascertain the true cost of processes or products by breaking down the activities necessary to perform them into individual tasks or cost drivers, which could then be used to calculate the actual cost necessary to execute each task (Ross, 2003).
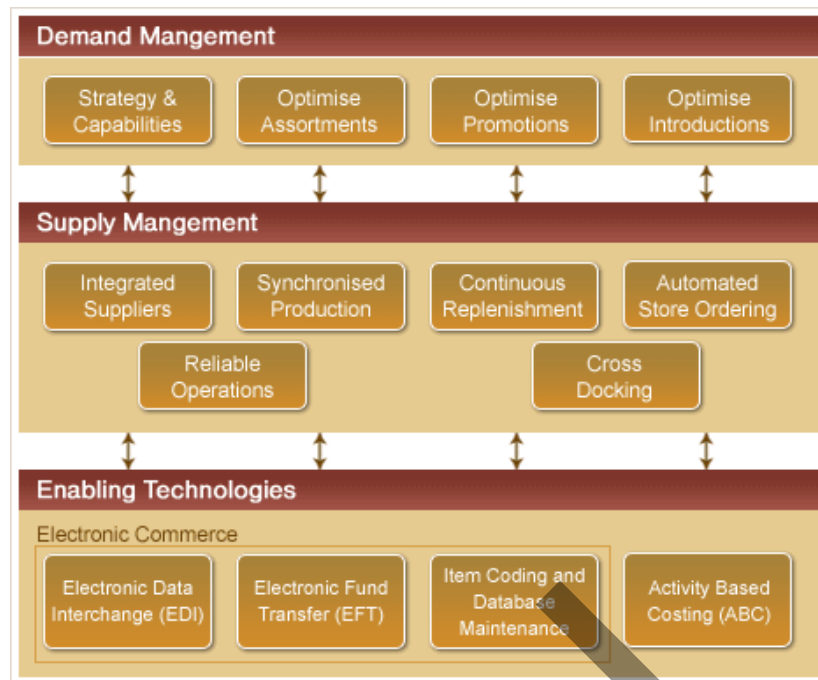
Figure 2.6: Three Main Factors of ECR (Source: ECR Thailand, 2008)

Furthermore, ECR Thailand has divided ECR into three factors as follows (as shown in Figure 2.6):

1. *Demand Management*

    Demand management is a set of activities that range determining or estimating the demand from customers through converting specific customer orders into promised delivery dates to help balance demand and supply (Wisner et al. 2008). The areas in demand management are composed of:

    - ➢ Strategy and capabilities
    - ➢ Optimized assortment
    - ➢ Optimized promotion
    - ➢ Optimized new product introduction

2. *Supply Management*

    According to Wisner et al. (2008), supply management is defined as the identification, acquisition, access, positioning and management of resources the organization needs or potentially needs in the attainment of its strategic objectives. Supply management is classified into six areas as follows:

    - ➢ Integrated supplier
    - ➢ Reliable operation
    - ➢ Synchronized production

> ➢ Cross docking

> ➢ Continuous replenishment

> ➢ Automated store ordering

3. *Enabling Technology*

One of the most important ECR factors is enabling technology which assists in the speed of information sharing among all participants in supply chain. This factor consists of:

> ➢ Electronic data interchange (EDI)

> ➢ electronic fund transfer (EFT)

> ➢ Item coding and database maintenance

> ➢ Activities-based costing (ABC)

According to various strategies of ECR, many firms have recognized it as a tool of consumer-pulled distribution process as well as cost reduction in supply chain. Also ECR has been frequently referred in academic works. To explore how important of ECR in business area, some selected researches are presented below.

The research of Martens and Dooley (2010) aims to reappraise efficient consumer response (ECR) in the grocery and food industry in order to determine whether financial and operating performance improves with ECR adoption. The paper uses a time-series multiple regression model. The methodology overcomes historical shortcomings in ECR and supply chain management research related to small sample size, one-tier investigation, and short-longitudinal focus. As a result, ECR adoption has beneficial impacts for both financial and operational performance.

Aastrup, Kotzab, Grant, Teller and Bjerre (2008) have proposed a model which structures and links different types of efficient consumer response (ECR) measures; it does so by considering the use of both quantitative or "hard" and qualitative or "soft" measures in ECR, emphasizing the importance and causal role of "soft" measures throughout the ECR process. Their study reviews the ECR and performance measurement literature and proposes a model that explains linkages from intra-organizational, inter-organizational and industry prerequisites through ECR activities to ECR outcomes; and highlights the role of performance, behavioral, attitude and capability measures (as shown in Figure 2.7).
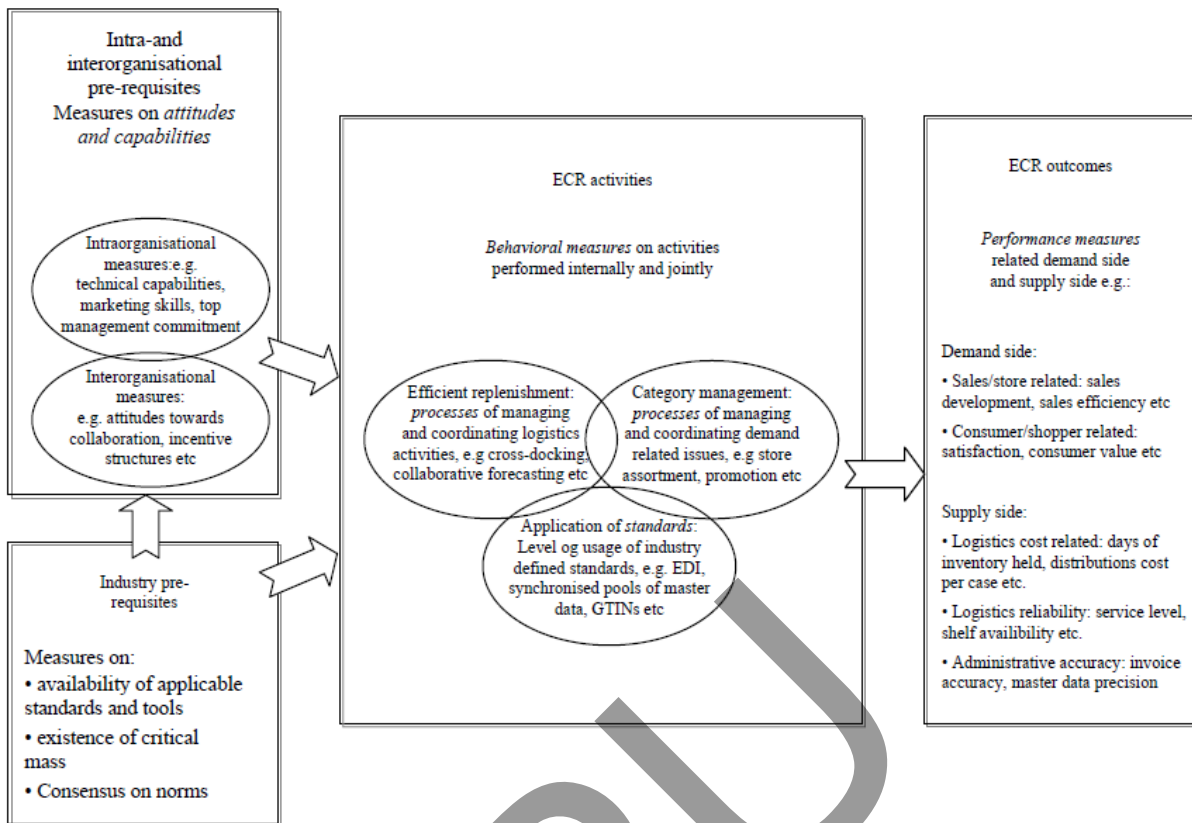
Figure 2.7: Structures of Measures in ECR (Source: Aastrup et al., 2008)

Lohita, Xie and Subramaniam (2004) have surveyed the practice of ECR in Japan from manufacturers, wholesalers and retailers. The results of this study show that the Japanese business environment is ripe for large-scale ECR implementation. More than 20% of the companies in the sample are in a stage beyond mere planning. This reflects the extent to which these companies believe that ECR is beneficial. In addition to the general benefits of ECR, Japanese channel members also valued the specific benefits related to efficient replenishment. Regarding their perceptions of the barriers to ECR adoption, those companies that had already implemented ECR and those that had not differed significantly. Financial barriers were big factors for those who had not implemented ECR. For those companies that had implemented ECR, lack of both skill and technology related capabilities and the attitudes of channel members were the main barriers to implementation.

According to Kurnia, Betts and Johnston (2002), ECR diffusion rate is low in Australia. The results of the analysis demonstrate that both manufacturer and retailer groups differ in relation to barriers to ECR implementation, perception of ECR characteristics and the benefits gained, in such a way that they support two hypotheses as follows:

1) In Australia, retailers are leading manufacturers in the ECR implementation.

2) Australian retailers have gained more benefits from ECR than manufacturers.

2.5 Structural Equation Modeling (SEM)

Structural equation modeling (SEM) uses various types of models to depict relationships among observed variables, with the same basic goal of providing a quantitative test of a theoretical model hypothesized by the researcher (Schumacker and Lomax, 2010). Also, Schumacker and Lomax (2010) have noted that more specifically, various theoretical models can be tested in SEM that hypothesized how sets of variables define constructs and how these constructs are related to each other. The basic models of SEM include regression, path and confirmatory factor. Each of them comprises two major types of variables, namely latent variables (not directly measured) and observed variables (directly measured). In addition, latent or observed variables can be either independent or dependent variables.

Schumacker and Lomax (2010) have described basic model of SEM as follows:

➢ A regression model consists solely of observed variables where a single dependent observed variable is predicted or explained by one or more independent observed variables.

➢ A path model is also specified entirely with observed variables, but the flexibility allows for multiple independent observed variables and multiple dependent observed variables. Therefore, path models test more complex models than regression models.

➢ Confirmatory factor models consist of observed variables that are hypothesized to measure one or more latent variables (independent or dependent)

Then, to conduct SEM with a variety of variables, software of LISREL is used for the computational analysis. LISREL is the statistics software for confirmatory factor analysis and structural equation modeling used in many areas (e.g. social sciences, behavioral sciences, educational sciences and relevance). LISREL is particularly designed to accommodate

models for latent variables, measurement errors in dependent and independent variables, reciprocal causation, simultaneity, and interdependence.

SEM can be also applied to such management area as logistics and supply chain. Some of research papers are presented below.

The study of Fantazy, Kumar and Kumar (2009) is to examine the relationships among strategy, flexibility and performance in the supply chain context. This research is based on a quantitative approach using a questionnaire survey and personal interviews from a total of 175 small and medium-sized Canadian manufacturing companies. The identified constructs have been utilized to test a theoretical model using the path analysis technique. As a consequence, first, the findings provide evidence of direct effects of strategy on flexibility and flexibility on performance. Second, innovative strategy firms must invest time and resources in developing new product and delivery flexibility; while customer-oriented strategy firms are required to invest heavily in developing sourcing, product, and delivery flexibility and follower strategy firms need no investment in any specific type of flexibility. Third, results demonstrated that Canadian manufacturers must reconsider how they use information technology to enhance information systems flexibility and improve overall performance.

Han, Trienekens and Omta (2009) have sought to discuss the interaction among integrated information technology, integrated logistics management, quality management practices and firm performance of pork processors in China. A conceptual framework was developed by examining the relationship between pork processors and their customers. A stratified random sample of 229 pork processors in eastern China provided data for empirical testing with partial least squares analysis. Results revealed that integrated information technology and integrated logistics management improved the quality management practices of the pork processors. The application of information technology also facilitated integrated logistics management. While quality management practices had significant impact on firm performance, the findings indicated neither integrated information technology nor integrated logistics management was significantly related to firm performance. However, integrated information technology had an indirect impact on firm performance through quality management practices.

According to Green Jr., Whitten and Inman (2008), their study aim is to theorize and assess a logistics performance model incorporating logistics performance as the focal construct with supply chain management strategy as antecedent and organizational performance, both marketing and financial, as consequences. Data came from 142 US plants and were analyzed by methodology of SEM. The results indicate that logistics performance is positively impacted by supply chain management strategy and that both logistics performance and supply chain management strategy positively impact marketing performance, which in turn positively impacts financial performance. Neither supply chain management strategy nor logistics performance was found to directly impact financial performance.

Kim (2006) has examined the casual linkages among supply chain management practice, competition capability, the level of supply chain integration and firm performance. From the results of LISREL analysis on small and large manufacturing firms, he finds that, in small firms, efficient supply chain integration may play a more critical role for sustainable performance improvement, while, in large firms, the close interrelationship between the level of supply chain management practices and competition capability may have more significant effect on performance improvement. It is concluded that, in early stage, the emphasis on systemic supply chain integration may be more crucial. Once supply chain integration has been implemented, it may be advisable to focus on supply chain management practice and competition capability.

Lin and Tseng (2006) have proposed a conceptual structural equation model to demonstrate the direct and indirect impact of supply chain participant strategy, information technology application, manufacturing participation strategy on customer satisfaction and organizational performance from a strategic perspective. This study is conducted through surveys of 109 senior managers in Taiwan and the data collected are used to test the relationships expressed in the proposed structural equation model. As a result, manufacturing participation strategy planning plays a pivotal role in achieving organizational performance in implementing the supply chain system. This demonstrates the strategic importance of integrating manufacturing (operations) with suppliers and customers in a supply chain system.

Chapter 3
Research Methodology

The descriptive research and models of causal relationship have been principally applied in this study. The main topics of chapter 3 are:

    3.1 Population and sample size

    3.2 Research Instrument

    3.3 Data collection

    3.4 Data analysis

3.1 Population and Sample Size

3.1.1 Population

The total population of this study was 550 retailers, dealing with general consumer goods in only Bangkok area, and listed in database of Department of Business Development, Ministry of Commerce on 7 August 2009.

3.1.2 Sample Size

According to sampling technique of Yamane (1967) at the confident level and error of 95 and 5 percent, respectively, including determining sample size by Israel (1992), the sample size of 550 retailers by means of interpolation between population of 500 and 600 in Bangkok are 231.

Table 3.1: Determining Sample Size (Source: Israel, 1992)

Precision Levels Where Confident Level is 95% and P = .5				
Size of	Sample Size (n) for Precision (e) of			
Population	±3%	±5%	±7%	±10%
500	a	222	145	83
600	a	240	152	86
a = Assumption of normal population is poor (Yamane, 1967). The entire population should be sampled.				

3.2 Research Instrument

3.2.1 Characteristics of Instrument

To directly obtain relevant data from retailers, the instrument of this study is questionnaire with regard to the ECR adoption of retailer in only Bangkok. Most questions were asked respondent, who has worked or involved in the retail enterprise, to evaluate scales ranging from one to five. The main purpose is to gather data of observed variables linking to latent variables. The structure of this questionnaire consists of ECR definition and five parts of questions as follows:

➢ *Definition: ECR*

It is the first step for respondent to understand the meaning and benefits of efficient customer response (ECR) toward business environment of retailer, vendor and customer.

➢ *Part 1: General Data of Respondent*

In this part, five questions are related to personal characteristics of respondent.

➢ *Part 2: General Data of Retailer*

It relates to six questions of enterprise characteristics of respondent.

➢ *Part 3: Data of Level of Logistics and Supply Chain*

There are ten questions concerned with current activities of logistics and supply chain of retailer. The rating scale ranges from "very low" to "very high" (5 scales) for each activity.

➢ *Part 4: Opinions Regarding ECR Perception*

This part holds twenty questions in three factors of ECR (i.e. demand management, supply management and enabling technology & cost). The respondent is asked to rate five scales ranging from "strongly disagree" to "strongly agree".

➢ *Part 5: Data of ECR Adoption*

It holds two sections. First one relates to six questions of the ECR adoption where 5 scales range from "slight/no implementation" to "entire implementation". The other one comprises seven questions of reason to adopt ECR where five scales range from "very low" to "very high".

3.2.2 Quality of Instrument

3.2.2.1 Reliability

To examine questions of observed variables, α-coefficient of Cronbach by SPSS 19 was applied. The reliabilities (α) of data were between 0.700 and 0.906. The details of them are presented in Table 3.2.

Table 3.2: Reliability (α) of Observed Variables

Latent Variable	No. of Observed Variables	α (n = 179)
1. Level of Logistics & Supply Chain	10	0.906
2. Demand Management	6	0.875
3. Supply Management	9	0.878
4. Enabling Technology & Cost	5	0.851
5. Perceived Factors of ECR	3	0.864
6. ECR Adoption	6	0.870

As demonstrated in Table 3.2, the questions connecting to a total of 39 observed variables are highly reliable with value above 0.700 (Pallant, 2003). Observed variables of level of logistics and supply chain are the most reliable with α of 0.906 while the rest of them are quite satisfied with α ranging from 0.851 to 0.878.

3.2.2.2 Construct Validity

To ensure that latent variables can be measured by observed variables, the method of confirmatory factor analysis (CFA) has been applied in order to examine fitness between measurement model and observed variables. In this study, seven measurement models are tested with LISREL 8.8 and then compared by following eight criteria of fit indices:

Table 3.3: Fit Indices and Criteria

(Source: Schermelleh-Engel, Moosbrugger and Muller, 2003)

Fit Index	Good Criteria	Acceptable Criteria
χ^2	$0.05 < p \leq 1.00$	$0.01 < p \leq 0.05$
χ^2 / df	$0 < \chi^2 / df \leq 2$	$2 < \chi^2 / df \leq 3$
RMSEA	$0 \leq RMSEA \leq 0.05$	$0.05 \leq RMSEA \leq 0.08$
Standardized RMR	$0 \leq$ Standardized RMR ≤ 0.05	$0.05 \leq$ Standardized RMR ≤ 0.08
NFI	$0.95 \leq NFI \leq 1.00$	$0.90 \leq NFI \leq 0.95$
CFI	$0.97 \leq CFI \leq 1.00$	$0.95 \leq CFI \leq 0.97$
GFI	$0.95 \leq GFI \leq 1.00$	$0.90 \leq GFI \leq 0.95$
AGFI	$0.90 \leq AGFI \leq 1.00$	$0.85 \leq AGFI \leq 0.90$

Remark: χ^2 is chi-square; df is degree of freedom; RMSEA is root mean square error of approximation; Standardized RMR is standardized root mean square residual; NFI is normed fit index; CFI is comparative fit index; GFI is goodness of fit index; and AGFI is adjusted goodness of fit index.

The results of fitness between measurement models and observed variables are demonstrated as follows:

1. The Measurement Model of Enterprise Characteristics
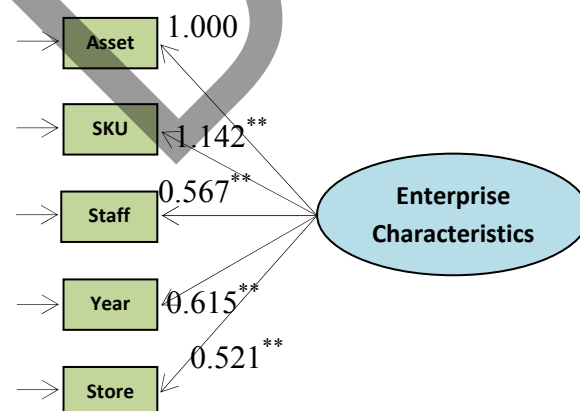
$\chi^2 = 2.714$, df = 3, p-value = 0.438, RMSEA = 0.000, [**]p < 0.01

Figure 3.1: The Measurement Model of Enterprise Characteristics with Factor Loadings

Table 3.4: Fit Indices between the Model of Enterprise Characteristics and Observed Variables

Fit Index	Obtained Value	Consideration
1. χ^2 (p)	0.438	Good
2. χ^2 / df	0.905	Good
3. RMSEA	0.000	Good
4. Standardized RMR	0.020	Good
5. NFI	0.988	Good
6. CFI	1.000	Good
7. GFI	0.994	Good
8. AGFI	0.970	Good

As shown above in Figure 3.1, the model is shown that SKU is the most important factor of enterprise characteristics on account of the highest factor loading of 1.142. In addition, all obtained values in Table 3.4 are compatible with the designated criteria in Table 3.3. This means that the model of enterprise characteristics, together with five observed variables (i.e. asset, number of SKUs, number of staff, years of operation and number of stores) is clearly considered as good fitness.

2. The Measurement Model of Level of Logistics and Supply Chain
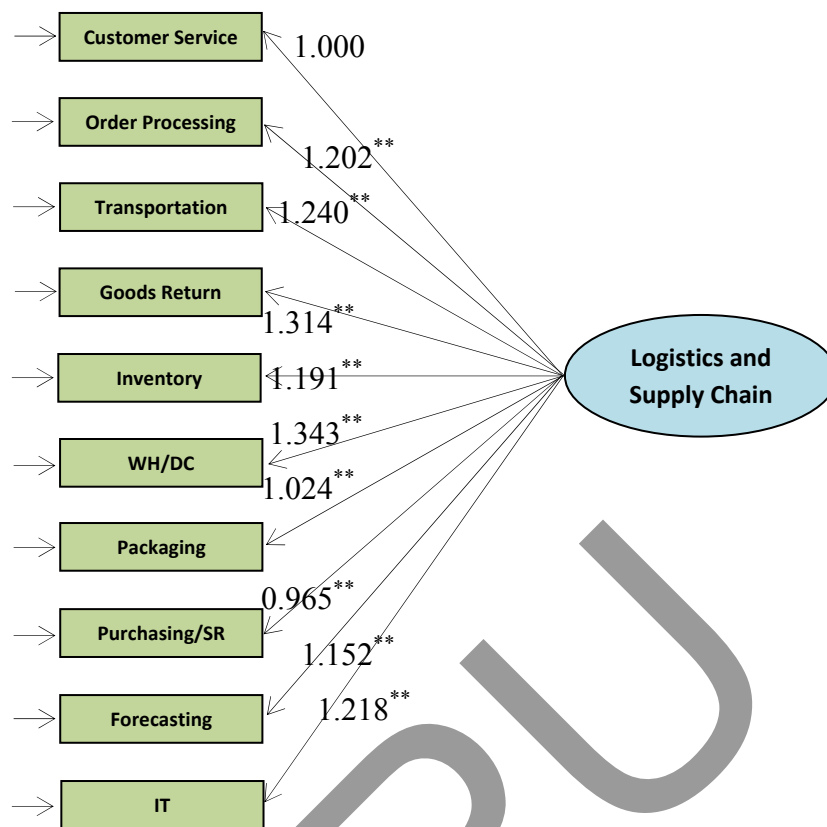
χ^2 = 27.965, df = 30, p-value = 0.572, RMSEA = 0.000, **p < 0.01

Figure 3.2: The Measurement Model of Level of Logistics and Supply Chain with Factor
Loadings

Table 3.5: Fit Indices between the Model of Level of Logistics and Supply Chain and
Observed Variables

Fit Index	Obtained Value	Consideration
1. χ^2 (p)	0.572	Good
2. χ^2 / df	0.932	Good
3. RMSEA	0.000	Good
4. Standardized RMR	0.028	Good
5. NFI	0.986	Good
6. CFI	1.000	Good
7. GFI	0.970	Good
8. AGFI	0.944	Good

As shown above in Figure 3.2, warehouse management of this model is considered as the most important factor with loading of 1.343. Moreover, all obtained values in Table 3.5 are compatible with the designated criteria in Table 3.3. This means that the model of level of logistics and supply chain, including ten general factors of them (i.e. customer service, order processing, transportation management, goods return, inventory management, warehouse management, appropriate package, purchasing and supplier relationship management, demand forecasting and information technology system) is noticeably viewed as complete fitness.

Figure 3.3: Level of Activity by Average of Observed Variable

With limitation of number of observed variables for LISREL 8.80 (student version), however, those of variables are averaged by SPSS 19.0 and then named as level of activity.

3. The Measurement Model of Demand Management

$\chi^2 = 4.798$, df = 5, p-value = 0.441, RMSEA = 0.000, **p < 0.01
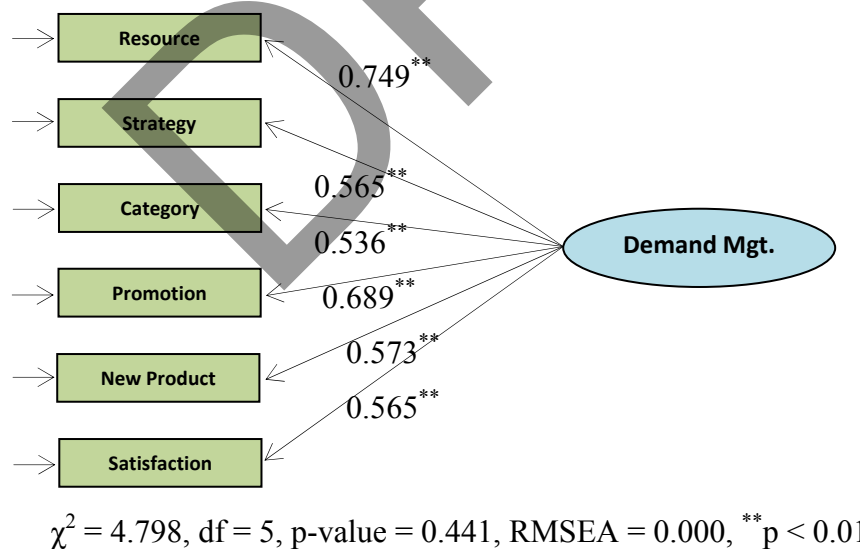
Figure 3.4: The Measurement Model of Demand Management with Factor Loadings

Table 3.6: Fit Indices between the Model of Demand Management and Observed Variables

Fit Index	Obtained Value	Consideration
1. χ^2 (p)	0.441	Good
2. χ^2 / df	0.960	Good
3. RMSEA	0.000	Good
4. Standardized RMR	0.018	Good
5. NFI	0.994	Good
6. CFI	1.000	Good
7. GFI	0.991	Good
8. AGFI	0.963	Good

According to Figure 3.4, resource is the most important factor where its value (0.749) is higher than others. Furthermore, all obtained values in Table 3.6 are compatible with the designated criteria in Table 3.3. This means that the model of demand management, as well as six observed variables (i.e. resource utilization, collaborated strategy, categories of product, efficient promotion, new product and customer satisfaction) is viewed as perfect fitness.

4. The Measurement Model of Supply Management

$$\chi^2 = 16.956, \ df = 19, \ p\text{-value} = 0.593, \ RMSEA = 0.000, \ ^{**}p < 0.01$$
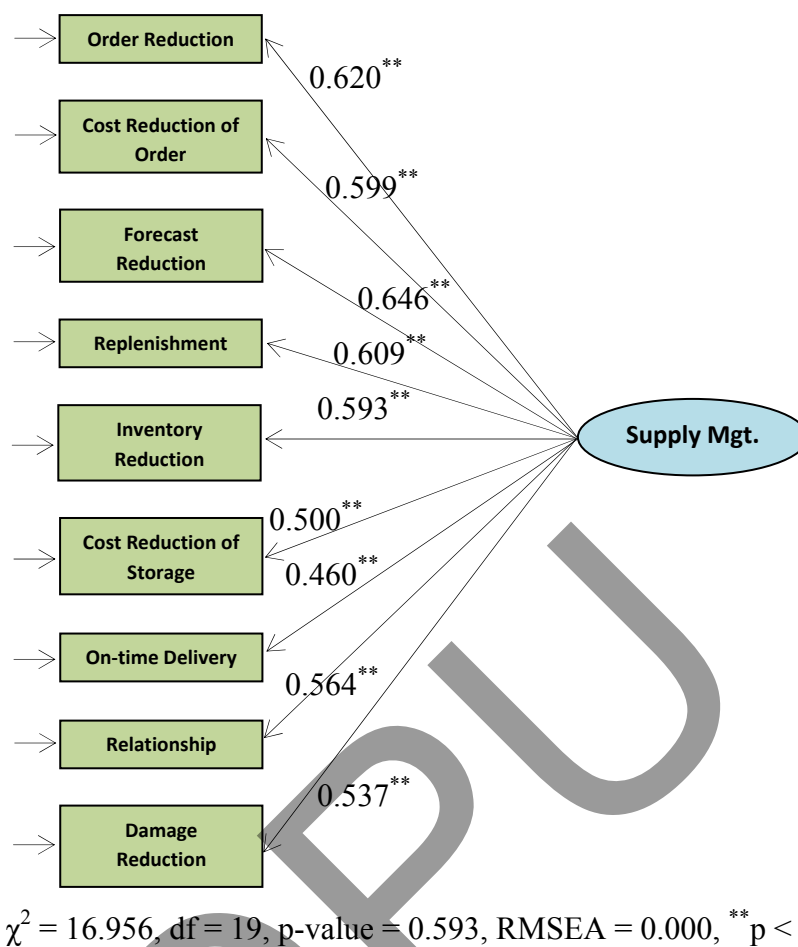
Figure 3.5: The Measurement Model of Supply Management with Factor Loadings

Table 3.7: Fit Indices between the Model of Supply Management and Observed Variables

Fit Index	Obtained Value	Consideration
1. χ^2 (p)	0.593	Good
2. χ^2 / df	0.892	Good
3. RMSEA	0.000	Good
4. Standardized RMR	0.024	Good
5. NFI	0.987	Good
6. CFI	1.000	Good
7. GFI	0.979	Good
8. AGFI	0.951	Good

According to Figure 3.5, reduction of forecasting is viewed as the most important factor (0.646) comparing to others. In addition, all obtained values in Table 3.7 are compatible with

the designated criteria in Table 3.3. This means that the model of supply management with nine typical factors (i.e. reduction of order processing, cost reduction of order, reduction of forecasting, replenishment, inventory reduction, cost reduction of storage, on-time delivery with high speed, damage reduction and vendor relationship) is considered as the good fitness.

5. The Measurement Model of Enabling Technology & Cost

$\chi^2 = 4.002$, df = 3, p-value = 0.261, RMSEA = 0.000, **p < 0.01
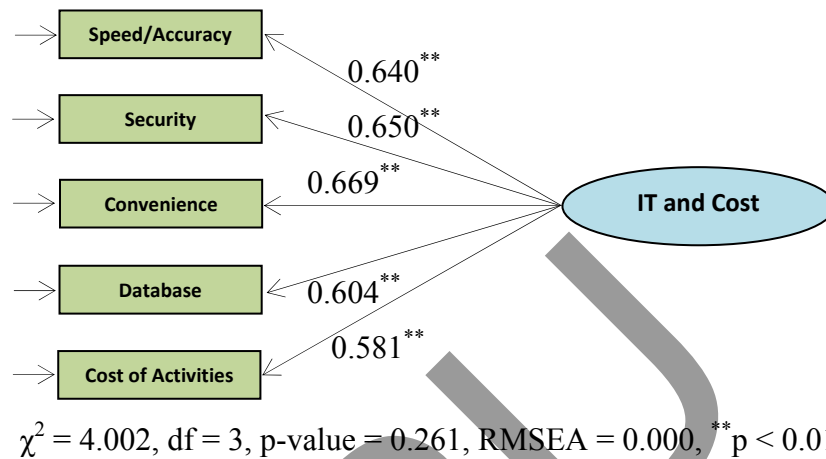
Figure 3.6: The Measurement Model of Enabling Technology and Cost with Factor Loadings

Table 3.8: Fit Indices between the Model of Enabling Technology and Cost and Observed Variables

Fit Index	Obtained Value	Consideration
1. χ^2 (p)	0.261	Good
2. χ^2 / df	1.334	Good
3. RMSEA	0.043	Good
4. Standardized RMR	0.018	Good
5. NFI	0.992	Good
6. CFI	0.998	Good
7. GFI	0.991	Good
8. AGFI	0.955	Good

According to Figure 3.6, this indicates that factor loading of convenient payment is highest value (0.669) among others. Moreover, all obtained values in Table 3.8 are compatible with the designated criteria in Table 3.3. This means that the model of enabling technology and cost, together with five observed variables (i.e. speed/accuracy of data, data security,

convenient payment, efficient database and activity-based costing) is clearly considered as good fitness.

6. The Measurement Model of Perceived Factors of ECR

$$\chi^2 = 0.319, df = 1, \text{p-value} = 0.572, \text{RMSEA} = 0.000$$
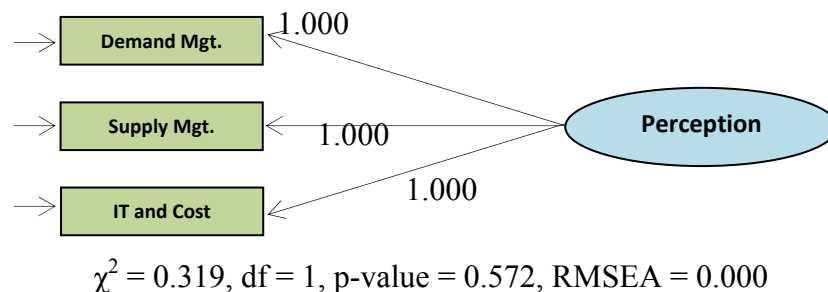
Figure 3.7: The Measurement Model of Perceived Factors of ECR with Factor Loadings

Table 3.9: Fit Indices between the Model of Perceived Factors of ECR and Variables Observed

Fit Index	Obtained Value	Consideration
1. χ^2 (p)	0.572	Good
2. χ^2 / df	0.319	Good
3. RMSEA	0.000	Good
4. Standardized RMR	0.020	Good
5. NFI	0.999	Good
6. CFI	1.000	Good
7. GFI	0.999	Good
8. AGFI	0.993	Good

In terms of perception in Figure 3.7, its factors are considered equally. Furthermore, all obtained values in Table 3.9 are compatible with the designated criteria in Table 3.3. This means that the model of perceived factors of ECR, including three important factors (i.e. demand management, supply management and enabling technology & cost) is viewed as the good fitness.

Based on the limitation to hold observed variables in LISREL 8.8 (student version), it is vital to transform all those observed ones by means of average to 3 prime observed variables, namely demand management, supply management and IT & cost, in the model of perceived factors of ECR.

7. The Measurement Model of ECR Adoption

$\chi^2 = 6.728$, df = 7, p-value = 0.458, RMSEA = 0.000, [**]p < 0.01
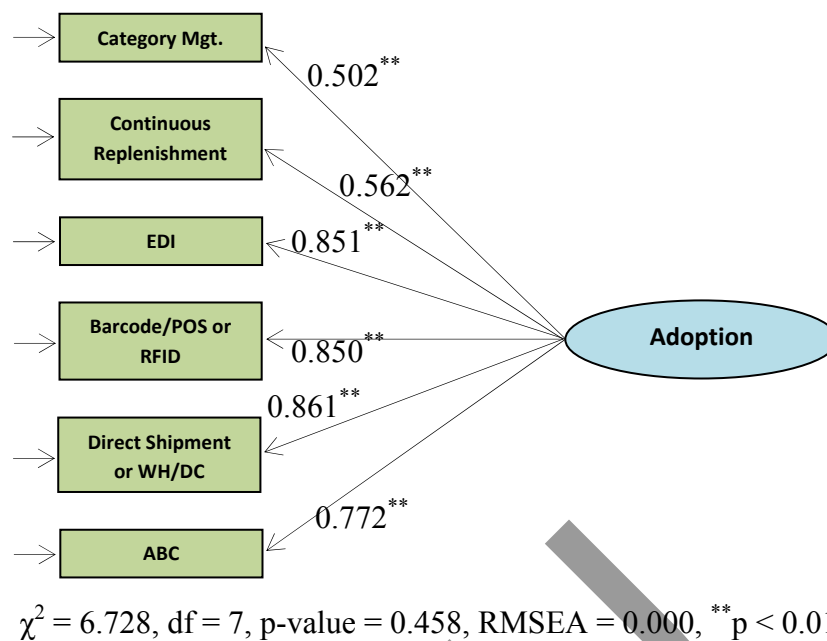
Figure 3.8: The Measurement Model of ECR Adoption with Factor Loadings

Table 3.10: Fit Indices between the Model of ECR Adoption and Observed Variables

Fit Index	Obtained Value	Consideration
1. χ^2 (p)	0.458	Good
2. χ^2 / df	0.961	Good
3. RMSEA	0.000	Good
4. Standardized RMR	0.018	Good
5. NFI	0.991	Good
6. CFI	1.000	Good
7. GFI	0.988	Good
8. AGFI	0.963	Good

As shown above in Figure 3.8, direct shipment or warehouse/distribution center is considered as the highest factor loading with value of 0.861. In addition, all obtained values in Table 3.10 are compatible with the designated criteria in Table 3.3. This means that the model of ECR adoption together with six remarkable variables, consisting of category management, continuous replenishment, EDI technology, barcode/POS or RFID, direct shipment or warehouse/distribution center and activity-based costing, is viewed as the complete fitness.

3.3 Data Collection

The questionnaire (in Thai) was mailed to those of 231 between October and November 2010. Respondents were requested to complete and return the questionnaire by January 2011. As a result, a total of 179 complete questionnaires were return on 31 January 2011 (a response rate of 77.49 percent). Generally, most respondents are female, comprising 60 percent. In aspects of experience of retail, most of them have been in their retailing career between one to five years.

3.4 Data Analysis

To analyze all data, the following statistics, including software are utilized:
- ➢ General data of respondent regarding personal and enterprise characteristics are processed by statistics means of frequency and percentage with SPSS version 19.
- ➢ The following data are calculated by statistics of mean ($\overline{X}$) and standard deviation (S) in SPSS version 19:
  - ▪ Level of activity in level of logistics and supply chain
  - ▪ Demand management in perceived factors of ECR
  - ▪ Supply management in perceived factors of ECR
  - ▪ Enabling technology and cost in perceived factors of ECR

Then, level of ECR adoption and reason to adopt ECR are shown by range of $\overline{X}$ where:

$$\frac{\text{Range}}{\text{Number of Intervals}} \quad = \quad \frac{5-1}{5} \quad = \quad 0.8$$

This means that the range of interval is 0.8.

Table 3.11: Interpreting of Range of $\overline{X}$ for Level of ECR adoption and Reason to

Adopt ECR

Range of $\overline{X}$	Level of ECR Adoption and Reason to Adopt ECR
4.24 – 5.00	Very High
3.43 – 4.23	High
2.62 – 3.42	Medium
1.81 – 2.61	Low
1.00 – 1.80	Very Low

➤ LISREL 8.8 (student version) is applied to analyze the following statistics methods:

- Confirmatory factor analysis (CFA) for such measurement model as enterprise characteristics, level of logistics and supply chain, demand management, supply management, enabling technology and cost, perceived factors of ECR and ECR adoption

- Path analysis for the causal relationship models of ECR adoption by retailer, together with comparing goodness of fitness (criteria in Table 3.3) from following indices:

  1) χ^2
  2) χ^2 / df
  3) RMSEA
  4) Standardized RMR
  5) NFI
  6) CFI
  7) GFI
  8) AGFI

Chapter 4

Research Results

4.1 General Information of Respondents in Personal Characteristics

The results of respondents regarding personal characteristics are demonstrated in Table 4.1.

Table 4.1: Demographic Information of Respondents in Personal Characteristics

Personal Characteristics	Respondents	
	Frequency	**Valid Percent (%)**
Gender:		
Male	71	39.70
Female	108	60.3
Age:		
Below 30 Years	70	39.10
31 – 40 Years	49	27.40
41 – 50 Years	40	22.30
51 – 60 Years	16	8.90
Above 60 Years	4	2.20
Education Level:		
Below undergraduate Degree	50	27.90
Undergraduate Degree	119	66.50
Postgraduate Degree	10	5.60
Experience of Retail:		
Below 1 Year	27	15.10
1 – 5 Years	91	50.80
6 – 10 Years	32	17.90
11 – 20 Years	20	11.20
Above 20 Years	8	4.50
Position:		
Employer	95	53.10
Employee	84	46.90

It can be seen from the Table 4.1 that most respondents are female, representing 60.30 percent. In terms of age, the largest percentage is below 30 years old (39.10 percent) whereas the second and third one are in interval of 31 – 40 and 41 – 50 years old, holding 27.40 and 22.30 percent, respectively. The majority group of education level comes from undergraduate degree, totaling 66.50 percent. For experience of retail, it displays that the group of 1 – 5 year(s) is the largest one (50.80 percent); on the other hand, the smallest one (4.50 percent) comes from group which is above 20 years. Finally, regarding position of respondent, most of them are employer, comprising 53.10 percent.

4.2 General Information of Respondents in Enterprise Characteristics

The results of respondents regarding enterprise characteristics are shown in Table 4.2.

Table 4.2: Demographic Information of Respondents in Enterprise Characteristics

Enterprise Characteristics	Respondents	
	Frequency	Valid Percent (%)
Current Asset:		
Below 1 MB	37	20.70
1 – 5 MB	87	48.60
6 – 20 MB	36	20.10
21 – 100 MB	15	8.40
Above 100 MB	4	2.20
Number of SKUs:		
Below 50 SKUs	51	28.50
50 – 100 SKUs	67	37.40
101 – 200 SKUs	27	15.10
201 – 1,000 SKUs	18	10.10
Above 1,000 SKUs	16	8.90
Number of Staff:		
Below 10	148	82.70
10 – 20	23	12.80
21 – 50	-	-
51 – 100	4	2.20
Above 100	4	2.20

Enterprise Characteristics	Respondents	
	Frequency	Valid Percent (%)
Years of Operation:		
Below 1 Year	5	2.80
1 – 5 Years	63	35.20
6 – 10 Years	66	36.90
11 – 20 Years	35	19.60
Above 20 Years	10	5.60
Number of Stores:		
1 Store	140	78.20
2 – 5 Stores	30	16.80
6 – 10 Stores	2	1.10
11 – 20 Stores	3	1.70
Above 20 Stores	3	1.70

According to Table 4.2, most retailers possess current assets between one and five million baht, representing 48.6 percent whereas percentage of enterprise below one and 6 – 20 million baht, coming second and third order is so close. In aspects of SKU, most of them occupy a number of SKUs between 50 and 100, comprising 37.4 percent. Next, it indicates that a majority of retailers has staff below ten (82.70 percent). In terms of service year, the largest percentage is between six and ten years (36.90 percent); then the second one, which is close to the largest one, is between one and five years, holding 35.20 percent. Finally, regarding number of stores, most retailers own one store with percentage of 78.20.

4.3 ECR Adoption Categorized by Enterprise Characteristics

The results of mean ($\overline{\text{X}}$) and standard deviation (s) in relation to ECR adoption and enterprise characteristics are demonstrated in Table 4.3, 4.4, 4.5, 4.6 and 4.7.

Table 4.3: Mean and Standard Deviation of ECR Adoption Categorized by Current Asset

ECR Adoption by Retailer	Current Asset (MB)									
	Below 1 (n = 37)		1 – 5 (n = 87)		6 – 20 (n = 36)		21 – 100 (n = 15)		Above 100 (n = 4)	
	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s
Category Mgt.	3.59	0.93	3.82	0.67	4.33	0.72	4.53	0.64	4.00	1.41
Continuous Replenishment	3.89	0.88	3.84	0.87	4.28	0.74	4.47	0.52	4.00	1.41
EDI	3.46	1.10	3.69	1.06	3.81	0.95	4.40	0.51	2.75	2.06
Barcode/POS or RFID	3.78	1.44	3.99	1.07	4.06	1.04	4.53	0.52	2.75	2.06
Direct Shipment or WH/DC	3.11	1.17	3.67	1.05	3.81	1.04	4.60	0.51	2.75	2.06
ABC	3.86	1.13	3.95	1.04	3.92	1.08	4.67	0.49	3.25	1.50
Total	3.62	0.89	3.83	0.72	4.03	0.72	4.53	0.35	3.25	1.68

It is clear from the Table 3.11 and 4.3 concerned with current asset that ECR adoption can be classified into two levels: very high for 21 – 100 million baht (mean = 4.53) and high for the others. The results of ECR adoption for intervals of current asset are described as follows:

➢ Below 1 Million Baht

Regarding retailers with their current assets below 1 million baht, ECR adoption can be classified into two levels:

▪ High adoption for category management, continuous replenishment, EDI, barcode/POS or RFID and ABC

▪ Medium adoption for direct shipment or WH/DC

➢ 1 – 5 Million Baht

Regarding retailers with their current assets of 1 – 5 million baht, ECR adoption has one level:

▪ High adoption for every activity

➢ 6 – 20 Million Baht

Regarding retailers with their current assets of 6 – 20 million baht, can be separated into two levels:

▪ Very high adoption for category management and continuous replenishment

- High adoption for EDI, barcode/POS or RFID, direct shipment or WH/DC and ABC

➢ 21 − 100 Million Baht

Regarding retailers with their current assets of 21 − 100 million baht, ECR adoption has one level:

- Very high adoption for every activity

➢ Above 100 Million Baht

Regarding retailers with their current assets above 100 million baht, ECR adoption can be divided into two levels:

- High adoption for category management and continuous replenishment
- Medium adoption for EDI, barcode/POS or RFID, direct shipment or WH/DC and ABC

Table 4.4: Mean and Standard Deviation of ECR Adoption Categorized by Number of SKUs

ECR Adoption by Retailer	Number of SKUs									
	Below 50 (n = 51)		50 − 100 (n = 67)		101 − 200 (n = 27)		201 − 1,000 (n = 18)		Above 1,000 (n = 16)	
	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s
Category Mgt.	3.67	0.77	3.88	0.81	4.15	0.82	4.17	0.79	4.44	0.63
Continuous Replenishment	3.80	0.94	3.97	0.83	4.19	0.74	4.11	0.83	4.25	0.86
EDI	3.51	1.08	3.85	0.91	4.00	0.68	3.39	1.33	3.56	1.59
Barcode/POS or RFID	3.65	1.26	4.19	0.99	4.19	0.79	4.17	1.29	3.56	1.59
Direct Shipment or WH/DC	3.39	1.1	3.73	1.01	4.00	1.04	3.50	1.54	3.56	1.26
ABC	3.76	1.12	4.16	0.85	4.22	0.80	3.78	1.44	3.63	1.41
Total	3.63	0.85	3.97	0.67	4.12	0.62	3.85	1.04	3.83	0.95

It is apparent from the Table 3.11 and 4.4 with respect to SKU that ECR adoption is in the high level for all numbers of SKUs (mean range from 3.63 to 4.12). The results of ECR adoption for intervals of them are described as follows:

➢ Below 50 SKUs

Regarding retailers with number of SKUs below 50, ECR adoption can be sorted into two levels:

- High adoption for category management, continuous replenishment, EDI, barcode/POS or RFID and ABC
- Medium adoption for direct shipment or WH/DC

➢ 50 – 100 SKUs

Regarding retailers with number of SKUs of 50 – 100, ECR adoption has one level:

- High adoption for every activity

➢ 101 – 200 SKUs

Regarding retailers with number of SKUs of 101 – 200, ECR adoption has one level:

- High adoption for every activity

➢ 201 – 1,000 SKUs

Regarding retailers with number of SKUs of 201 – 1,000, ECR adoption can be grouped into two levels:

- High adoption for category management, continuous replenishment, barcode/POS or RFID, direct shipment or WH/DC and ABC
- Medium adoption for EDI

➢ Above 1,000 SKUs

Regarding retailers with number of SKUs over 1,000, ECR adoption can be separated into two levels:

- Very high adoption for category management and continuous replenishment
- High adoption for EDI, barcode/POS or RFID, direct shipment or WH/DC and ABC

Table 4.5: Mean and Standard Deviation of ECR Adoption Categorized by Number of Staff

ECR Adoption by Retailer	Number of Staff									
	Below 10 (n = 148)		10 – 20 (n = 23)		21 – 50 (n = 4)		51 – 100 (n = 0)		Above 100 (n = 4)	
	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s
Category Mgt.	3.88	0.79	4.26	0.81	4.50	0.58	-	-	3.75	1.26
Continuous Replenishment	3.94	0.85	4.48	0.59	3.75	1.26	-	-	3.50	1.29
EDI	3.64	1.05	4.39	0.58	3.50	1.29	-	-	2.50	1.73
Barcode/POS or RFID	3.93	1.15	4.61	0.58	2.75	2.06	-	-	3.25	1.50
Direct Shipment or WH/DC	3.55	1.13	4.30	0.88	3.50	1.29	-	-	3.25	1.50
ABC	3.93	1.02	4.61	0.89	3.25	1.26	-	-	2.75	1.50
Total	3.81	0.78	4.44	0.42	3.54	1.07	-	-	3.17	1.28

According to Table 3.11 and 4.5, ECR adoption can be classified into three levels: very high for number of staff between 10 and 20 (mean = 4.44), high for number of staff below 10 and between 21 and 50 and medium for number of staff over 100. The results of ECR adoption for intervals of them are represented as follows:

➢ Staff below 10

Regarding retailers with number of staff under 10, ECR adoption has one level:

▪ High adoption for every activity

➢ Staff with 10 – 20

Regarding retailers with number of staff of 10 – 20, ECR adoption has one level:

▪ High adoption for every activity

➢ Staff with 21 – 50

Regarding retailers with number of staff of 10 – 20, ECR adoption can be divided into three levels:

▪ Very high adoption for category management

▪ High adoption for continuous replenishment, EDI and direct shipment or WH/DC

▪ Medium adoption for barcode/POS or RFID and ABC

> ➤ Staff above 100

Regarding retailers with number of staff of over 100, ECR adoption can be sorted into three levels:

- ▪ High adoption for category management and continuous replenishment
- ▪ Medium adoption for barcode/POS or RFID, direct shipment or WH/DC and ABC
- ▪ Low adoption for EDI

Table 4.6: Mean and Standard Deviation of ECR Adoption Categorized by Years of Operation

ECR Adoption by Retailer	Years of Operation									
	Below 1 (n = 5)		1 – 5 (n = 63)		6 – 10 (n = 66)		11 – 20 (n = 35)		Above 20 (n = 10)	
	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s
Category Mgt.	3.80	0.45	3.76	0.87	4.00	0.70	4.11	0.76	4.10	1.20
Continuous Replenishment	3.80	1.10	3.79	0.92	4.11	0.77	4.20	0.72	3.90	1.20
EDI	3.40	0.89	3.67	1.00	3.85	0.83	3.74	1.27	3.00	1.83
Barcode/POS or RFID	3.80	1.64	3.73	1.17	4.21	0.89	4.17	1.27	3.40	1.71
Direct Shipment or WH/DC	3.60	0.89	3.67	1.06	3.67	1.00	3.80	1.26	2.70	1.70
ABC	3.20	1.30	3.94	0.98	4.15	0.81	4.11	1.21	2.90	1.66
Total	3.60	1.00	3.76	0.78	4.00	0.62	4.02	0.84	3.33	1.37

It is clear from the Table 3.11 and 4.6 concerned with years of operation that ECR adoption can be classified into two levels: high for below 1, 1 – 5, 6 – 10 and 11 – 20 year(s) (mean range between 3.60 and 4.02) and medium for more than 20 years. The results of ECR adoption for intervals of years of operation are explained as follows:

- ➢ Below 1 Year

  Regarding retailers with less than 1 year of operation, ECR adoption can be separated into two levels:

    - ▪ High adoption for category management, continuous replenishment, barcode/POS or RFID and direct shipment or WH/DC
    - ▪ Medium adoption for EDI and ABC

- ➢ 1 – 5 Year(s)

  Regarding retailers with 1 – 5 years of operation, ECR adoption has one level:

    - ▪ High adoption for every activity

- ➢ 6 – 10 Years

  Regarding retailers with 6 – 10 years of operation, ECR adoption has one level:

    - ▪ High adoption for every activity

- ➢ 11 – 20 Years

  Regarding retailers with 11 – 20 years of operation, ECR adoption has one level:

    - ▪ High adoption for every activity

- ➢ Above 20 Years

  Regarding retailers with more than 20 years of operation, ECR adoption can be sorted into two levels:

    - ▪ High adoption for category management and continuous replenishment
    - ▪ Medium adoption for EDI, barcode/POS or RFID, direct shipment or WH/DC and ABC

Table 4.7: Mean and Standard Deviation of ECR Adoption Categorized by Number of Stores

ECR Adoption by Retailer	Number of Stores									
	1 (n = 140)		2 – 5 (n = 30)		6 – 10 (n = 2)		11 – 20 (n = 3)		Above 20 (n = 3)	
	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s	$\overline{X}$	s
Category Mgt.	3.90	0.80	4.13	0.73	4.00	0.00	3.67	1.53	3.67	1.53
Continuous Replenishment	4.00	0.86	3.93	0.87	4.00	0.00	3.67	1.53	4.33	0.58
EDI	3.66	1.06	3.97	1.03	3.00	0.00	3.00	1.73	4.00	1.00
Barcode/POS or RFID	3.94	1.20	4.13	0.94	3.50	0.71	3.33	2.08	4.67	0.58
Direct Shipment or WH/DC	3.56	1.15	4.03	0.89	2.50	2.12	3.00	1.73	4.33	0.58
ABC	3.91	1.05	4.27	1.14	4.50	0.71	3.33	1.15	4.00	1.00
Total	3.83	0.79	4.08	0.76	3.58	0.35	3.33	1.59	4.17	0.73

According to Table 3.11 and 4.7, ECR adoption can be classified into two levels: high for 1, 2 – 5, 6 – 10 and over 20 store(s) (mean range between 3.58 and 4.17) and medium for 11 – 20 stores. The results of ECR adoption for intervals of them are described as follows:

➢ 1 Store

Regarding retailers with 1 store, ECR adoption has one level:

▪ High adoption for every activity

➢ 2 – 5 Stores

Regarding retailers with 2 – 5 stores, ECR adoption can be grouped into two levels:

▪ Very high adoption for ABC

▪ High adoption for category management, continuous replenishment, EDI, barcode/POS or RFID and direct shipment or WH/DC

➢ 6 – 10 Stores

Regarding retailers with 6 – 10 stores, ECR adoption can be organized into four levels:

▪ Very high adoption for ABC

▪ High adoption for category management, continuous replenishment, and barcode/POS or RFID

▪ Medium adoption for EDI

- Low adoption for direct shipment or WH/DC
  - 11 – 20 Stores

  Regarding retailers with 11 – 20 stores, ECR adoption can be divided into two levels:
    - High adoption for category management and continuous replenishment
    - Medium adoption for EDI, barcode/POS or RFID, direct shipment or WH/DC and ABC
  - Above 20 Stores

  Regarding retailers with over 20 stores, ECR adoption can be arranged into two levels:
    - Very high adoption for continuous replenishment, barcode/POS or RFID and direct shipment or WH/DC
    - High adoption for category management, EDI and ABC

To extend ECR adoption categorized by enterprise characteristics, the reasons to adopt it are provided by mean and standard deviation in Table 4.8.

Table 4.8: Mean and Standard Deviation of Reason to Adopt ECR

Reason to Adopt ECR	n = 179	
	$\overline{X}$	s
Vendor/customer Need	3.88	0.83
Asset Utilization	4.01	0.80
Improvement of Customer Service	4.15	0.78
Unpredictable Demand	3.81	0.97
Unbalanced Inventory	3.88	0.91
Unpredictable Cost of Shipping and Storing	3.81	0.93
Improvement of Competitiveness	4.21	0.83

As can be seen from the Table 3.11 and 4.8, the reason to adopt ECR is in the high level for all issues. Most retailers obviously adopted ECR based on the reason of improvement of competitiveness (mean = 4.21) while unpredictable demand and unpredictable cost of shipping and sorting are the least reason (same means of 3.81) to adopt ECR.

4.4 The Results of SEM

4.4.1 The Results of Construct Reliability, Average Variance Extracted and Square Multiple Correlations

The construct reliability and average variance extracted of latent variables, including square multiple correlations of observed variables, in the model of ECR adoption are summarized in Table 4.9.

Table 4.9: Construct Reliability (ρ_c) and Average Variance Extracted (ρ_v) of Latent Variables with Squared Multiple Correlations (R^2) of Observed Variables

Latent Variable	Observed Variable	ρ_c	ρ_v	R^2
Enterprise Characteristics		0.687	0.340	
	Asset			0.549
	SKU			0.548
	Staff			0.392
	Year			0.186
	Store			0.024
Level of Logistics and Supply Chain		1.000	1.000	
	Level of Activity			1.000
Perceive Factors of ECR		0.839	0.643	
	Demand Management			0.737
	Supply Management			0.714
	IT and Cost			0.479
ECR Adoption by Retailer		0.866	0.518	
	Category Mgt.			0.507
	Continuous Replenishment			0.471
	EDI			0.526
	Barcode/POS or RFID			0.551
	Direct Shipment or WH/DC			0.517
	ABC			0.537

According to Table 4.9, the construct reliability of latent variables ranges from 0.687 to 1.000. This means, all of them are much reliable. Next, in terms of average variance extracted of latent variable, 0.340 of the variance of enterprise characteristics accounted for by observed variables of asset, SKU, staff, year and store is moderately low.

Furthermore, the variances of staff, year and store are explained by enterprise characteristics with 39.20, 18.60 and 2.4 percent, respectively. This proves that the explanation of it with relation to them is low, comparing to other observed variables. Then, the models explain 47.90 and 47.1 percent of the variances in perceive factors of ECR and ECR adoption by retailer, respectively. This indicates that both values are moderately low.

4.4.2 The Results of Fit Index

It is apparent from Figure 4.1 and Table 4.10 that the causal relationship model of ECR adoption by retailers is rather valid on account of six good and two acceptable criterions of fit indices (as shown in Table 3.3, suggested by Schermelleh-Engel et al., 2003). The fitted SEM indicates the chi-square value (χ^2) is 84.497 where p is 0.085; the degree of freedom (df) is 68, and the χ^2 / df is 1.243. The root mean square error of approximation (RMSEA) is 0.037, and the standardized root mean square residual (Standardized RMR) is 0.058 (this value can be acceptable because it is more than 0.05 but less than 0.08). The normed fit index (NFI) is 0.962; the comparative fit index (CFI) is 0.989, and the goodness of fit index (GFI) is 0.940. The adjusted goodness of fit index (AGFI) is 0.895 (this value can be acceptable because it is more than 0.85 but less than 0.90).
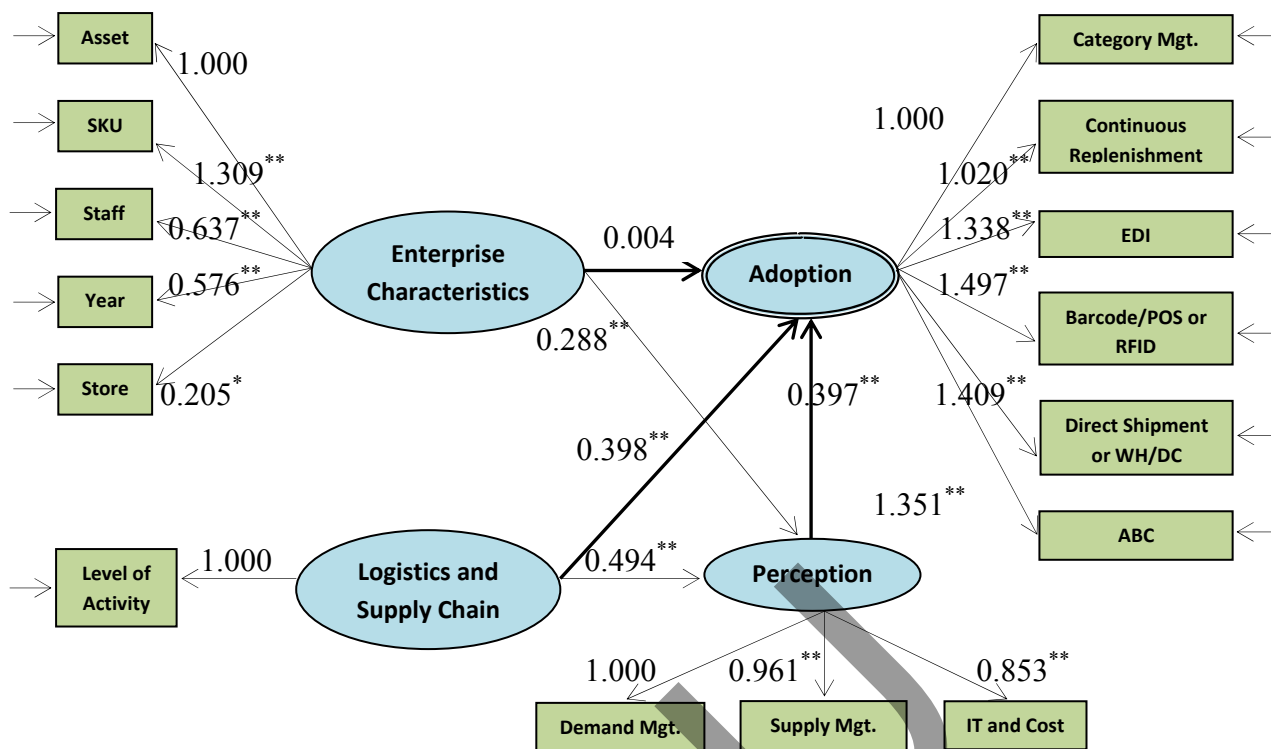
$\chi^2 = 84.497$, df = 68, p-value = 0.085, RMSEA = 0.037, $^*p < 0.05$, $^{**}p < 0.01$

Figure 4.1: The Causal Relationship Models of ECR Adoption by Retailers with Factor Loadings

Table 4.10: Fit Indices between the Causal Relationship Models of ECR Adoption by Retailers and Observed Variables

Fit Index	Obtained Value	Consideration
1. χ^2 (p)	0.085	Good
2. χ^2 / df	1.243	Good
3. RMSEA	0.037	Good
4. Standardized RMR	0.058	Acceptable
5. NFI	0.962	Good
6. CFI	0.989	Good
7. GFI	0.940	Good
8. AGFI	0.895	Acceptable

4.4.3 The Results of Direct and Indirect Effects

Table 4.11: Effect in the Causal Relationship Models of ECR Adoption by Retailers

Endogenous (Dependent) Variable	R^2	Effect	Exogenous (Independent) Variable			
			Enterprise Characteristics	Logistics and Supply Chain	Perception	Adoption
Perception	0.544	DE	0.288**	0.494**	-	-
		IE	-	-	-	-
		TE	0.288**	0.494**	-	-
Adoption	0.647	DE	0.004	0.398**	0.397**	-
		IE	0.115*	0.196**	-	-
		TE	0.119	0.595**	0.397**	-
Priority of Effect			**3**	**1**	**2**	-

Remark: DE = Direct Effect, IE = Indirect Effect, TE = Total Effect, *$p < 0.05$, **$p < 0.01$

This SEM includes:

➢ Endogenous (dependent) variables comprise ECR adoption by retailers and perceived factors of ECR (also served as exogenous variable).

➢ Exogenous (independent) variables comprise enterprise characteristics and level of logistics and supply chain.

Overall, as shown in Table 4.11, exogenous variables of enterprise characteristics, level of logistics and supply chain and perceived factors of ECR explains 64.70 percent of the variance in endogenous variable of ECR adoption. Also, 54.40 percent of the variance in endogenous variable of perceived factors of ECR is accounted for by exogenous variables of enterprise characteristics and level of logistics and supply chain.

In terms of factor loading, level of logistics and supply chain is viewed as the most powerful direct effect of 0.494 and 0.398 on perceived factors of ECR and ECR adoption, respectively. Also, level of logistics and supply chain is the strongest indirect effect of 0.196 on ECR adoption while enterprise characteristics are the least indirect effect of 0.115 on ECR adoption.

4.4.4 The Results of Hypothesis Testing

As demonstrated in Figure 4.1 and Table 4.11, including Appendix D, the results of testing on seven hypotheses by SEM with LISREL 8.8 are described as follows:

1) **H1** stated that enterprise characteristics have direct effect on ECR adoption.

   The analysis of SEM indicates that path coefficient from enterprise characteristics to ECR adoption is 0.004. The t-value is 0.066, where is not significant. This proves that there is no direct effect of enterprise characteristics on ECR adoption.

2) **H2** stated that enterprise characteristics have direct effect on perceived factors of ECR.

   The analysis of SEM indicates that path coefficient from enterprise characteristics to perceived factors of ECR is 0.288. The t-value is 4.184, where is significant at level of 0.01. This means that there is direct effect of enterprise characteristics on perceived factors of ECR.

3) **H3** stated that enterprise characteristics have indirect effect on ECR adoption.

   The analysis of SEM indicates that path coefficient from enterprise characteristics to ECR adoption through perceived factors of ECR is 0.115. The t-value is 2.716, where is significant at level of 0.05. This shows that there is indirect effect of enterprise characteristics on ECR adoption.

4) **H4** stated that level of logistics and supply chain has direct effect on ECR adoption.

   The analysis of SEM indicates that path coefficient from level of logistics and supply chain to ECR adoption is 0.398. The t-value is 5.228, where is significant at level of 0.01. This confirms that there is direct effect of level of logistics and supply chain on ECR adoption.

5) **H5** stated that level of logistics and supply chain has direct effect on perceived factors of ECR.

   The analysis of SEM indicates that path coefficient from level of logistics and supply chain to perceived factors of ECR is 0.494. The t-value is 9.646, where is significant at level of 0.01. This verifies that there is direct effect of level of logistics and supply chain on perceived factors of ECR.

6) **H6** stated that level of logistics and supply chain has indirect effect on ECR adoption.

The analysis of SEM indicates that path coefficient from level of logistics and supply chain to ECR adoption through perceived factors of ECR is 0.196. The t-value is 3.275, where is significant at level of 0.01. This proves that there is indirect effect of level of logistics and supply chain on ECR adoption.

7) **H7** stated that perceived factors of ECR have direct effect on ECR adoption.

The analysis of SEM indicates that path coefficient from perceived factors of ECR to ECR adoption is 0.397. The t-value is 3.445, where is significant at level of 0.01. This means that there is direct effect of perceived factors of ECR on ECR adoption.

Therefore, the results confirm that six (H2 – H7) out of seven hypotheses are supported while one of them (H1) is rejected.

Moreover, each exogenous variable influenced on ECR adoption in the model of causal relationship can be described its total effect in order as follows:

➢ Level of logistics and supply chain – *first order*

It is the most influence variable on ECR adoption with total effect of 0.595 at the significant level of 0.01. Its direct effect is 0.398 (where significant level is 0.01) while indirect one through perceived factors of ECR is 0.196 (where significant level is 0.01).

➢ Perceived factors of ECR – *second order*

These are the group of the most second influence variable on ECR adoption with total effect of 0.397, holding only direct effect, at the significant level of 0.01.

➢ Enterprise characteristics – *third order*

This group is considered as the no influence variables on ECR adoption with total effect of 0.119 without significant level. Its direct effect is 0.004 without significant level while indirect one through perceived factors of ECR is 0.115 (where significant level is 0.05).

Also, the following exogenous variables having effect on perceived factors of ECR can be presented their total effects in order as follows:

> Level of logistics and supply chain – *first order*

It is the most influence variable on perceived factors of ECR with total effect of 0.494, holding only direct effect, at the significant level of 0.01.

> Enterprise characteristics – *second order*

This group is viewed as the least influence variable on perceived factors of ECR with total effect of 0.288, holding only direct effect, at the significant level of 0.01.

Chapter 5

Conclusion and Discussion

5.1 Conclusion

The three main objectives of this research are composed of: (1) to investigate the relationship between level of logistics/supply chain of the retailer and the ECR adoption, including perceived factors of ECR, (2) to investigate perceived factors of ECR influencing on decision of retailer concerned with ECR adoption and (3) to investigate the characteristics of retailer associated with the adoption of ECR, including perceived factors of ECR.

The models of ECR adoption by retailers in Bangkok are valid as shown in Figure 5.1 below.
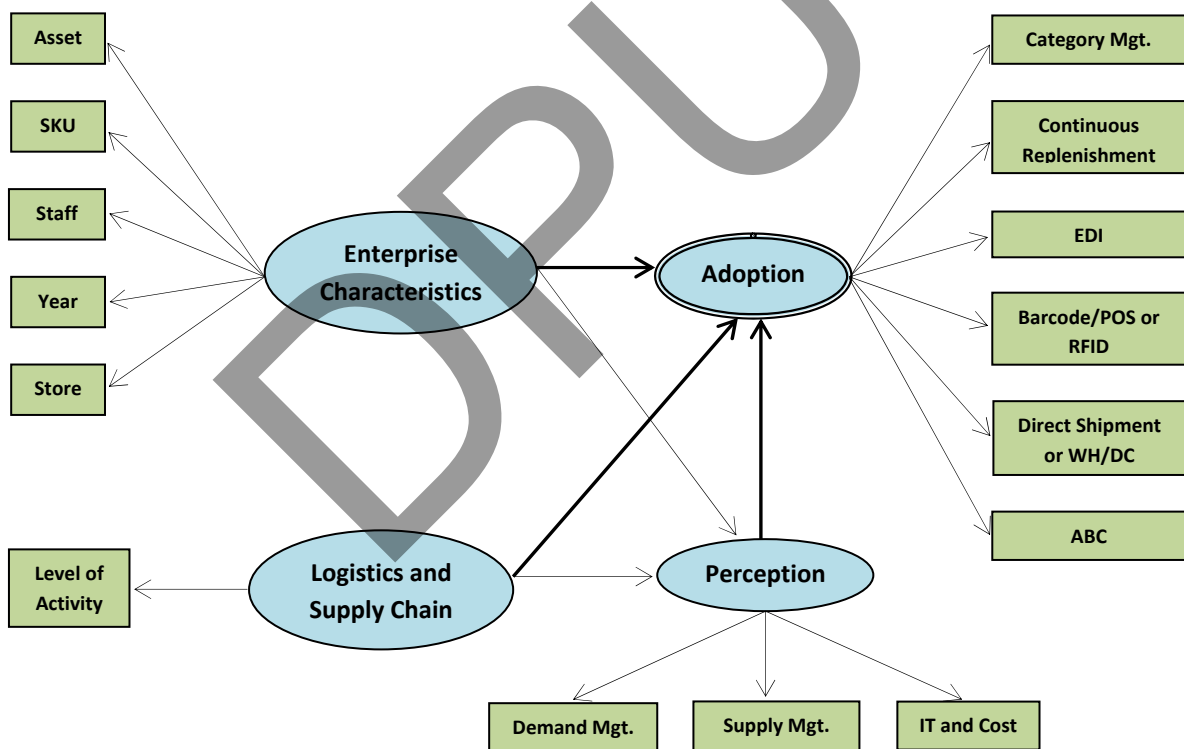
Figure 5.1: The Causal Relationship Models of ECR Adoption by Retailers

In terms of population, 550 retailers selling general consumer goods in only Bangkok from the database of Department of Business Development, Ministry of Commerce on 7 August 2009 are brought to study. Then, the total sample size of 179 retailers of this study can be collected.

The important instrument of this research is questionnaire. Most questions were asked respondent to evaluate scales ranging from one to five, in order to measure seven latent variables. To test the reliability of all questions, values of α were between 0.700 and 0.906. This proves that observed variables are rather reliable. Next, the confirmatory factor analysis (CFA) is used for inspecting fitness between seven measurement models and 44 observed variables. The fitness between them is shown by such fit index as χ^2 (p), χ^2 / df, RMSEA, Standardized RMR, NFI, CFI, GFI and AGFI. Consequently, those of them are viewed as the good fitness.

To analyze data, the following appropriate statistics with software are applied:

➢ Frequency and percentage by SPSS version 19 for general data of respondent associated with personal and enterprise characteristics

➢ Mean ($\overline{X}$) and standard deviation (S) by SPSS version 19 for level of activity in level of logistics and supply chain, demand management in perceived factors of ECR, supply management in perceived factors of ECR and enabling technology and cost in perceived factors of ECR

➢ Confirmatory factor analysis (CFA) by LISREL 8.8 for enterprise characteristics, level of logistics and supply chain, demand management, supply management, enabling technology and cost, perceived factors of ECR and ECR adoption

➢ Path analysis by LISREL 8.8 for the causal relationship model of ECR adoption by retailer, together with comparing goodness of fitness

The results after analyzing data can be summarized as follows:

➢ Retailers with very high adoption of ECR (mean = 4.53) have current asset ranging from 21 to 100 million baht.

➢ Retailers with high adoption of ECR (mean = 3.97) have goods between 50 and 100 SKUs.

➢ Retailers with very high adoption of ECR (mean = 4.44) have staff between 10 and 20.

➢ Retailers with high adoption of ECR (mean = 4.02) have established between 11 and 20 years.

➢ Retailers with very high adoption of ECR (mean = 4.17) have more than 20 stores.

➢ The most important reason to adopt ECR is to improve retailers' competitiveness (mean = 4.21), following by improvement of customer service (mean = 4.15) while the least important ones are unpredictable demand and unpredictable cost of shipping and sorting, which their means are equal (3.81).

➢ All fit indices of the causal Relationship model of ECR adoption by retailers and observed variables are viewed as good and acceptable fitness (χ^2 (p) = 0.085, χ^2 / df = 1.243, RMSEA = 0.037, Standardized RMR = 0.058, NFI = 0.962, CFI = 0.989, GFI = 0.940 and AGFI = 0.895)

➢ 64.70 percent of the variance in ECR adoption can be explained by all exogenous variables (i.e. enterprise characteristics, level of logistics and supply chain and perceived factors of ECR).

➢ After hypothesis testing, the following hypotheses can be accepted:
- **H2:** Enterprise characteristics have ***direct effect*** on perceived factors of ECR (path coefficient = 0.288 and t-value = 4.184 with significant level of 0.01).
- **H3:** Enterprise characteristics have ***indirect effect*** on ECR adoption (path coefficient = 0.115 and t-value = 2.716 with significant level of 0.05).
- **H4:** Level of logistics and supply chain has ***direct effect*** on ECR adoption (path coefficient = 0.398 and t-value = 5.228 with significant level of 0.01).
- **H5:** Level of logistics and supply chain has ***direct effect*** on perceived factors of ECR (path coefficient = 0.494 and t-value = 9.646 with significant level of 0.01).
- **H6:** Level of logistics and supply chain has ***indirect effect*** on ECR adoption (path coefficient = 0.196 and t-value = 3.275 with significant level of 0.01).
- **H7:** Perceived factors of ECR have ***direct effect*** on ECR adoption (path coefficient = 0.397 and t-value = 3.445 with significant level of 0.01).

➢ Level of logistics and supply chain is the most influential effect with total effect of 0.494 and 0.595 on perceived factors of ECR and ECR adoption, respectively.

The complete causal relationship models of ECR adoption by retailers with factor loadings is illustrated by the following diagram:
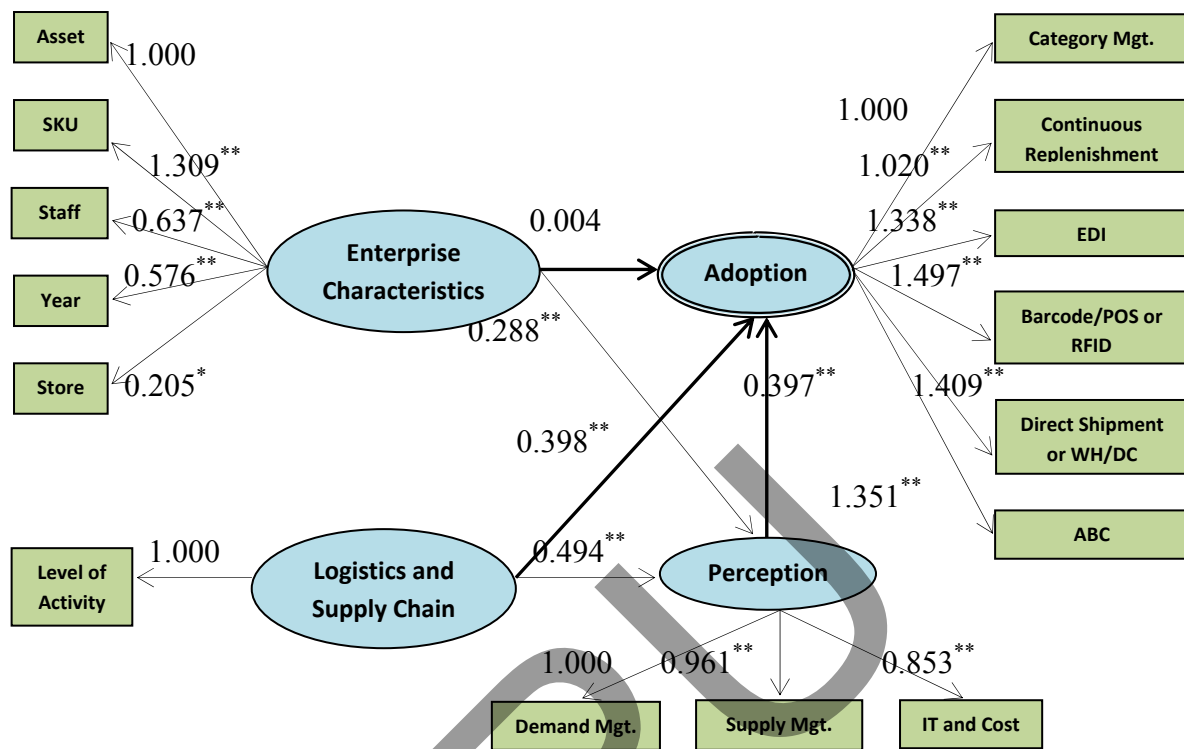
Figure 5.2: The Complete Causal Relationship Models of ECR Adoption by Retailers with Factor Loadings

5.2 Discussion

This study has provided relationships of various factors toward the adoption of ECR, by surveying Thai retailers in Bangkok. In the causal relationship models, they display that ECR adoption is determined by three main groups – enterprise characteristics, level of logistics and supply chain and perceived factors of ECR.

The results imply that ECR adoption is heavily relied on level of logistics and supply chain both direct and indirect way. This indicates that a firm with background of logistics and supply chain management tends to adopt ECR as its strategic tool. ECR's purpose is to integrate supply chain management with demand management to create smooth flows of product through the supply chain to satisfy consumer demand efficiently at lowest cost

(Hines, 2004). Simultaneously, ECR is considered as the sustainable way for supply chain management as follows (Hines, 2004):

➢ Better value and efficiency in the total supply chain;

➢ Profitable business alliances are key to managing the total supply chain;

➢ High-quality information is needed to ensure supply chains are responsive to customer demands;

➢ Bottlenecks must be identified and removed from the supply chain and activities that add value and lower cost for the consumer must be pursued vigorously;

➢ Better performance measures that indicate effectiveness of the whole supply chain rather than focusing upon elements of it must be used if the total system is to respond better to market demand and better measurement is required for equitable reward sharing by those that added value to the system.

Then, the perceived factors of ECR by retailers through understanding in areas of demand management, supply management and IT with cost are viewed as the second major role for the direct effect on ECR adoption. Furthermore, the perceived factors of ECR may enable retailer to save its cost by concentrating on four principal strategies of ECR consisting of (Kurt Salmon Associates, 1993):

1) *Efficient store assortment*, the objective of which was to optimize the productivity of inventories and store space at the consumer interface.

2) *Efficient replenishment*, whose objective was to optimize time and cost in the replenishment system.

3) *Efficient promotion*, whose objective was to maximize the total system efficiency of trade and consumer promotion.

4) *Efficient product introduction*, whose objective was maximize the effectiveness of new product development and introduction activities.

Next, the results show that there is no direct effect of enterprise characteristics on ECR adoption. It is clear that current assets, number of SKUs, number of staff, year(s) of operation and number of store(s) have no influence over implementation of ECR. This confirms that the relationships between them are uncertain (see in Table 5.1 with highest mean of each enterprise characteristic).

Table 5.1: Comparison between Enterprise Characteristics and Activities of ECR Adoption

Enterprise Characteristic	Activity of ECR Adoption by Retailer
Current Assets (21 – 100 Million Baht)	*ABC* (Mean = 4.67)
Number of SKUs (More Than 1,000 SKUs)	*Category Management* (Mean = 4.41)
Number of Staff (10 – 20 Employees)	*ABC and Barcode/POS or RFID* (Mean = 4.61)
Years of Operation (6 – 10 Years)	*Barcode/POS or RFID* (Mean = 4.21)
Number of Stores (More Than 20 Stores)	*Barcode/POS or RFID* (Mean = 4.67)

However, those of enterprise characteristics show the indirect interaction with ECR adoption through the perceived factors of ECR. In addition, most Thai retailers may adopt ECR with the three main reasons comprising improvement of competitiveness, improvement of customer service and asset utilization (mean of them are greater than 4).

Next, enterprise characteristics and level of logistics and supply chain prove that both of them have direct effects on the perceived factors of ECR. This indicates that learning of ECR factors has caused from current characteristics of organization and level of logistics and supply chain activities.

5.3 Recommendation

According to the causal relationship models, Thai retailers are likely to adopt ECR as their competitive tools. Generally, they have operated daily logistics and supply chain tasks, together with manipulated the processes of demand and supply sides with vendors and customers regularly. However, to sustain their ability in good positions of market, they should improve the following recommendations (Kurt Salmon Associates, 1995 and 1997):

  ➢ Investments in communication both in a technological and behavioral sense to address the reluctance in sharing information between trading partners.

- Training to address the inadequacy of skilled personnel and to develop clear road maps for the implementation process.
- Investment in information system to achieve compatibility between organizations.
- Reassessment of priorities for resources.
- Improving the strategic use of ECR to longer term business growth to overcome the problem of conflicting priorities.

5.4 Future Research

This study involves in research implications, so some issues may require attention in future research as follows:

- This research is a study of Thai retailers selling general consumer goods, where their locations are based in Bangkok. Future research may collect data from other categories of goods and other regional parts of Thailand. These may provide a more useful insight into ECR adoption.
- Enterprise characteristics may include in groups e.g. finance, operation.
- Respondent may classified as owner, top manager, middle manager and staff in order to compare attitudes towards ECR adoption.
- Some of ECR activities can be separated to study solely such as ABC (activity-based costing), category management and technology of EDI/POS/RFID.
- In SEM, sample size may require more (at least 20 x observed variables) in order to have results precisely.

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Appendix A:

Cover Letter and Questionnaire (in Thai)

วันที่ 23 พฤศจิกายน 2553

เรื่อง   ขอความอนุเคราะห์ตอบแบบสอบถาม

เรียน   ท่านผู้บริหารสถานประกอบการ

สิ่งที่ส่งมาด้วย   แบบสอบถามพร้อมซองส่งคืนจำนวน 1 ชุด

        แบบสอบถามฉบับนี้จัดทำขึ้นเพื่อเก็บรวบรวมข้อมูลสำหรับการทำวิจัยในหัวข้อเรื่อง **"ปัจจัยที่มีผลต่อการยอมรับกลยุทธ์การตอบสนองผู้บริโภคอย่างมีประสิทธิภาพ (ECR: Efficient Consumer Response) ของร้านค้าปลีกในเขตกรุงเทพมหานคร"** เพื่อศึกษาว่าลักษณะธุรกิจของท่าน การดำเนินงานด้านโลจิสติกส์และซัพพลายเชน และความคิดเห็นการใช้ ECR มีผลต่อระดับการยอมรับการใช้ ECR อย่างไร แบบสอบถามมี 5 ส่วน จำนวน 4 หน้า ประกอบด้วย

        ส่วนที่ 1: ข้อมูลทั่วไปของท่านผู้ตอบแบบสอบถาม

        ส่วนที่ 2: ข้อมูลทั่วไปของธุรกิจท่านผู้ตอบแบบสอบถาม

        ส่วนที่ 3: ข้อมูลเกี่ยวกับกิจกรรมโลจิสติกส์และซัพพลายเชน

        ส่วนที่ 4: ความคิดเห็นการใช้ ECR

        ส่วนที่ 5: การยอมรับการใช้ ECR

        <u>คำตอบของท่านมีคุณค่าและความสำคัญอย่างยิ่งต่อการศึกษาครั้งนี้ และจะไม่มีข้อมูลใดที่อาจแสดงถึงชื่อหรือสถานภาพของท่านและธุรกิจของท่าน เนื่องจากข้อมูลที่ได้จากแบบสอบถามจะนำไปสรุปผลการศึกษาในภาพรวม โดยไม่มีผลเสียหายต่อท่าน และธุรกิจของท่านแต่อย่างใด</u>

        จึงใคร่ขอความอนุเคราะห์จากท่านตอบแบบสอบถามอย่างครบถ้วนทุกข้อ โดยส่งคืนตามที่อยู่บนหน้าซองที่แนบมาพร้อมกัน และขอขอบพระคุณล่วงหน้ามา ณ โอกาสนี้

ขอแสดงความนับถือ

(อาจารย์ไกรสีห์ กำจรฤทธิ์)
อาจารย์ประจำคณะบริหารธุรกิจ

คณะบริหารธุรกิจ มหาวิทยาลัยธุรกิจบัณฑิตย์
โทรศัพท์: 0-2954-7300-29 ต่อ 218
โทรสาร: 0-2954-7350

แบบสอบถาม

ปัจจัยที่มีผลต่อการยอมรับกลยุทธ์การตอบสนองผู้บริโภคอย่างมีประสิทธิภาพ (ECR) ของร้านค้าปลีก

คำจำกัดความ: การตอบสนองผู้บริโภคอย่างมีประสิทธิภาพ (Efficient Customer Response: ECR)

        การตอบสนองผู้บริโภคอย่างมีประสิทธิภาพ (ECR) คือ การประสานความร่วมมือกันระหว่าง ร้านค้าปลีก และคู่ค้า (ผู้ผลิต/ซัพพลาย เออร์) อย่างใกล้ชิด ทำให้เกิดการวางแผนการผลิตที่แน่นอน และสอดคล้องกับความต้องการของลูกค้า สำหรับการจัดส่งสินค้าก็จะมีวิธีการ บริหารการจัดส่งสินค้าที่มีประสิทธิภาพด้วยต้นทุนที่ต่ำลง สามารถช่วยให้ผู้ประกอบการร้านค้าปลีกบริหารสินค้าหลากหลายประเภทได้มี ประสิทธิภาพมากขึ้น เพราะสินค้าจะถูกจัดส่งมาเติมแบบอัตโนมัติ และเป็นไปตามความต้องการของลูกค้าอย่างแท้จริง นอกจากนี้ยังช่วย ประหยัดเวลา และลดงานด้านเอกสารลง รวมถึงช่วยลดปริมาณสินค้าภายในร้านค้าปลีกลงได้อย่างมาก

คำชี้แจง โปรดทำเครื่องหมาย ✔ ลงใน ◯ (หรือช่องว่าง) หรือเติมคำตอบให้ตรงกับความเป็นจริง

ส่วนที่ 1: ข้อมูลทั่วไปของท่านผู้ตอบแบบสอบถาม

1. เพศ

    ◯ ชาย   ◯ หญิง

2. อายุ

    ◯ ต่ำกว่า 30 ปี   ◯ 31 – 40 ปี   ◯ 41 – 50 ปี
    ◯ 51 – 60 ปี   ◯ มากกว่า 60 ปี

3. ระดับการศึกษา

    ◯ ต่ำกว่าปริญญาตรี   ◯ ปริญญาตรี   ◯ สูงกว่าปริญญาตรี

4. ประสบการณ์การทำงานในธุรกิจค้าปลีก

    ◯ ต่ำกว่า 1 ปี   ◯ 1 – 5 ปี   ◯ 6 – 10 ปี
    ◯ 11 – 20 ปี   ◯ มากกว่า 20 ปี

5. ตำแหน่งงานในปัจจุบันของท่าน..

ส่วนที่ 2: ข้อมูลทั่วไปของร้านค้าปลีกของท่าน

6. สินทรัพย์รวมของกิจการในปัจจุบัน

    ◯ ต่ำกว่า 1 ล้านบาท   ◯ 1 – 5 ล้านบาท   ◯ 6 – 20 ล้านบาท
    ◯ 21 – 100 ล้านบาท   ◯ มากกว่า 100 ล้านบาท

7. ยอดขายในปีพ.ศ.2553 (ประมาณการ)

    ◯ ต่ำกว่า 1 ล้านบาท   ◯ 1 – 5 ล้านบาท   ◯ 6 – 20 ล้านบาท
    ◯ 21 – 100 ล้านบาท   ◯ มากกว่า 100 ล้านบาท

8. จำนวน SKU (Stock Keeping Unit) ในปัจจุบัน

    ◯ ต่ำกว่า 50 SKU   ◯ 50 – 100 SKU   ◯ 101 – 200 SKU

    ◯ 201 – 1,000 SKU   ◯ มากกว่า 1,000 SKU

9. จำนวนพนักงานทั้งหมดในปัจจุบัน

    ◯ ต่ำกว่า 10 คน   ◯ 10 – 20 คน   ◯ 21 – 50 คน

    ◯ 51 – 100 คน   ◯ มากกว่า 100 คน

10. ระยะเวลาในการดำเนินกิจการร้านค้าปลีก

    ◯ ไม่ถึง 1 ปี   ◯ 1 – 5 ปี   ◯ 6 – 10 ปี

    ◯ 11 – 20 ปี   ◯ มากกว่า 20 ปี

11. จำนวนร้านค้าปลีก หรือจำนวนสาขาร้านค้าปลีก (เฉพาะในกรุงเทพฯ ไม่รวมปริมณฑล) ในปัจจุบัน

    ◯ 1 สาขา   ◯ 2 – 5 สาขา   ◯ 6 – 10 สาขา

    ◯ 11 – 20 สาขา   ◯ มากกว่า 20 สาขา

ส่วนที่ 3: ข้อมูลเกี่ยวกับกิจกรรมโลจิสติกส์/ซัพพลายเชน สำหรับร้านค้าปลีก

ระดับการดำเนินกิจกรรมโลจิสติกส์/ซัพพลายเชน สำหรับร้านค้าปลีกของท่านในปัจจุบัน	ระดับการดำเนินกิจกรรม โลจิสติกส์/ซัพพลายเชน สำหรับร้านค้าปลีกของท่าน				
กิจกรรมโลจิสติกส์/ซัพพลายเชน	น้อยที่สุด	น้อย	ปานกลาง	มาก	มากที่สุด
	1	2	3	4	5
12. มีบริการอื่นๆ ที่นอกจากการขายสินค้าแล้วที่ทำให้ลูกค้ามีความพึงพอใจ					
13. มีการจัดการรอบเวลาการสั่งซื้อสินค้า					
14. มีการดำเนินการขนส่งสินค้าระหว่างร้านค้าปลีกกับลูกค้า และ/หรือร้านค้าปลีกกับคู่ค้า					
15. มีการรับคืนสินค้าจากลูกค้า และ/หรือการคืนสินค้าไปยังคู่ค้า					
16. มีการบริหารสินค้าในสต็อก					
17. มีการดำเนินงานด้านศูนย์กระจายสินค้า หรือคลังสินค้า หรือสถานที่เก็บสินค้า					
18. มีการใช้บรรจุภัณฑ์ที่เหมาะสมกับสินค้า					
19. มีระบบบริหารการจัดซื้อจัดหาสินค้า รวมถึงการสร้างความสัมพันธ์กับคู่ค้า					
20. มีการพยากรณ์ความต้องการสินค้าของลูกค้าล่วงหน้า					
21. มีการใช้เทคโนโลยีสารสนเทศ (เช่น EDI, บาร์โค้ด, POS เป็นต้น)					

ส่วนที่ 4: ความคิดเห็นเกี่ยวกับการใช้ ECR ภายในองค์กร

ในความคิดเห็นของท่าน เห็นว่าการใช้ ECR สำหรับร้านค้าปลีกเป็นอย่างไร					
	ระดับความคิดเห็นการใช้ ECR สำหรับร้านค้าปลีก				
องค์ประกอบของ ECR	เห็นด้วยน้อย	เห็นด้วยค่อนข้างน้อย	ไม่แน่ใจ	เห็นด้วยค่อนข้างมาก	เห็นด้วยมาก
	1	2	3	4	5
การจัดการอุปสงค์					
22. ช่วยทำให้เกิดการใช้ทรัพยากร (เช่น ข้อมูล, บุคลากร, อุปกรณ์) และการทำงานที่สอดคล้องกับคู่ค้า เพื่อตอบสนองความต้องการของลูกค้าให้ดีขึ้น					
23. ช่วยให้เกิดการวางแผนกลยุทธ์ร่วมกันกับคู่ค้า เพื่อตอบสนองความต้องการที่เปลี่ยนแปลงของลูกค้า					
24. สามารถคัดสรรกลุ่มหรือประเภทสินค้า รวมทั้งจำนวนสินค้าที่เหมาะสมกับความต้องการของลูกค้า					
25. สามารถสร้างกิจกรรมส่งเสริมการขายที่มีประสิทธิภาพ					
26. มีการนำเสนอสินค้าใหม่ให้กับลูกค้าในเวลาที่เหมาะสม					
27. สร้างความพึงพอใจให้กับลูกค้าเพิ่มขึ้น					
การจัดการอุปทาน					
28. ช่วยลดขั้นตอนการทำงานจากการสั่งซื้อสินค้าจากคู่ค้า					
29. ช่วยลดต้นทุนในการสั่งซื้อสินค้าจากคู่ค้า					
30. ช่วยลดการพยากรณ์ที่ไม่แน่นอนจากการสั่งซื้อสินค้าจากคู่ค้า					
31. มีการเติมเต็มสินค้าอย่างต่อเนื่องจากคู่ค้าในเวลาที่เหมาะสม					
32. ช่วยลดจำนวนสินค้าในสต็อคที่มากเกินไปของร้านค้าปลีก					
33. ช่วยลดต้นทุนในการจัดเก็บสินค้า					
34. มีการจัดส่งสินค้ามายังร้านค้าปลีกได้รวดเร็ว และตรงเวลา					
35. ช่วยลดจำนวนสินค้าที่ชำรุด และเสียหายที่มาจากคู่ค้า					
36. สร้างความสัมพันธ์ที่ดีระหว่างร้านค้าปลีก และคู่ค้า					
เทคโนโลยีสารสนเทศ และต้นทุน					
37. เพิ่มความรวดเร็ว และความถูกต้องของรับส่งข้อมูล					
38. เพิ่มความปลอดภัยของการรับส่งข้อมูล					
39. เพิ่มความสะดวกในการชำระเงินระหว่างกัน					
40. มีระบบการจัดเก็บข้อมูลที่มีประสิทธิภาพ					
41. ช่วยให้เห็นต้นทุนที่เกินความจำเป็นในแต่ละกิจกรรม					

<u>ส่วนที่ 5:</u> **การยอมรับสำหรับการใช้ ECR สำหรับร้านค้าปลีก**

การยอมรับการใช้ ECR สำหรับร้านค้าปลีกของท่านเป็นอย่างไร					
กิจกรรมของ ECR	**ระดับการใช้ ECR กับสินค้าสำหรับร้านค้าปลีกของท่าน**				
	ใช้น้อยมากหรือไม่ใช้เลย	ใช้เป็นส่วนน้อย	ใช้/ไม่ใช้ พอๆกัน	ใช้เป็นส่วนใหญ่	ใช้ทั้งหมด
	1	2	3	4	5
42. มีการบริหารจัดกลุ่มสินค้า หรือประเภทสินค้าสำหรับร้านค้าปลีกของท่าน					
43. มีระบบการเติมเต็มสินค้าในร้านค้าปลีกของท่านอย่างต่อเนื่อง และสม่ำเสมอ					
44. มีการใช้เทคโนโลยี EDI (Electronic Data Interchange) เพื่อทำธุรกรรมส่งข้อมูลกับคู่ค้า					
45. มีการใช้บาร์โค้ด/สแกนเนอร์/POS หรือระบบคลื่นความถี่วิทยุ (RFID)					
46. มีการส่งสินค้าโดยตรงจากคู่ค้ามายังร้านค้าปลีกของท่าน หรือมีการเปลี่ยนถ่ายสินค้า (Cross Docking) ณ ศูนย์กระจายสินค้า หรือคลังสินค้า ก่อนส่งมายังร้านค้าปลีกของท่าน					
47. มีการจัดทำบัญชีต้นทุนกิจกรรม (Activity-based Costing หรือ ABC)					

อะไรเป็นเหตุผลที่จะนำ ECR มาใช้ในร้านค้าปลีกของท่าน					
เหตุผล	**ระดับความสำคัญของเหตุผลที่ท่านจะนำ ECR มาใช้**				
	น้อยที่สุด	น้อย	ปานกลาง	มาก	มากที่สุด
	1	2	3	4	5
48. สอดคล้องกับความต้องการของผู้ผลิต หรือซัพพลายเออร์ หรือลูกค้า					
49. ต้องการใช้สินทรัพย์ที่มีอยู่เพื่อให้เกิดประโยชน์อย่างสูงสุด					
50. ต้องการเพิ่มความสามารถในการบริการลูกค้าให้ดีขึ้น					
51. ไม่สามารถพยากรณ์ความต้องการสินค้าของลูกค้าได้					
52. จำนวนสินค้าในสต็อคที่มากหรือน้อยเกินไป					
53. ต้นทุนของการเคลื่อนย้ายและจัดเก็บสินค้าเพิ่มขึ้น					
54. ต้องการเพิ่มศักยภาพในการแข่งขันทางธุรกิจ					

<u>*หมายเหตุ*</u> *หากท่านต้องการทราบผลที่ได้จากการวิจัย กรุณาแนบนามบัตร*

หรือเติม E-mail _____ *กลับมาพร้อมแบบสอบถามนี้*

ขอขอบพระคุณที่ท่านกรุณาตอบแบบสอบถามในครั้งนี้

Appendix B:

Reliability

Reliability: Level of Logistics and Supply Chain

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	179	100.0
	Excluded[a]	0	.0
	Total	179	100.0

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.906	10

Item Statistics

	Mean	Std. Deviation	N
c12	3.7318	.96898	179
c13	3.9385	.91898	179
c14	3.8771	.99238	179
c15	3.7598	1.21014	179
c16	4.0838	.95324	179
c17	3.6369	1.11021	179
c18	4.1117	.91727	179
c19	3.9832	.90860	179
c20	3.8659	.96798	179
c21	4.1061	1.07312	179

Reliability: Demand Management

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	179	100.0
	Excluded[a]	0	.0
	Total	179	100.0

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.875	6

Item Statistics

	Mean	Std. Deviation	N
d22	3.8603	.88530	179
d23	3.9888	.82099	179
d24	4.0112	.85452	179
d25	4.2235	.81785	179
d26	4.1676	.81065	179
d27	4.1397	.79149	179

Reliability: Supply Management

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	179	100.0
	Excluded[a]	0	.0
	Total	179	100.0

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.878	9

Item Statistics

	Mean	Std. Deviation	N
d28	3.8827	.94374	179
d29	3.8994	.88111	179
d30	3.9106	.86300	179
d31	4.0447	.85342	179
d32	4.0000	.86765	179
d33	3.8492	.87064	179
d34	3.9777	.88657	179
d35	3.9162	1.00488	179
d36	4.0279	.90833	179

Reliability: Enabling Technology and Cost

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	179	100.0
	Excluded[a]	0	.0
	Total	179	100.0

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.851	5

Item Statistics

	Mean	Std. Deviation	N
d37	4.1229	.90967	179
d38	4.0670	.89692	179
d39	4.0615	.84243	179
d40	4.1006	.81485	179
d41	4.1732	.87932	179

Reliability: Perceived Factors of ECR

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	179	100.0
	Excluded[a]	0	.0
	Total	179	100.0

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.864	3

Item Statistics

	Mean	Std. Deviation	N
demand	4.0652	.65183	179
supply	3.9454	.63941	179
itcost	4.1050	.68772	179

Reliability: ECR Adoption

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	179	100.0
	Excluded^a	0	.0
	Total	179	100.0

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.870	6

Item Statistics

	Mean	Std. Deviation	N
adop1	3.9385	.80840	179
adop2	3.9944	.85786	179
adop3	3.7039	1.06346	179
adop4	3.9777	1.16095	179
adop5	3.6369	1.13027	179
adop6	3.9721	1.06228	179

Appendix C:

Confirmatory Factor Analysis

(Diagrams and Goodness of Fit Statistics by LISREL 8.8)

1. Model of Enterprise Characteristics
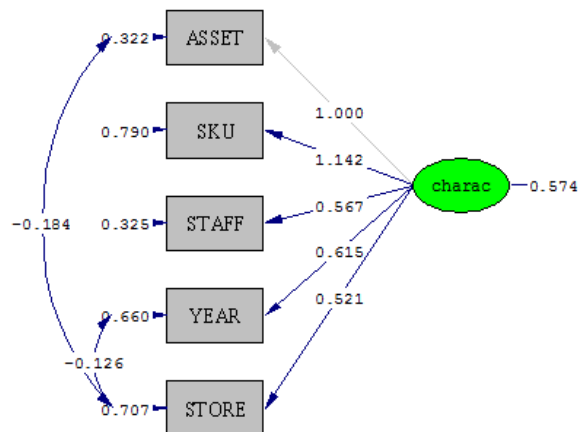
Chi-Square=2.71, df=3, P-value=0.43779, RMSEA=0.000

Goodness of Fit Statistics: Enterprise Characteristics

Degrees of Freedom = 3
Minimum Fit Function Chi-Square = 2.633 (P = 0.452)
Normal Theory Weighted Least Squares Chi-Square = 2.714 (P = 0.438)
Estimated Non-centrality Parameter (NCP) = 0.0
90 Percent Confidence Interval for NCP = (0.0 ; 7.913)

Minimum Fit Function Value = 0.0148
Population Discrepancy Function Value (F0) = 0.0
90 Percent Confidence Interval for F0 = (0.0 ; 0.0445)
Root Mean Square Error of Approximation (RMSEA) = 0.0
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.122)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.613

Expected Cross-Validation Index (ECVI) = 0.152
90 Percent Confidence Interval for ECVI = (0.152 ; 0.196)
ECVI for Saturated Model = 0.169
ECVI for Independence Model = 1.331

Chi-Square for Independence Model with 10 Degrees of Freedom = 226.909
Independence AIC = 236.909
Model AIC = 26.714
Saturated AIC = 30.000
Independence CAIC = 257.846
Model CAIC = 76.963
Saturated CAIC = 92.811

Normed Fit Index (NFI) = 0.988
Non-Normed Fit Index (NNFI) = 1.006
Parsimony Normed Fit Index (PNFI) = 0.297
Comparative Fit Index (CFI) = 1.000
Incremental Fit Index (IFI) = 1.002
Relative Fit Index (RFI) = 0.961

Critical N (CN) = 768.118

Root Mean Square Residual (RMR) = 0.0193
Standardized RMR = 0.0198
Goodness of Fit Index (GFI) = 0.994
Adjusted Goodness of Fit Index (AGFI) = 0.970
Parsimony Goodness of Fit Index (PGFI) = 0.199

2. Model of Level of Logistics and Supply Chain
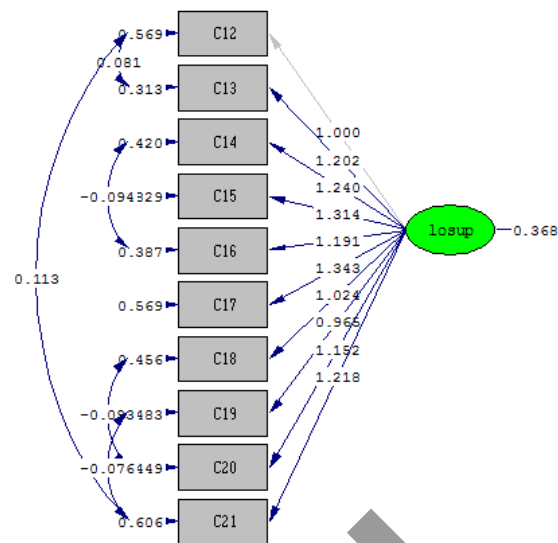
Chi-Square=27.97, df=30, P-value=0.57228, RMSEA=0.000

Goodness of Fit Statistics: **Level of Logistics and Supply Chain**

Degrees of Freedom = 30
Minimum Fit Function Chi-Square = 28.506 (P = 0.544)
Normal Theory Weighted Least Squares Chi-Square = 27.965 (P = 0.572)
Estimated Non-centrality Parameter (NCP) = 0.0
90 Percent Confidence Interval for NCP = (0.0 ; 14.225)

Minimum Fit Function Value = 0.160
Population Discrepancy Function Value (F0) = 0.0
90 Percent Confidence Interval for F0 = (0.0 ; 0.0799)
Root Mean Square Error of Approximation (RMSEA) = 0.0
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0516)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.942

Expected Cross-Validation Index (ECVI) = 0.449
90 Percent Confidence Interval for ECVI = (0.449 ; 0.529)
ECVI for Saturated Model = 0.618
ECVI for Independence Model = 11.372

Chi-Square for Independence Model with 45 Degrees of Freedom = 2004.266
Independence AIC = 2024.266
Model AIC = 77.965
Saturated AIC = 110.000
Independence CAIC = 2066.140
Model CAIC = 182.650
Saturated CAIC = 340.306

Normed Fit Index (NFI) = 0.986
Non-Normed Fit Index (NNFI) = 1.001
Parsimony Normed Fit Index (PNFI) = 0.657
Comparative Fit Index (CFI) = 1.000
Incremental Fit Index (IFI) = 1.001
Relative Fit Index (RFI) = 0.979

Critical N (CN) = 318.784

Root Mean Square Residual (RMR) = 0.0296
Standardized RMR = 0.0282
Goodness of Fit Index (GFI) = 0.970
Adjusted Goodness of Fit Index (AGFI) = 0.944
Parsimony Goodness of Fit Index (PGFI) = 0.529

3. Model of Demand Management
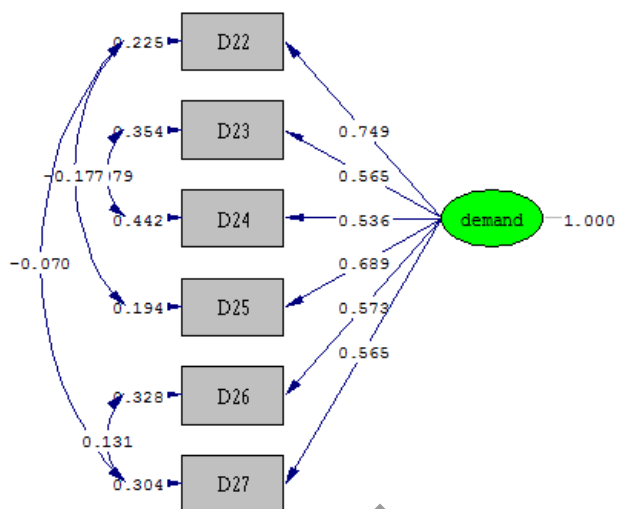
Chi-Square=4.80, df=5, P-value=0.44099, RMSEA=0.000

Goodness of Fit Statistics: Demand Management

Degrees of Freedom = 5
Minimum Fit Function Chi-Square = 4.744 (P = 0.448)
Normal Theory Weighted Least Squares Chi-Square = 4.798 (P = 0.441)
Estimated Non-centrality Parameter (NCP) = 0.0
90 Percent Confidence Interval for NCP = (0.0 ; 9.262)

Minimum Fit Function Value = 0.0266
Population Discrepancy Function Value (F0) = 0.0
90 Percent Confidence Interval for F0 = (0.0 ; 0.0520)
Root Mean Square Error of Approximation (RMSEA) = 0.0
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.102)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.666

Expected Cross-Validation Index (ECVI) = 0.208
90 Percent Confidence Interval for ECVI = (0.208 ; 0.260)
ECVI for Saturated Model = 0.236
ECVI for Independence Model = 4.535

Chi-Square for Independence Model with 15 Degrees of Freedom = 795.304
Independence AIC = 807.304
Model AIC = 36.798
Saturated AIC = 42.000
Independence CAIC = 832.429
Model CAIC = 103.796
Saturated CAIC = 129.935

Normed Fit Index (NFI) = 0.994
Non-Normed Fit Index (NNFI) = 1.001
Parsimony Normed Fit Index (PNFI) = 0.331
Comparative Fit Index (CFI) = 1.000
Incremental Fit Index (IFI) = 1.000
Relative Fit Index (RFI) = 0.982

Critical N (CN) = 567.177

Root Mean Square Residual (RMR) = 0.0126
Standardized RMR = 0.0182
Goodness of Fit Index (GFI) = 0.991
Adjusted Goodness of Fit Index (AGFI) = 0.963
Parsimony Goodness of Fit Index (PGFI) = 0.236

4. Model of Supply Management
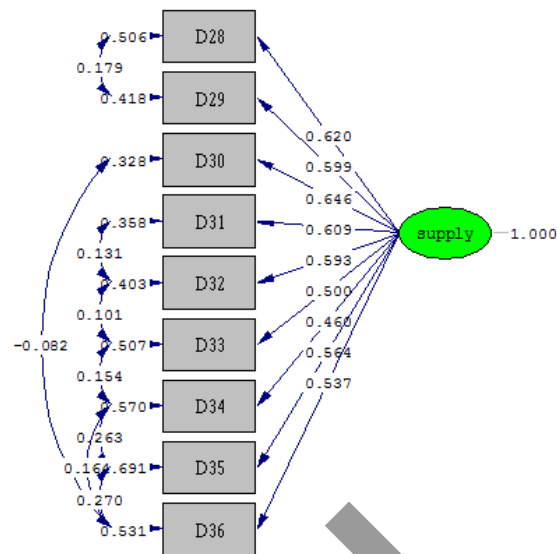
Chi-Square=16.96, df=19, P-value=0.59285, RMSEA=0.000

Goodness of Fit Statistics: Supply Management

Degrees of Freedom = 19
Minimum Fit Function Chi-Square = 17.804 (P = 0.536)
Normal Theory Weighted Least Squares Chi-Square = 16.956 (P = 0.593)
Estimated Non-centrality Parameter (NCP) = 0.0
90 Percent Confidence Interval for NCP = (0.0 ; 11.415)

Minimum Fit Function Value = 0.100
Population Discrepancy Function Value (F0) = 0.0
90 Percent Confidence Interval for F0 = (0.0 ; 0.0641)
Root Mean Square Error of Approximation (RMSEA) = 0.0
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0581)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.908

Expected Cross-Validation Index (ECVI) = 0.399
90 Percent Confidence Interval for ECVI = (0.399 ; 0.463)
ECVI for Saturated Model = 0.506
ECVI for Independence Model = 7.562

Chi-Square for Independence Model with 36 Degrees of Freedom = 1328.039
Independence AIC = 1346.039
Model AIC = 68.956
Saturated AIC = 90.000
Independence CAIC = 1383.725
Model CAIC = 177.828
Saturated CAIC = 278.432

Normed Fit Index (NFI) = 0.987
Non-Normed Fit Index (NNFI) = 1.002
Parsimony Normed Fit Index (PNFI) = 0.521
Comparative Fit Index (CFI) = 1.000
Incremental Fit Index (IFI) = 1.001
Relative Fit Index (RFI) = 0.975

Critical N (CN) = 362.820

Root Mean Square Residual (RMR) = 0.0192
Standardized RMR = 0.0242
Goodness of Fit Index (GFI) = 0.979
Adjusted Goodness of Fit Index (AGFI) = 0.951
Parsimony Goodness of Fit Index (PGFI) = 0.413

5. Model of Enabling Technology and Cost
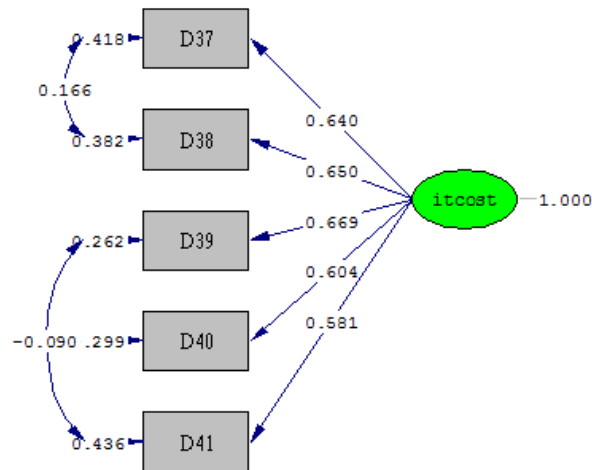
Chi-Square=4.00, df=3, P-value=0.26128, RMSEA=0.043

Goodness of Fit Statistics: Enabling Technology and Cost

Degrees of Freedom = 3
Minimum Fit Function Chi-Square = 4.126 (P = 0.248)
Normal Theory Weighted Least Squares Chi-Square = 4.002 (P = 0.261)
Estimated Non-centrality Parameter (NCP) = 1.002
90 Percent Confidence Interval for NCP = (0.0 ; 10.528)

Minimum Fit Function Value = 0.0232
Population Discrepancy Function Value (F0) = 0.00563
90 Percent Confidence Interval for F0 = (0.0 ; 0.0591)
Root Mean Square Error of Approximation (RMSEA) = 0.0433
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.140)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.439

Expected Cross-Validation Index (ECVI) = 0.157
90 Percent Confidence Interval for ECVI = (0.152 ; 0.211)
ECVI for Saturated Model = 0.169
ECVI for Independence Model = 2.965

Chi-Square for Independence Model with 10 Degrees of Freedom = 517.723
Independence AIC = 527.723
Model AIC = 28.002
Saturated AIC = 30.000
Independence CAIC = 548.660
Model CAIC = 78.250
Saturated CAIC = 92.811

Normed Fit Index (NFI) = 0.992
Non-Normed Fit Index (NNFI) = 0.993
Parsimony Normed Fit Index (PNFI) = 0.298
Comparative Fit Index (CFI) = 0.998
Incremental Fit Index (IFI) = 0.998
Relative Fit Index (RFI) = 0.973

Critical N (CN) = 490.573

Root Mean Square Residual (RMR) = 0.0137
Standardized RMR = 0.0179
Goodness of Fit Index (GFI) = 0.991
Adjusted Goodness of Fit Index (AGFI) = 0.955
Parsimony Goodness of Fit Index (PGFI) = 0.198

6. Model of Perceived Factors of ECR
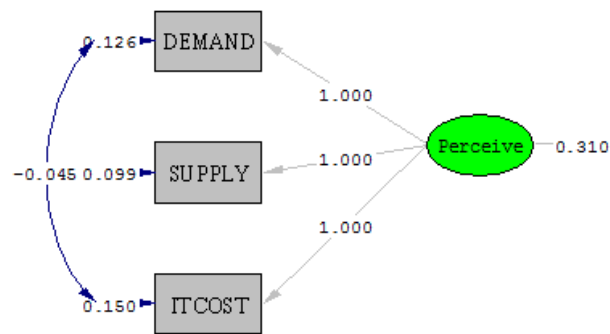
Chi-Square=0.32, df=1, P-value=0.57246, RMSEA=0.000

Goodness of Fit Statistics: Perceived Factors of ECR

Degrees of Freedom = 1
Minimum Fit Function Chi-Square = 0.319 (P = 0.572)
Normal Theory Weighted Least Squares Chi-Square = 0.319 (P = 0.572)
Estimated Non-centrality Parameter (NCP) = 0.0
90 Percent Confidence Interval for NCP = (0.0 ; 4.755)

Minimum Fit Function Value = 0.00179
Population Discrepancy Function Value (F0) = 0.0
90 Percent Confidence Interval for F0 = (0.0 ; 0.0267)
Root Mean Square Error of Approximation (RMSEA) = 0.0
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.163)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.650

Expected Cross-Validation Index (ECVI) = 0.0618
90 Percent Confidence Interval for ECVI = (0.0618 ; 0.0885)
ECVI for Saturated Model = 0.0674
ECVI for Independence Model = 1.437

Chi-Square for Independence Model with 3 Degrees of Freedom = 249.700
Independence AIC = 255.700
Model AIC = 10.319
Saturated AIC = 12.000
Independence CAIC = 268.262
Model CAIC = 31.256
Saturated CAIC = 37.124

Normed Fit Index (NFI) = 0.999
Non-Normed Fit Index (NNFI) = 1.008
Parsimony Normed Fit Index (PNFI) = 0.333
Comparative Fit Index (CFI) = 1.000
Incremental Fit Index (IFI) = 1.003
Relative Fit Index (RFI) = 0.996

Critical N (CN) = 3704.909

Root Mean Square Residual (RMR) = 0.00861
Standardized RMR = 0.0195
Goodness of Fit Index (GFI) = 0.999
Adjusted Goodness of Fit Index (AGFI) = 0.993
Parsimony Goodness of Fit Index (PGFI) = 0.166

7. Model of ECR Adoption
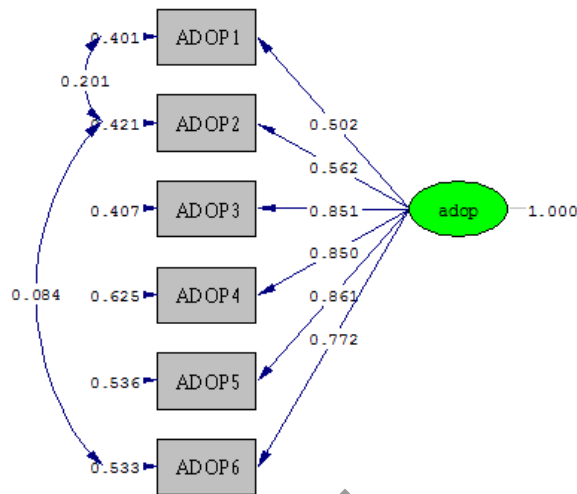
Chi-Square=6.73, df=7, P-value=0.45777, RMSEA=0.000

Goodness of Fit Statistics: ECR Adoption

Degrees of Freedom = 7
Minimum Fit Function Chi-Square = 6.870 (P = 0.443)
Normal Theory Weighted Least Squares Chi-Square = 6.728 (P = 0.458)
Estimated Non-centrality Parameter (NCP) = 0.0
90 Percent Confidence Interval for NCP = (0.0 ; 10.088)

Minimum Fit Function Value = 0.0386
Population Discrepancy Function Value (F0) = 0.0
90 Percent Confidence Interval for F0 = (0.0 ; 0.0567)
Root Mean Square Error of Approximation (RMSEA) = 0.0
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0900)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.717

Expected Cross-Validation Index (ECVI) = 0.197
90 Percent Confidence Interval for ECVI = (0.197 ; 0.253)
ECVI for Saturated Model = 0.236
ECVI for Independence Model = 4.475

Chi-Square for Independence Model with 15 Degrees of Freedom = 784.610
Independence AIC = 796.610
Model AIC = 34.728
Saturated AIC = 42.000
Independence CAIC = 821.734
Model CAIC = 93.351
Saturated CAIC = 129.935

Normed Fit Index (NFI) = 0.991
Non-Normed Fit Index (NNFI) = 1.000
Parsimony Normed Fit Index (PNFI) = 0.463
Comparative Fit Index (CFI) = 1.000
Incremental Fit Index (IFI) = 1.000
Relative Fit Index (RFI) = 0.981

Critical N (CN) = 479.723

Root Mean Square Residual (RMR) = 0.0186
Standardized RMR = 0.0184
Goodness of Fit Index (GFI) = 0.988
Adjusted Goodness of Fit Index (AGFI) = 0.963
Parsimony Goodness of Fit Index (PGFI) = 0.329

Appendix D:

The Causal Relationship Models of ECR Adoption by Retailer

(All Outputs and Diagram by LISREL 8.8)

```
                         LISREL 8.80 (STUDENT EDITION)

                                     BY

                      Karl G. Jöreskog and Dag Sörbom


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 LE
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 LK
 charac losup
 FI TD(6,6)
 FR LY(2,2) LY(3,2) LY(4,2) LY(5,2) LY(6,2) LY(8,1) LY(9,1) LX(2,1) LX(3,1)
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 FR TE(5,3) TE(6,1) TE(6,2) TE(6,3) TE(7,5) TE(7,6) TE(8,4) TE(9,6) TE(9,8)
 FR TD(4,1) TD(5,2) TD(5,3) TD(6,1) TD(6,4) TD(6,5)
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 VA 1 LX(6,2)
 PD
 OU AM RS EF FS SC ND=3 IT=1000 AD=OFF


                         Number of Input Variables 15
                         Number of Y - Variables    9
                         Number of X - Variables    6
                         Number of ETA - Variables  2
                         Number of KSI - Variables  2
                         Number of Observations   179
```

TI ECR

Covariance Matrix

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	0.654					
ADOP2	0.483	0.736				
ADOP3	0.386	0.481	1.131			
ADOP4	0.465	0.483	0.701	1.348		
ADOP5	0.455	0.475	0.757	0.722	1.278	
ADOP6	0.386	0.517	0.677	0.674	0.625	1.128
DEMAND	0.280	0.247	0.268	0.324	0.294	0.235
SUPPLY	0.280	0.246	0.240	0.257	0.320	0.264
ITCOST	0.238	0.221	0.203	0.245	0.293	0.275
ASSET	0.256	0.159	0.124	0.067	0.247	0.079
SKU	0.290	0.176	-0.001	0.052	0.077	-0.036
STAFF	0.050	0.007	-0.029	-0.039	0.045	-0.060
YEAR	0.123	0.112	-0.041	0.071	-0.082	-0.037
STORE	0.050	0.041	0.071	0.075	0.072	0.032
LOSUPAVE	0.324	0.321	0.449	0.469	0.506	0.462

Covariance Matrix (continued)

	DEMAND	SUPPLY	ITCOST	ASSET	SKU	STAFF
DEMAND	0.425					
SUPPLY	0.302	0.409				
ITCOST	0.266	0.319	0.473			
ASSET	0.141	0.151	0.190	0.897		
SKU	0.208	0.167	0.235	0.642	1.539	
STAFF	0.093	0.076	0.066	0.322	0.406	0.509
YEAR	0.103	0.064	0.099	0.383	0.360	0.184
STORE	0.021	0.034	0.036	0.110	0.370	0.165
LOSUPAVE	0.252	0.265	0.209	0.198	0.001	-0.017

Covariance Matrix (continued)

	YEAR	STORE	LOSUPAVE
YEAR	0.877		
STORE	0.041	0.870	
LOSUPAVE	-0.056	-0.047	0.549

TI ECR

Parameter Specifications

LAMBDA-Y

	percep	adop
ADOP1	0	0
ADOP2	0	1
ADOP3	0	2
ADOP4	0	3
ADOP5	0	4
ADOP6	0	5
DEMAND	0	0
SUPPLY	6	0
ITCOST	7	0

LAMBDA-X

	charac	losup
ASSET	0	0
SKU	8	0
STAFF	9	0
YEAR	10	0
STORE	11	0
LOSUPAVE	0	0

BETA

	percep	adop
percep	0	0
adop	12	0

GAMMA

	charac	losup
percep	13	14
adop	15	16

PHI

	charac	losup
charac	17	
losup	18	19

PSI

percep	adop
20	21

THETA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	22					
ADOP2	23	24				
ADOP3	25	0	26			
ADOP4	0	0	0	27		
ADOP5	0	0	28	0	29	
ADOP6	30	31	32	0	0	33
DEMAND	0	0	0	0	34	35
SUPPLY	0	0	0	37	0	0
ITCOST	0	0	0	0	0	39

THETA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
DEMAND	36		
SUPPLY	0	38	
ITCOST	0	40	41

THETA-DELTA

	ASSET	SKU	STAFF	YEAR	STORE	LOSUPAVE
ASSET	42					
SKU	0	43				
STAFF	0	0	44			
YEAR	45	0	0	46		
STORE	0	47	48	0	49	
LOSUPAVE	50	0	0	51	52	0

TI ECR

Number of Iterations = 20

LISREL Estimates (Maximum Likelihood)

LAMBDA-Y

	percep	adop
ADOP1	- -	1.000
ADOP2	- -	1.020 (0.093) 10.929
ADOP3	- -	1.338 (0.165) 8.090
ADOP4	- -	1.497 (0.168) 8.911
ADOP5	- -	1.409 (0.164) 8.620
ADOP6	- -	1.351 (0.162) 8.318
DEMAND	1.000	- -
SUPPLY	0.961 (0.083) 11.624	- -
ITCOST	0.853 (0.094) 9.085	- -

LAMBDA-X

	charac	losup
ASSET	1.000	- -
SKU	1.309	- -
	(0.183)	
	7.161	
STAFF	0.637	- -
	(0.095)	
	6.685	
YEAR	0.576	- -
	(0.111)	
	5.189	
STORE	0.205	- -
	(0.127)	
	1.606	
LOSUPAVE	- -	1.000

BETA

	percep	adop
percep	- -	- -
adop	0.397	- -
	(0.115)	
	3.445	

GAMMA

	charac	losup
percep	0.288	0.494
	(0.069)	(0.051)
	4.184	9.646
adop	0.004	0.398
	(0.067)	(0.076)
	0.066	5.228

Covariance Matrix of ETA and KSI

	percep	adop	charac	losup
percep	0.313			
adop	0.229	0.333		
charac	0.145	0.062	0.492	
losup	0.260	0.312	0.006	0.523

PHI

	charac	losup
charac	0.492	
	(0.104)	
	4.730	
losup	0.006	0.523
	(0.045)	(0.052)
	0.139	10.026

PSI

Note: This matrix is diagonal.

percep	adop
0.143	0.117
(0.027)	(0.027)
5.350	4.274

Squared Multiple Correlations for Structural Equations

percep	adop
0.544	0.647

Squared Multiple Correlations for Reduced Form

percep	adop
0.544	0.579

Reduced Form

	charac	losup
percep	0.288	0.494
	(0.069)	(0.051)
	4.184	9.646
adop	0.119	0.595
	(0.061)	(0.064)
	1.956	9.311

THETA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	0.324					
	(0.043)					
	7.589					
ADOP2	0.147	0.390				
	(0.037)	(0.049)				
	4.004	8.002				
ADOP3	-0.067	- -	0.535			
	(0.032)		(0.071)			
	-2.117		7.518			
ADOP4	- -	- -	- -	0.608		
				(0.077)		
				7.882		
ADOP5	- -	- -	0.128	- -	0.617	
			(0.055)		(0.078)	
			2.342		7.955	
ADOP6	-0.061	0.052	0.078	- -	- -	0.524
	(0.039)	(0.041)	(0.047)			(0.070)
	-1.588	1.257	1.645			7.459
DEMAND	- -	- -	- -	- -	-0.038	-0.046
					(0.025)	(0.024)
					-1.530	-1.924
SUPPLY	- -	- -	- -	-0.052	- -	- -
				(0.023)		
				-2.248		
ITCOST	- -	- -	- -	- -	- -	0.051
						(0.027)
						1.894

THETA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
DEMAND	0.112		
	(0.023)		
	4.944		
SUPPLY	- -	0.116	
		(0.022)	
		5.320	
ITCOST	- -	0.061	0.248
		(0.021)	(0.033)
		2.847	7.577

Squared Multiple Correlations for Y - Variables

ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
0.507	0.471	0.526	0.551	0.517	0.537

Squared Multiple Correlations for Y - Variables (continued)

DEMAND	SUPPLY	ITCOST
0.737	0.714	0.479

THETA-DELTA

	ASSET	SKU	STAFF	YEAR	STORE	LOSUPAVE
ASSET	0.404 (0.074) 5.469					
SKU	- -	0.696 (0.117) 5.934				
STAFF	- -	- -	0.310 (0.040) 7.802			
YEAR	0.099 (0.059) 1.696	- -	- -	0.714 (0.084) 8.460		
STORE	- -	0.238 (0.078) 3.055	0.105 (0.045) 2.338	- -	0.850 (0.091) 9.311	
LOSUPAVE	0.156 (0.031) 4.967	- -	- -	-0.052 (0.033) -1.560	-0.071 (0.034) -2.104	- -

Squared Multiple Correlations for X - Variables

ASSET	SKU	STAFF	YEAR	STORE	LOSUPAVE
0.549	0.548	0.392	0.186	0.024	1.000

Goodness of Fit Statistics

```
Degrees of Freedom = 68
Minimum Fit Function Chi-Square = 93.635 (P = 0.0214)
Normal Theory Weighted Least Squares Chi-Square = 84.497 (P = 0.0853)
Estimated Non-centrality Parameter (NCP) = 16.497
90 Percent Confidence Interval for NCP = (0.0 ; 44.026)

Minimum Fit Function Value = 0.526
Population Discrepancy Function Value (F0) = 0.0927
90 Percent Confidence Interval for F0 = (0.0 ; 0.247)
Root Mean Square Error of Approximation (RMSEA) = 0.0369
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0603)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.802

Expected Cross-Validation Index (ECVI) = 1.059
90 Percent Confidence Interval for ECVI = (0.966 ; 1.214)
ECVI for Saturated Model = 1.348
ECVI for Independence Model = 13.918

Chi-Square for Independence Model with 105 Degrees of Freedom = 2447.492
Independence AIC = 2477.492
Model AIC = 188.497
Saturated AIC = 240.000
Independence CAIC = 2540.303
Model CAIC = 406.241
Saturated CAIC = 742.486

Normed Fit Index (NFI) = 0.962
Non-Normed Fit Index (NNFI) = 0.983
Parsimony Normed Fit Index (PNFI) = 0.623
Comparative Fit Index (CFI) = 0.989
Incremental Fit Index (IFI) = 0.989
Relative Fit Index (RFI) = 0.941

Critical N (CN) = 187.354

Root Mean Square Residual (RMR) = 0.0505
Standardized RMR = 0.0580
Goodness of Fit Index (GFI) = 0.940
Adjusted Goodness of Fit Index (AGFI) = 0.895
Parsimony Goodness of Fit Index (PGFI) = 0.533
```

TI ECR

Fitted Covariance Matrix

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	0.656					
ADOP2	0.487	0.736				
ADOP3	0.378	0.454	1.131			
ADOP4	0.498	0.508	0.666	1.354		
ADOP5	0.469	0.478	0.755	0.702	1.278	
ADOP6	0.388	0.510	0.679	0.673	0.633	1.132
DEMAND	0.229	0.233	0.306	0.342	0.284	0.263
SUPPLY	0.220	0.224	0.294	0.277	0.310	0.297
ITCOST	0.195	0.199	0.261	0.292	0.275	0.314
ASSET	0.062	0.064	0.083	0.093	0.088	0.084
SKU	0.082	0.083	0.109	0.122	0.115	0.110
STAFF	0.040	0.040	0.053	0.059	0.056	0.054
YEAR	0.036	0.037	0.048	0.054	0.051	0.048
STORE	0.013	0.013	0.017	0.019	0.018	0.017
LOSUPAVE	0.312	0.318	0.417	0.466	0.439	0.421

Fitted Covariance Matrix (continued)

	DEMAND	SUPPLY	ITCOST	ASSET	SKU	STAFF
DEMAND	0.425					
SUPPLY	0.301	0.405				
ITCOST	0.267	0.318	0.476			
ASSET	0.145	0.139	0.124	0.897		
SKU	0.190	0.182	0.162	0.644	1.539	
STAFF	0.092	0.089	0.079	0.313	0.410	0.509
YEAR	0.083	0.080	0.071	0.383	0.371	0.180
STORE	0.030	0.029	0.025	0.101	0.369	0.169
LOSUPAVE	0.260	0.250	0.222	0.162	0.008	0.004

Fitted Covariance Matrix (continued)

	YEAR	STORE	LOSUPAVE
YEAR	0.877		
STORE	0.058	0.871	
LOSUPAVE	-0.048	-0.070	0.523

Fitted Residuals

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	-0.003					
ADOP2	-0.004	0.000				
ADOP3	0.008	0.028	0.000			
ADOP4	-0.033	-0.025	0.035	-0.006		
ADOP5	-0.014	-0.003	0.002	0.020	0.000	
ADOP6	-0.002	0.006	-0.002	0.001	-0.009	-0.003
DEMAND	0.052	0.013	-0.038	-0.018	0.011	-0.028
SUPPLY	0.060	0.021	-0.054	-0.019	0.010	-0.033
ITCOST	0.043	0.022	-0.058	-0.047	0.019	-0.039
ASSET	0.193	0.095	0.041	-0.026	0.159	-0.005
SKU	0.209	0.093	-0.110	-0.070	-0.037	-0.146
STAFF	0.010	-0.033	-0.082	-0.098	-0.011	-0.114
YEAR	0.087	0.075	-0.089	0.017	-0.132	-0.085
STORE	0.037	0.028	0.054	0.056	0.054	0.015
LOSUPAVE	0.013	0.003	0.033	0.002	0.067	0.040

Fitted Residuals (continued)

	DEMAND	SUPPLY	ITCOST	ASSET	SKU	STAFF
DEMAND	0.000					
SUPPLY	0.002	0.004				
ITCOST	-0.001	0.001	-0.003			
ASSET	-0.004	0.012	0.067	0.000		
SKU	0.019	-0.015	0.073	-0.002	0.000	
STAFF	0.001	-0.013	-0.013	0.008	-0.004	0.000
YEAR	0.020	-0.016	0.028	0.000	-0.011	0.003
STORE	-0.009	0.006	0.011	0.009	0.001	-0.003
LOSUPAVE	-0.008	0.015	-0.013	0.035	-0.007	-0.021

Fitted Residuals (continued)

	YEAR	STORE	LOSUPAVE
YEAR	0.000		
STORE	-0.017	-0.001	
LOSUPAVE	-0.007	0.023	0.026

Summary Statistics for Fitted Residuals

```
 Smallest Fitted Residual =   -0.146
   Median Fitted Residual =    0.000
  Largest Fitted Residual =    0.209
```

Stemleaf Plot

```
 -14|6
 -12|2
 -10|40
 - 8|8952
 - 6|0
 - 4|847
 - 2|9873338651
 - 0|98765433311998776544433333222211000000000
   0|111122233466889001123355799
   2|0012368883557
   4|0132446
   6|07735
   8|735
  10|
  12|
  14|9
  16|
  18|3
  20|9
```

Standardized Residuals

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	-1.049					
ADOP2	-1.049	- -				
ADOP3	0.758	1.060	0.105			
ADOP4	-1.299	-0.866	1.090	-0.781		
ADOP5	-0.528	-0.095	0.187	0.561	-0.010	
ADOP6	-0.299	0.669	-0.161	0.016	-0.271	-0.328
DEMAND	2.712	0.632	-1.578	-0.677	0.668	-1.879
SUPPLY	3.135	1.003	-2.189	-1.130	0.372	-1.345
ITCOST	1.649	0.768	-1.719	-1.284	0.513	-1.663
ASSET	4.492	2.030	0.737	-0.440	2.663	-0.085
SKU	3.696	1.512	-1.510	-0.886	-0.478	-2.008
STAFF	0.287	-0.866	-1.751	-1.951	-0.213	-2.448
YEAR	1.672	1.354	-1.308	0.230	-1.821	-1.248
STORE	0.668	0.480	0.742	0.706	0.702	0.208
LOSUPAVE	0.667	0.141	1.344	0.085	2.532	1.653

Standardized Residuals (continued)

	DEMAND	SUPPLY	ITCOST	ASSET	SKU	STAFF
DEMAND	0.105					
SUPPLY	0.538	1.286				
ITCOST	-0.224	0.298	-0.873			
ASSET	-0.143	0.462	1.904	- -		
SKU	0.552	-0.455	1.591	-0.128	- -	
STAFF	0.040	-0.528	-0.451	0.522	-0.363	- -
YEAR	0.525	-0.432	0.662	- -	-0.336	0.123
STORE	-0.213	0.144	0.234	0.527	0.098	-0.563
LOSUPAVE	-0.709	1.223	-0.710	1.788	-0.229	-0.789

Standardized Residuals (continued)

	YEAR	STORE	LOSUPAVE
YEAR	- -		
STORE	-0.314	-0.308	
LOSUPAVE	-0.225	0.660	1.390

Summary Statistics for Standardized Residuals

```
 Smallest Standardized Residual =   -2.448
   Median Standardized Residual =    0.008
  Largest Standardized Residual =    4.492
```

Stemleaf Plot

```
 - 2|4200
 - 1|9887765
 - 1|33332100
 - 0|999988777655555
 - 0|44433333322222221111000000000
   0|11111112222334
   0|5555555666777777777788
   1|01123344
   1|5667789
   2|0
   2|577
   3|1
   3|7
   4|
   4|5
```

Largest Positive Standardized Residuals

Residual for		and		
Residual for	**DEMAND**	and	**ADOP1**	**2.712**
Residual for	**SUPPLY**	and	**ADOP1**	**3.135**
Residual for	**ASSET**	and	**ADOP1**	**4.492**
Residual for	**ASSET**	and	**ADOP5**	**2.663**
Residual for	**SKU**	and	**ADOP1**	**3.696**

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Qplot of Standardized Residuals

```
  3.5.................................................................................
     .                                                                      ..
     .                                                                    . .
     .                                                                .   .
     .                                                             .
     .                                                           .
     .                                                         .
     .                                                       .         x
     .                                                     .
     .                                                   .           x
     .                                                 .        x   .
     .                                               .      x   .
     .                                             .     xx   .
     .                                           . x x    .
     .                                         .  *x     .
   N .                                       .  xxxx      .
   o .                                     .  xx*        .
   r .                                   x .x*          .
   m .                                  xx            .
   a .                                **              .
   l .                              *x               .
     .                              **                .
   Q .                            .x                  .
   u .                           **x                  .
   a .                          **                    .
   n .                        .x*                     .
   t .                        .xx                     .
   i .                       x x                      .
   l .                      **                        .
   e .                  x x*                          .
   s .                  xx.                           .
     .                xxx.                            .
     .               xx .                             .
     .              *  .                              .
     .             x.                                 .
     .             x                                  .
     .           x                                    .
     .        .                                       .
     .      x                                         .
     .     .                                          .
     .   .                                            .
     . .                                              .
     . .                                              .
   -3.5.................................................................................
    -3.5                                                                       3.5
```
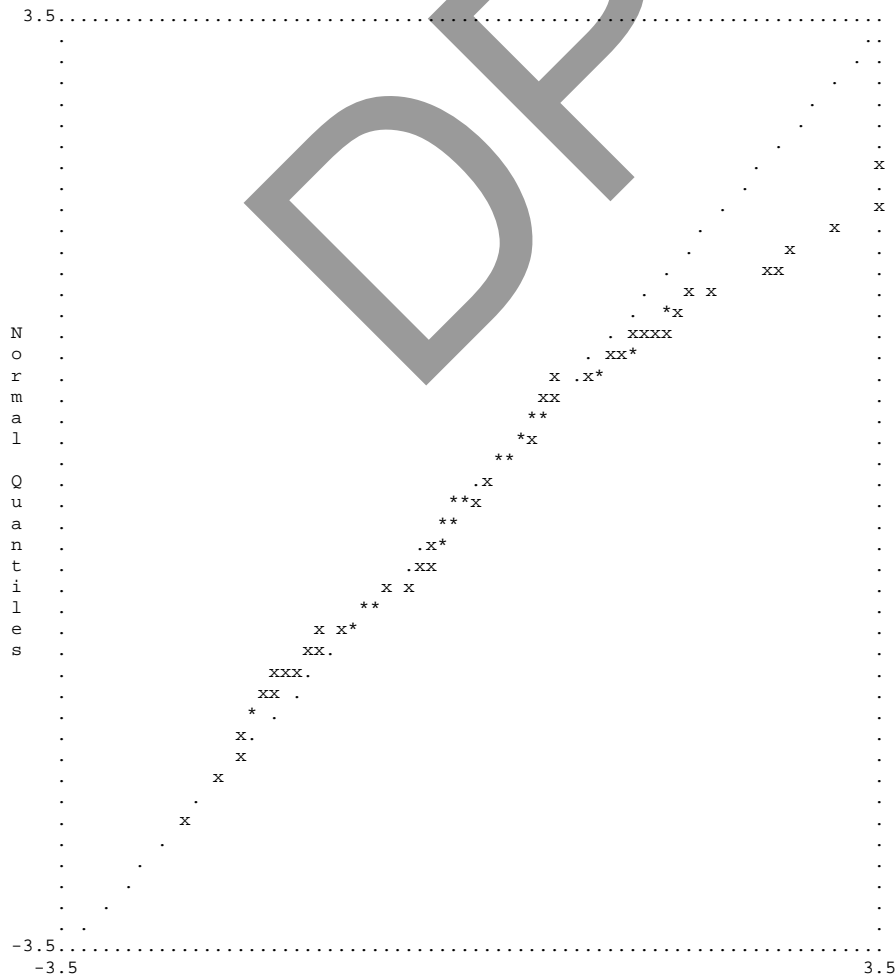
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Modification Indices and Expected Change

Modification Indices for LAMBDA-Y

	percep	adop
ADOP1	9.896	– –
ADOP2	0.035	– –
ADOP3	3.521	– –
ADOP4	1.514	– –
ADOP5	1.089	– –
ADOP6	1.159	– –
DEMAND	– –	0.006
SUPPLY	– –	0.610
ITCOST	– –	0.943

Expected Change for LAMBDA-Y

	percep	adop
ADOP1	0.450	– –
ADOP2	−0.026	– –
ADOP3	−0.369	– –
ADOP4	−0.286	– –
ADOP5	0.232	– –
ADOP6	−0.238	– –
DEMAND	– –	0.014
SUPPLY	– –	0.088
ITCOST	– –	−0.114

Standardized Expected Change for LAMBDA-Y

	percep	adop
ADOP1	0.251	– –
ADOP2	−0.015	– –
ADOP3	−0.206	– –
ADOP4	−0.160	– –
ADOP5	0.130	– –
ADOP6	−0.133	– –
DEMAND	– –	0.008
SUPPLY	– –	0.051
ITCOST	– –	−0.066

Completely Standardized Expected Change for LAMBDA-Y

	percep	adop
ADOP1	0.310	– –
ADOP2	−0.017	– –
ADOP3	−0.194	– –
ADOP4	−0.138	– –
ADOP5	0.115	– –
ADOP6	−0.125	– –
DEMAND	– –	0.012
SUPPLY	– –	0.080
ITCOST	– –	−0.095

Modification Indices for LAMBDA-X

	charac	losup
ASSET	– –	3.445
SKU	– –	0.337
STAFF	– –	0.935
YEAR	– –	0.289
STORE	– –	0.720
LOSUPAVE	– –	– –

Expected Change for LAMBDA-X

	charac	losup
ASSET	– –	0.202
SKU	– –	−0.068
STAFF	– –	−0.064
YEAR	– –	−0.064
STORE	– –	0.106
LOSUPAVE	– –	– –

Standardized Expected Change for LAMBDA-X

	charac	losup
ASSET	- -	0.146
SKU	- -	-0.049
STAFF	- -	-0.046
YEAR	- -	-0.046
STORE	- -	0.076
LOSUPAVE	- -	- -

Completely Standardized Expected Change for LAMBDA-X

	charac	losup
ASSET	- -	0.155
SKU	- -	-0.040
STAFF	- -	-0.065
YEAR	- -	-0.049
STORE	- -	0.082
LOSUPAVE	- -	- -

No Non-Zero Modification Indices for BETA

No Non-Zero Modification Indices for GAMMA

No Non-Zero Modification Indices for PHI

No Non-Zero Modification Indices for PSI

Modification Indices for THETA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	- -					
ADOP2	- -	- -				
ADOP3	- -	1.101	- -			
ADOP4	0.330	0.208	0.435	- -		
ADOP5	0.263	0.002	- -	0.162	- -	
ADOP6	- -	- -	- -	0.007	0.230	- -
DEMAND	0.472	0.138	0.010	0.009	- -	- -
SUPPLY	0.667	0.100	0.652	- -	0.047	0.155
ITCOST	0.002	0.555	0.187	0.543	1.102	- -

Modification Indices for THETA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
DEMAND	- -		
SUPPLY	0.060	- -	
ITCOST	0.060	- -	- -

Expected Change for THETA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	- -					
ADOP2	- -	- -				
ADOP3	- -	0.044	- -			
ADOP4	-0.022	-0.017	0.035	- -		
ADOP5	-0.019	-0.002	- -	0.022	- -	
ADOP6	- -	- -	- -	0.005	-0.027	- -
DEMAND	0.012	-0.007	-0.003	0.003	- -	- -
SUPPLY	0.012	-0.005	-0.017	- -	-0.005	-0.012
ITCOST	-0.001	0.015	-0.011	-0.025	0.030	- -

Expected Change for THETA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
DEMAND	- -		
SUPPLY	-0.006	- -	
ITCOST	0.005	- -	- -

Completely Standardized Expected Change for THETA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	- -					
ADOP2	- -	- -				
ADOP3	- -	0.048	- -			
ADOP4	-0.024	-0.017	0.028	- -		
ADOP5	-0.021	-0.002	- -	0.017	- -	
ADOP6	- -	- -	- -	0.004	-0.022	- -
DEMAND	0.022	-0.012	-0.004	0.004	- -	- -
SUPPLY	0.023	-0.009	-0.024	- -	-0.007	-0.017
ITCOST	-0.001	0.025	-0.016	-0.031	0.038	- -

Completely Standardized Expected Change for THETA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
DEMAND	- -		
SUPPLY	-0.014	- -	
ITCOST	0.012	- -	- -

Modification Indices for THETA-DELTA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ASSET	4.323	0.479	0.929	3.341	5.567	0.006
SKU	2.768	0.315	0.324	0.051	1.744	0.866
STAFF	1.257	0.263	0.602	0.345	0.774	0.217
YEAR	0.140	2.104	0.216	2.805	7.792	0.301
STORE	0.266	0.007	0.754	0.842	0.062	0.044
LOSUPAVE	0.703	0.032	0.022	0.280	0.006	0.646

Modification Indices for THETA-DELTA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
ASSET	2.381	0.649	2.353
SKU	0.585	1.240	1.868
STAFF	1.404	0.368	1.877
YEAR	0.407	0.019	0.000
STORE	1.443	0.447	0.160
LOSUPAVE	0.133	1.883	1.899

Expected Change for THETA-DELTA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ASSET	0.056	-0.019	0.035	-0.078	0.094	-0.003
SKU	0.063	0.022	-0.029	-0.013	-0.074	-0.048
STAFF	-0.027	-0.013	-0.025	-0.022	0.031	-0.015
YEAR	-0.012	0.049	-0.020	0.086	-0.135	-0.025
STORE	-0.018	-0.003	0.041	0.050	0.013	0.010
LOSUPAVE	-0.017	-0.003	-0.004	0.017	-0.002	0.023

Expected Change for THETA-DELTA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
ASSET	-0.033	-0.015	0.035
SKU	0.024	-0.029	0.044
STAFF	0.022	0.010	-0.028
YEAR	0.016	-0.003	0.000
STORE	-0.033	0.016	-0.012
LOSUPAVE	-0.007	0.019	-0.022

Completely Standardized Expected Change for THETA-DELTA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ASSET	0.074	-0.024	0.035	-0.071	0.088	-0.003
SKU	0.062	0.021	-0.022	-0.009	-0.053	-0.037
STAFF	-0.046	-0.021	-0.033	-0.026	0.038	-0.020
YEAR	-0.016	0.061	-0.021	0.079	-0.128	-0.025
STORE	-0.024	-0.004	0.041	0.046	0.012	0.010
LOSUPAVE	-0.029	-0.006	-0.005	0.020	-0.003	0.030

Completely Standardized Expected Change for THETA-DELTA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
ASSET	-0.054	-0.024	0.054
SKU	0.029	-0.036	0.052
STAFF	0.048	0.022	-0.057
YEAR	0.027	-0.005	0.000
STORE	-0.054	0.026	-0.019
LOSUPAVE	-0.015	0.042	-0.044

Modification Indices for THETA-DELTA

	ASSET	SKU	STAFF	YEAR	STORE	LOSUPAVE
ASSET	- -					
SKU	0.009	- -				
STAFF	0.026	0.131	- -			
YEAR	- -	0.055	0.043	- -		
STORE	0.221	- -	- -	0.101	- -	
LOSUPAVE	- -	0.163	0.163	- -	- -	- -

Expected Change for THETA-DELTA

	ASSET	SKU	STAFF	YEAR	STORE	LOSUPAVE
ASSET	- -					
SKU	0.011	- -				
STAFF	0.009	-0.037	- -			
YEAR	- -	-0.019	0.008	- -		
STORE	0.039	- -	- -	-0.018	- -	
LOSUPAVE	- -	-0.022	0.010	- -	- -	- -

Completely Standardized Expected Change for THETA-DELTA

	ASSET	SKU	STAFF	YEAR	STORE	LOSUPAVE
ASSET	- -					
SKU	0.009	- -				
STAFF	0.014	-0.042	- -			
YEAR	- -	-0.016	0.013	- -		
STORE	0.044	- -	- -	-0.021	- -	
LOSUPAVE	- -	-0.024	0.020	- -	- -	- -

 Maximum Modification Index is   9.90 for Element (1, 1) of LAMBDA-Y

TI ECR

Factor Scores Regressions

ETA

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
percep	0.010	-0.006	-0.008	0.028	0.026	0.032
adop	0.135	0.031	0.076	0.096	0.073	0.106

ETA (continued)

	DEMAND	SUPPLY	ITCOST	ASSET	SKU	STAFF
percep	0.366	0.305	0.051	-0.006	0.022	0.024
adop	0.076	0.069	-0.036	-0.050	0.012	0.013

ETA (continued)

	YEAR	STORE	LOSUPAVE
percep	0.016	0.001	0.082
adop	0.026	0.011	0.167

KSI

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
charac	0.033	0.005	0.014	0.030	0.024	0.033
losup	-0.037	-0.008	-0.020	-0.027	-0.021	-0.030

KSI (continued)

	DEMAND	SUPPLY	ITCOST	ASSET	SKU	STAFF
charac	0.128	0.108	0.007	0.353	0.198	0.214
losup	-0.036	-0.032	0.008	-0.394	0.086	0.097

KSI (continued)

	YEAR	STORE	LOSUPAVE
charac	-0.002	-0.089	-0.341
losup	0.198	0.087	1.290

TI ECR

Standardized Solution

LAMBDA-Y

	percep	adop
ADOP1	- -	0.577
ADOP2	- -	0.588
ADOP3	- -	0.771
ADOP4	- -	0.864
ADOP5	- -	0.813
ADOP6	- -	0.779
DEMAND	0.559	- -
SUPPLY	0.538	- -
ITCOST	0.477	- -

LAMBDA-X

	charac	losup
ASSET	0.702	- -
SKU	0.918	- -
STAFF	0.447	- -
YEAR	0.404	- -
STORE	0.144	- -
LOSUPAVE	- -	0.723

BETA

	percep	adop
percep	- -	- -
adop	0.385	- -

GAMMA

	charac	losup
percep	0.362	0.639
adop	0.005	0.499

Correlation Matrix of ETA and KSI

	percep	adop	charac	losup
percep	1.000			
adop	0.708	1.000		
charac	0.369	0.154	1.000	
losup	0.643	0.747	0.012	1.000

PSI

Note: This matrix is diagonal.

percep	adop
0.456	0.353

Regression Matrix ETA on KSI (Standardized)

	charac	losup
percep	0.362	0.639
adop	0.145	0.745

TI ECR

Completely Standardized Solution

LAMBDA-Y

	percep	adop
ADOP1	- -	0.712
ADOP2	- -	0.686
ADOP3	- -	0.726
ADOP4	- -	0.742
ADOP5	- -	0.719
ADOP6	- -	0.733
DEMAND	0.858	- -
SUPPLY	0.845	- -
ITCOST	0.692	- -

LAMBDA-X

	charac	losup
ASSET	0.741	- -
SKU	0.740	- -
STAFF	0.626	- -
YEAR	0.431	- -
STORE	0.154	- -
LOSUPAVE	- -	1.000

BETA

	percep	adop
percep	- -	- -
adop	0.385	- -

GAMMA

	charac	losup
percep	0.362	0.639
adop	0.005	0.499

Correlation Matrix of ETA and KSI

	percep	adop	charac	losup
percep	1.000			
adop	0.708	1.000		
charac	0.369	0.154	1.000	
losup	0.643	0.747	0.012	1.000

PSI

Note: This matrix is diagonal.

percep	adop
0.456	0.353

THETA-EPS

	ADOP1	ADOP2	ADOP3	ADOP4	ADOP5	ADOP6
ADOP1	0.493					
ADOP2	0.212	0.529				
ADOP3	-0.078	- -	0.474			
ADOP4	- -	- -	- -	0.449		
ADOP5	- -	- -	0.107	- -	0.483	
ADOP6	-0.071	0.057	0.069	- -	- -	0.463
DEMAND	- -	- -	- -	- -	-0.052	-0.067
SUPPLY	- -	- -	- -	-0.071	- -	- -
ITCOST	- -	- -	- -	- -	- -	0.069

THETA-EPS (continued)

	DEMAND	SUPPLY	ITCOST
DEMAND	0.263		
SUPPLY	- -	0.286	
ITCOST	- -	0.139	0.521

THETA-DELTA

	ASSET	SKU	STAFF	YEAR	STORE	LOSUPAVE
ASSET	0.451					
SKU	- -	0.452				
STAFF	- -	- -	0.608			
YEAR	0.112	- -	- -	0.814		
STORE	- -	0.205	0.157	- -	0.976	
LOSUPAVE	0.228	- -	- -	-0.077	-0.106	- -

Regression Matrix ETA on KSI (Standardized)

	charac	losup
percep	0.362	0.639
adop	0.145	0.745

TI ECR

Total and Indirect Effects

Total Effects of KSI on ETA

	charac	losup
percep	0.288	0.494
	(0.069)	(0.051)
	4.184	9.646
adop	0.119	0.595
	(0.061)	(0.064)
	1.956	9.311

Indirect Effects of KSI on ETA

	charac	losup
percep	- -	- -
adop	0.115	0.196
	(0.042)	(0.060)
	2.716	3.275

Total Effects of ETA on ETA

	percep	adop
percep	- -	- -
adop	0.397	- -
	(0.115)	
	3.445	

Largest Eigenvalue of B*B' (Stability Index) is   0.158

Total Effects of ETA on Y (continued)

	percep	adop
ADOP1	0.397	1.000
	(0.115)	
	3.445	
ADOP2	0.406	1.020
	(0.118)	(0.093)
	3.423	10.929
ADOP3	0.532	1.338
	(0.154)	(0.165)
	3.452	8.090
ADOP4	0.595	1.497
	(0.170)	(0.168)
	3.493	8.911
ADOP5	0.560	1.409
	(0.163)	(0.164)
	3.445	8.620
ADOP6	0.537	1.351
	(0.156)	(0.162)
	3.442	8.318
DEMAND	1.000	- -
SUPPLY	0.961	- -
	(0.083)	
	11.624	
ITCOST	0.853	- -
	(0.094)	
	9.085	

Indirect Effects of ETA on Y

	percep	adop
ADOP1	0.397	– –
	(0.115)	
	3.445	
ADOP2	0.406	– –
	(0.118)	
	3.423	
ADOP3	0.532	– –
	(0.154)	
	3.452	
ADOP4	0.595	– –
	(0.170)	
	3.493	
ADOP5	0.560	– –
	(0.163)	
	3.445	
ADOP6	0.537	– –
	(0.156)	
	3.442	
DEMAND	– –	– –
SUPPLY	– –	– –
ITCOST	– –	– –

Total Effects of KSI on Y

	charac	losup
ADOP1	0.119	0.595
	(0.061)	(0.064)
	1.956	9.311
ADOP2	0.121	0.607
	(0.062)	(0.068)
	1.953	8.954
ADOP3	0.159	0.795
	(0.081)	(0.084)
	1.958	9.498
ADOP4	0.178	0.890
	(0.091)	(0.091)
	1.960	9.799
ADOP5	0.168	0.838
	(0.086)	(0.089)
	1.957	9.456
ADOP6	0.161	0.803
	(0.082)	(0.083)
	1.958	9.646
DEMAND	0.288	0.494
	(0.069)	(0.051)
	4.184	9.646
SUPPLY	0.277	0.475
	(0.066)	(0.050)
	4.169	9.486
ITCOST	0.246	0.422
	(0.061)	(0.053)
	4.006	7.944

TI ECR

Standardized Total and Indirect Effects

Standardized Total Effects of KSI on ETA

	charac	losup
percep	0.362	0.639
adop	0.145	0.745

Standardized Indirect Effects of KSI on ETA

	charac	losup
percep	– –	– –
adop	0.139	0.246

Standardized Total Effects of ETA on ETA

	percep	adop
percep	– –	– –
adop	0.385	– –

Standardized Total Effects of ETA on Y (continued)

	percep	adop
ADOP1	0.222	0.577
ADOP2	0.227	0.588
ADOP3	0.297	0.771
ADOP4	0.333	0.864
ADOP5	0.313	0.813
ADOP6	0.300	0.779
DEMAND	0.559	– –
SUPPLY	0.538	– –
ITCOST	0.477	– –

Completely Standardized Total Effects of ETA on Y

	percep	adop
ADOP1	0.274	0.712
ADOP2	0.264	0.686
ADOP3	0.280	0.726
ADOP4	0.286	0.742
ADOP5	0.277	0.719
ADOP6	0.282	0.733
DEMAND	0.858	– –
SUPPLY	0.845	– –
ITCOST	0.692	– –

Standardized Indirect Effects of ETA on Y

	percep	adop
ADOP1	0.222	– –
ADOP2	0.227	– –
ADOP3	0.297	– –
ADOP4	0.333	– –
ADOP5	0.313	– –
ADOP6	0.300	– –
DEMAND	– –	– –
SUPPLY	– –	– –
ITCOST	– –	– –

Completely Standardized Indirect Effects of ETA on Y

	percep	adop
ADOP1	0.274	– –
ADOP2	0.264	– –
ADOP3	0.280	– –
ADOP4	0.286	– –
ADOP5	0.277	– –
ADOP6	0.282	– –
DEMAND	– –	– –
SUPPLY	– –	– –
ITCOST	– –	– –

Standardized Total Effects of KSI on Y

	charac	losup
ADOP1	0.083	0.430
ADOP2	0.085	0.439
ADOP3	0.112	0.575
ADOP4	0.125	0.644
ADOP5	0.118	0.606
ADOP6	0.113	0.581
DEMAND	0.202	0.357
SUPPLY	0.194	0.343
ITCOST	0.173	0.305

Completely Standardized Total Effects of KSI on Y

	charac	losup
ADOP1	0.103	0.531
ADOP2	0.099	0.511
ADOP3	0.105	0.541
ADOP4	0.107	0.553
ADOP5	0.104	0.536
ADOP6	0.106	0.546
DEMAND	0.310	0.548
SUPPLY	0.306	0.540
ITCOST	0.250	0.442

                    Time used: 0.094 Seconds

The Complete Diagram of the Study

Chi-Square=84.50, df=68, P-value=0.08531, RMSEA=0.037
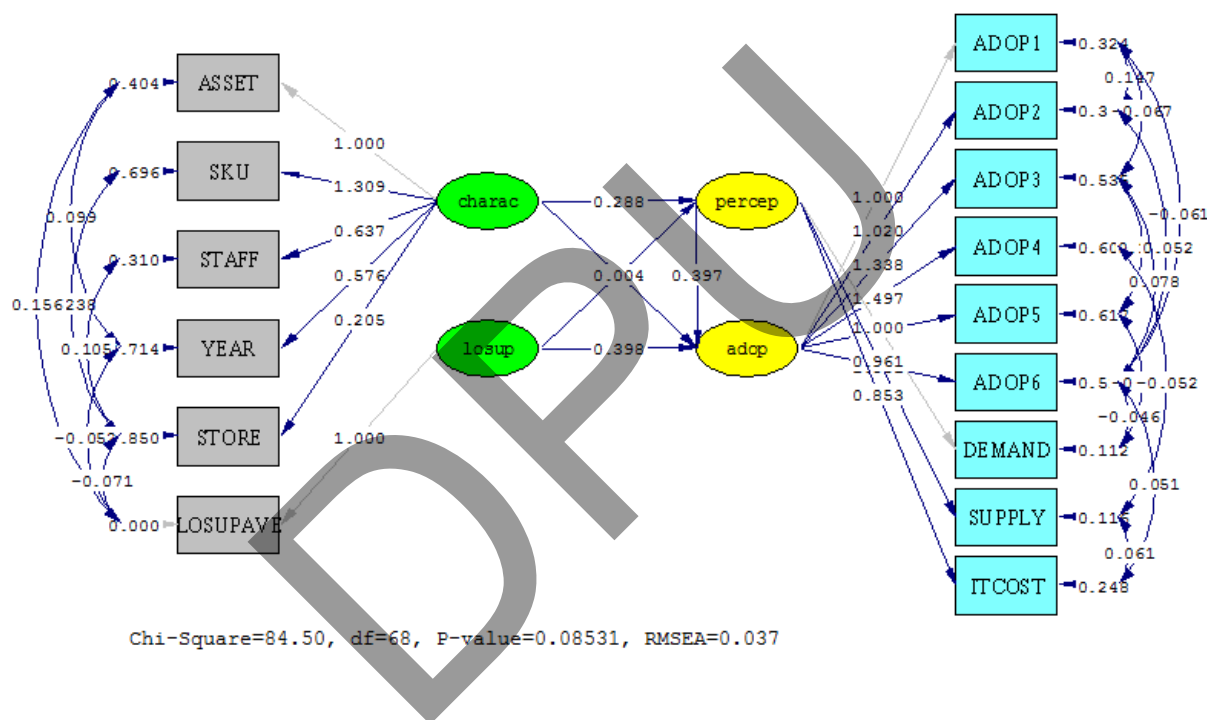
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