Date: 14th April 2008

A Feasibility Study Of ECR Pallet Standardisation In FMCG Industry

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Chapter One

Introduction

1.1 Focus of The Study

Wooden pallets are the fundamental of storage, transportation, export and shipping of goods in the supply chain for more than half a century. With palletized more can be handled with lesser manpower resources. This increased warehouse storage capacity and is thus classified under wooden packaging material (WPM) used in the export. There are several types of wooden pallets in the industries and no one pallet size fit all pallet users. Generally, wooden pallets are still more economical and practical compare to plastic pallets.

In the Fast-Moving Consumer Goods (FMCG) industry, wooden pallets are the main packaging of goods in transportation and warehouse storage /distribution centre needs. Food manufacturer usually deliver in palletised loads of goods to the Distribution Centre (DC). Forklifts are used during movements of palletised load in the warehouses/ distribution centre. All kinds of customized pallets are delivered to the distribution centre (DC), making it difficult in storages and stacking of goods.

In order for the wooden pallet to be efficient in the FMCG supply chain, urgently adopting of standards for pallet has become a priority. ECR Singapore is a private sector initiative comprising of suppliers, manufacturers, distributors and retailers. The objectives of this initiative are to improve consumer choice, satisfaction and service by achieving a reduction of total costs, inventories, physical assets and remove unnecessary cost from the distribution system making it more responsive to consumer demand.

The Pallet Standardisation Working Group is one of the many working groups targeted at improving consumer choice, satisfaction and service and at the same time, reducing total costs, inventories and physical assets under the strategy called ECR, a movement which began in the United States in 1993 in response to the recession. ECR Singapore was launched in Aug 1998, an industry-led initiative of the Fast-Moving Consumer Goods (FMCG) industry in Singapore which includes the grocery industry.

ECR Singapore initiated the first pallet standardisation pilot. This project inception of the national standardisation program where definitive measurements of productivity gains from the use of a standard were carried out during actual industry operations. The project was undertaken by SPRING Singapore, formerly known as PSB (Singapore Productivity and Standard Board) with ECR Singapore to roll out the first standards implementation.

This study researches and reviews the academic literature of the first successful standard ECR wooden pallet.

- The effective and efficient deployment in the FMCG industries and its life cycle management in the supply chain.
- How the ECR standard pallet evolve to fit into future supply chain trends

The wooden pallet has proven for more than 50 years that it is the most efficient and cost-effective unit load carrier to handle goods throughout the whole supply chain from the suppliers down to the retailers' outlets.

1.2   Background

The concept of Efficient Consumer Response (ECR) was introduced in the United States in the 1990s. It refers to a set of strategies that aims to get

companies across a supply chain to work closely to serve their customers better and at lower costs. Consumers benefit from improved availability and choice, while the distributors and suppliers derive better efficiency and cost savings.

Today, manufacturers, suppliers and retailers are faced with rapidly changing markets, keener competition and more exacting customers. In order to cope with these challenges, an increasing number of companies worldwide have incorporated ECR principles into their business models.

The ECR movement in Asia-Pacific has gained significant momentum in recent years. This progress is largely due to the efforts of ECR Asia-Pacific Council, which has tirelessly advocated the adoption of ECR techniques such as category management and continuous replenishment.

It has also promoted the GS1 System (GS1 is a global body which manages the article number system and RFID standards in 104 countries in the world). This global open system for bar-coding and RFID enables manufacturers, distributors and retailers to better align their operations by standardising the manner in which products, services, transport units and locations are identified. This allows trading data and information to be transmitted accurately and speedily across the supply chain through electronic data interchanges. All parties in the supply chain achieve tighter inventory control, more efficient order and delivery, and higher productivity. It ultimately enables them to deliver better customer service.

The ECR initiatives and activities in Asia-Pacific have succeeded in cutting unnecessary costs from supply chain and bring value and choice to consumers.

1.2.1 Pallet Pooling Company

In order to manage pallet assets and usage effectively, an organised pallet pooling system with strong processes and respected disciplines has appeared to be the best option to standardise materials management, control assets, ensure pallet quality and deliver the most effective mechanism for moving goods within the total supply chain.

By definition, pallet pooling within the total supply chain relationship implies that those who "touch and manage" pallet assets have a material impact on the efficiency of a collective system of asset utilisation, and ultimately on the supply chain costs and costs to the end-consumer.

This total integrated supply chain implies 3 partners

- The pallet pool provider
- The manufacturers
- The retailers

Usually the physical link between these partners is through a logistics service provider or carrier.

The pallet pool provider:

- Owns the pallets
- Is responsible for the management, supply, collection, inspection and repair of the pallets

The manufacturers:

- Receive pallets according to needs
- Dispatch goods to retailers on good quality pallets
- Usually support the cost of pallets based on use (movements and time)

The retailers:

- Receive pallets from the manufacturers
- Accept/help (sort) the pallet pool provider to collect the pallets

It is generally recognised that a pallet pooling system with advantages which accrue to all players can only work efficiently and cost-effectively if the partners collaborate and share the responsibility of assets control, pallet quality and fast rotation of the assets. Any loss or damage of pallets, leads to inefficiencies and higher cost of the total supply chain, which will ultimately affect consumers.

1.3   Objectives

LHT Holdings (Singapore) Limited was one of 35 companies that were part of the ambitious project which started in 1998 to reduce supply chain costs and increase productivity in the FMCG industry through standardisation of pallet sizes.

In 2000, LHT set up a new pallet pooling business called Kim Hiap Lee Co. (Pte) Ltd whose core business is leasing of standardised wooden pallet namely "ECR pallet". Being a newcomer in pallet pooling market, LHT felt great challenges and competition over global pallet pooling companies like CHEP (USA) and Loscam (Australia) which established their own customers' base in Singapore several years ago.

1. To conduct feasibility study on the benefits and advantages of first standard size wooden pallets in FMCG industry and re-engineering that streamline with the Global RFID-enabled supply chain.
2. What makes local pallet pooling company, LHT, a better choice over its global giant pallets pooling competitors in the logistic supply chain?

The aim of this research project is to analyse the ECR standard pallet and its strategic role in the FMCG industry. It also aims to explain the pallet

pooling system which manages pallet assets, effective usage and ultimately reduced costs in the supply chain. Ultimately the pallet pooling system helps save trees by recycling of the pallets.

1.4   Research Problem

Before implementing of standardised pallets, manufacturers and suppliers customise their pallets according to their goods packing requirements instead of the standard size 1 meter by 1.2 meters pallets. Low quality pallets were used to minimise costs as these pallets were delivered to the distribution centre and will not be returned and decommission later.

ECR Singapore is a private sector initiate comprising of suppliers, manufacturers, distributors and retailers. It is open to all companies in the grocery and FMCG sector. The objectives are to improve consumer choice, satisfaction and service. Thereby remove unnecessary cost from distribution system and make it more responsive to consumer demand.

However, there were several issues faces by the manufacturers. They have traditionally been using low grade 'non-returnable' pallets for many years. With the adoption of standard pallet (1 meter by 1.2 meters) for the FMCG industry, manufacturer will see a tremendous two hundred to three hundred percent price increase in purchasing of standard pallets comparing to the low grade one.

No mandate but rather a recommendation for using standard pallets when moving in the distribution centre. This helps move goods fast in the supply chain and stacking of goods is made easy. Ultimately, food manufacturers not using the standard pallet were encouraged to do so by the distribution centre or they will face risk of slow sales of their products due to the slow movement in the distribution channel.

Rental of standard pallets made it possible by pallet pooling companies like LHT, CHEP and Loscam. All these standard pallets are interchangeable, which means that once the grocery manufacturers' pallets arrive at the distribution centre, the same number of empty pallets could then be collected from the pallet yard after off-loading the goods and the pallets. Pallet pooling companies identify their pallets by colours. The user will collate the same number of colour pallets delivered to the distribution centre.

1.5   Research Methodology

The two types of common research are quantitative method & qualitative method. Both research techniques are methods that helps to define the research problems and data collections to examine the preceding issues. Although the qualitative method is applied in this project, qualitative data can be organized and reported in variety of ways. "Qualitative methodology provides a way of understanding phenomena that supports experiential knowing and the involved participation of the researcher with the phenomena". **(Filstaed, 1970; Maslow,1966).**

1.6   Scope of Project

The scope of the project should be large enough to discuss the functions of ECR pallet as the basic needs for transportation and storage of goods in the FMCG industry, as well as the implementation of the RFID pilot toward future global RFID-enabled supply chain. To achieve the project objective, it focuses on Pallets Lifecycle Managements System and the adoption of RFID pilot on ECR pallets.

1.7   Chapter Review

Chapter One introduces the topic of study on the ECR movement adopted by private sector to improve supply chain operation. The collaboration between ECR Singapore and SPRING Singapore (Standards, Productivity and Innovation Board)-formerly known as Singapore Productivity Standards Board (PSB).

Chapter Two reviews the pipeline Fast Moving Consumers Response, mission, and objective of the ECR organisation and standard pallet. It also reviews the emerging technology in Supply Chain Management (SCM).

Chapter Three discusses the research method best applied for the study and the limitation in the research.

Chapter Four discusses the qualitative technique uses in the research methodology in this project that was carried out with considerations of the limitations in the approaches.

Chapter Five presents the conclusion of secondary research findings on the general pallets for transportation and storages in the warehouses. It talks about the challenges faced in the next generation of RFID-enabled warehouses.

Charter Six presents the findings and analysis of the research undertaken. It evaluates the strategic role of ECR in logistics and supply chain managements and its future development.

Chapter Two

Literature Review

Dr E.Grosvenor Plowman said that "the "five rights" of a logistics system are supplying the right product at the right place at the right time in the right condition for the right cost to those customers consuming the product". **James F. Roberson & William C. Copacina (1994)** *Logistics Handbook: Total Quality Management in Logistics* **The Free Press pg 196**

The "seven R's rule" offer a simple description of how integrated logistics creates customer service. The seven R's mean having the right product, in the right quantity, in the right condition, at the right place, at the right time, for the right the right customer and at the right cost. Any breakdown in the seven R's disrupt the flow of product and leads to poor customer service. **Roy D. Shappiro and James L. Heskett (1985)** *Logistics Strategy: Cases and Concept* **St. Paul, MN: West Publishing Company pg 6**

2.1 Fast Moving Consumer Goods (FMCG) Industry

The FMCG industry is also part of the supply chain management (SCM) as the integration of key business processes from end user through to original suppliers that provides products, services and information that add value to customers and stakeholders. FMCG are those products where each family meets its own household needs. These are such goods which are consumed by everyone irrespective of status, level of income, place of stay. FMCG are those products you buy at regular basis at places like your local supermarket. Once consumed, they do not exist. Everyone is a consumer. This makes the industry personally relevant as everyone is personally affected. There's a saying in the industry that goes "everyone has to eat." Unlike some industries, such as automobiles, computers, and airlines, FMCG industry does not suffer from mass layoffs every time the

economy starts to dip. With varied sources of supplies such as parallel importers that sell directly to the consumers, several same brands of FMCG products can have few countries of origin. For example, consumers can expect a Coke made in Singapore, Mexico and Thailand. This makes the pricing of FMCG relatively competitive.

2.2. Distribution Centre (FMCG)

The difference between a warehouse and a distribution centre may cause some confusion. On one hand, the purpose of a warehouse is to store products until customers require them. On the other hand, a distribution centre is not used for storage, but rather for the receiving the products for the purpose of distributing them.

Major local FMCG food manufacturers that make products likes canned drinks, canned foods and other food products used third party logistics providers to delivery their products to distribution centres (DC). Besides local food (FMCG) manufacturers, Malaysia and Thailand FMCG manufacturers delivers their products (FMCG) via land transport to local FMCG distribution centre. **(Refer to appendix A**).

Although the primary role of a distribution centre is to receive large quantities of products and ship small quantities to individual stores, an important secondary role is storage. Many retailers have prioritized having as many items in stock at one time as possible. Distribution centres are the foundation of a retailing network. They allow a retail location to stock vast numbers of products without incurring an explosion in transportation costs. The way a typical distribution network operates is to have centres setup throughout a commercial market.

A FMCG Distribution Centre has the same activities of warehousing. Warehousing can be viewed as physical system, involving facility space, labour, and equipment, where inbound products are put away, stored, and

protected until the outbound product shipment-related processes occur. The warehousing "system" has controls to manage the physical flow, to ensure the proper care and handling of materials, and to document all activities occurring in the warehouse. The major activities of warehousing are receiving; put-away; storage; order picking; packing, marking, and staging; and shipping **(Ernst & Whinney,1985).**

2.2.1. Distribution Centre Organisation

All distribution centres have three main areas and may have additional specialized areas. The three main areas are the receiving dock, the storage area and the shipping dock. In small organizations it is possible for the receiving and shipping functions to occur side by side, but in large centres, separating these areas simplifies the process. Often a distribution centre will have dedicated dock doors for each store in its shipping area. The receiving area can also be specialized based on the handling characteristics of freight being received, whether the product is going into storage or is going straight to a store or by the type of vehicle delivering the product.

Transportation – arranges and coordinates shipments in and out of the DC

Dedicated Product Departments – divisions can be based on handling characteristics or storage characteristics. For example, refrigerated and non-refrigerated [Meat & Produce, Frozen, Dairy, Dry] each of the three areas have both shipping and receiving departments as well.

Cross –Docking – a process that involves unloading inbounding product, sorting products for individual stores and reloading the shipments onto trucks destined for a particular store. No warehousing or storage of the product occurs, except for a few hours or, at most a day. **Tom Andel (1994) "Define Cross-Docking before You Do It",** *Transportation and Distribution* **35, no 11 pg 93-98**

Wal-Mart's cross docking practice utilizes its distribution centres as switching stations rather than warehouses so that Wal-Mart saves both inventory carry costs and warehouse and dock spaces **(Stalk, Evans, & Shulman,1992).**

2.3.   Third Party Logistics (Outsourcing)

"Many companies are learning that just because they can come up with a good product idea doesn't mean that they can actually produce the product. Or at least make it efficiently. They look to the outside for people to take care of certain operation tasks". **Gene Marks (2005)**

Outsourcing to third party logistics or commonly known as 3PL means engaging another logistic expert company that could have otherwise been done by your company. Outsourcing isn't always the right decision, as it might make more financial and overall business sense to hire an employee for a task rather than to farm out the work. Then again, employee can be more expensive and require more resources. These are among the pros and con to outsourcing.

Many FMCG food manufacturers choose to outsource their inventory management to 3PL. Better management of corporate inventories can improve cash flow and return of investment (ROI). Inventories serve five purposes within the company;

- It enables the firm to achieve economies of scale.

- It balances supply and demand.

- It enabled specialization.

- It provides protection from uncertainties in demand and order cycle.

- It acts a buffer between critical interfaces within the supply chain.

The 3PL must have an existing internal information infrastructure. It is imperative that a 3PL has sophisticated logistics, and communication built into its operation. It is also important for the service provider to keep track of the products shipped. Many 3PL have struck partnership with software vendors in collaborating to provide with IT support. The information chain is more complex than a product chain. Due to the supply chain complexities in the world of global business, a company's best chance for developing a seamless, continuous flow of distribution lies in the ability of its 3PL to provide knowledge-based logistics solution for them.

2.4. Reverse Logistics

Reverse logistics deal with products that flow in the opposite direction from standard logistics channel. Instead of products and services flowing out to the consumer, the products and services flows back to manufacturer. It includes the backward flow of hazardous and non-hazardous waste, recycling materials, reuse of products, product recalls, damaged goods, outdated products, and other reverse flow of products. The aim of reverse logistics is to reduce waste of all types whenever possible. Reverse logistics increase the pressure to ensure that the integrated logistics system is operating properly. However, at times, they must move products from customers backward through supply chain. Sometimes the products being returned to the firm flow in the same channel as products flowing to consumers, causing congestion.

"Reverse logistics refers to logistics activities and management skills used to reduce manage, and dispose of waste from packaging and products". **R.J. Kopicki, M.J.Berg, L.L. Legg, V.Dassappa, and C. Maggioni(1993)** *Reuse and Recycling Reverse Logistics Opportunities,* **Oak Brook, IL; Council of Logistics Management pg 2.**

2.5.   Efficient Consumer Response (ECR)

"The benefits of efficient consumer response (ECR) were first identified in a 1993 study. The study concluded that a saving of $30 billion was possible in the consumer-packaged goods industry if the majority of the companies implemented ECR strategies". **Richard J. Sheman (1994)**

"ECR envisions a direct link among the consumer household, the retail store, the distributor and the supplier. ECR further envisions that connection to be accurate, paperless flow information driving the movement of product matched precisely to consumer [needs]. The vision requires a major shift in the way trading partner think" **(Ibid., pg 143)**

The concept of Efficient Consumer Response (ECR) was introduced in the United States in the 1990s. It refers to a set of strategies that aims to get companies across a supply chain network to work closely to serve their customers better and at lower cost. Consumers benefit from improved product availability and choice, while distributors and suppliers derive better efficiency and cost savings.

Today, manufacturers, suppliers, and retailers are faced with rapidly changing markets, keener competition and more exacting customers. In order to cope with these challenges, an increasing number of companies worldwide have incorporated ECR principles into their business models.

The ECR movement in Asia-Pacific has gained significant momentum in recent years. This progress is largely due to the efforts of ECR Asia-Pacific Council, which has tirelessly advocated the adoption of ECR techniques such as category management and continuous replenishment.

It has also promoted the GS1 System, GS1 is a global body which manages the article number system and RFID standards in 104 countries in the world. This global open system for bar-coding and RFID enables manufacturers, distributors and retailers to better align their operations by

standardising the manner in which products, services, transport units and locations are identified. This allows trading data and information to be transmitted accurately and speedily across the supply chain through electronic data interchanges. All parties in the supply chain achieve tighter inventory control, more efficient order and delivery, and higher productivity. It ultimately enables them to deliver better customer service.

The ECR initiatives and activities in Asia-Pacific have succeeded in cutting unnecessary costs from the supply chain and bring value and choice to consumers.

2.5.1. ECR Asia

"ECR Asia" is an independent joint trade and industry body, launched in 1999, to promote the use of ECR techniques to remove unnecessary costs from the supply chain and make the sector, as a whole, more responsive to consumer demand. The objectives are identified and drive industry-wide implementation of best practices which improve efficiency of FMCG industry and deliver better value to consumers and shoppers. It is also aims to promote the use of ECR techniques**. ECR Asia. Available at URL: http://www.ecrasia.com/ (Accessed: 10 March 2008)**

2.5.2. ECR Singapore

ECR Singapore is a private sector initiative comprising of suppliers, manufacturers, distributors and retailers. ECR Singapore is open to all companies in the grocery and fast-moving consumer goods (FMCG) sector. Objectives are;

- Improve consumer choice, satisfaction and service. Achieve a reduction of total costs, inventories and physical assets.

- Achieve a reduction of total costs, inventories and physical assets

- Remove unnecessary cost from the distribution system and make it more responsive to consumer demand.

- Network with ECR organisations in USA, Europe and Asia.
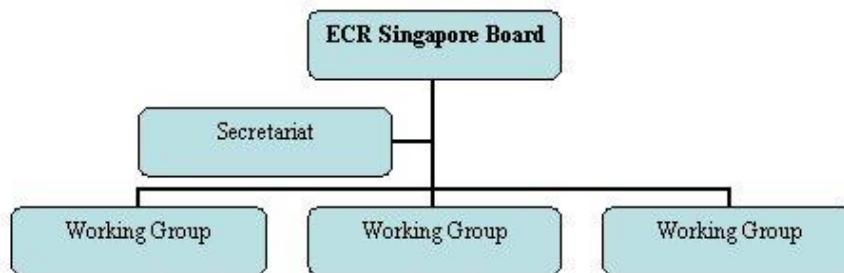
ECR Singapore. Available at URL: http://www.sanc.org.sg/ecr.htm (Accessed: 10 March 2008)

2.6.   ECR Pallet

This is a four-way 1m by 1.2m standard sized as it conforms to the international standard ISO 6780 "General-purpose flat pallets for through transit of goods - Principal dimensions and tolerances". Ideally, goods should be easily transported from the manufacturer to the distributor or the central warehouse on a standard-sized pallet. The recommended pallet size was endorsed by the ECR Singapore Council at its Board meeting in February 1999. It was subsequently endorsed by the ECR Asia Council Board to be the ECR Standard Pallet

ECR Pallet

*Picture from the courtesy of LHT Holdings

Food manufacturers usually deliver in palletised load of goods to the Distribution Centre (DC). The goods will then be placed on slave pallet (a convenience pallet for stacking in the rack and transfer for internal use).

Adopting standard ECR pallet designed to meet these requirements should eliminate the need for additional slave pallet to be provided at the Distribution Centres. This can reduce the cost and logistics requirements associated with having the materials and systems necessary at the Centres as well as helping to keep packaging line speeds as high as possible. Overall, the efficiencies of moving these performance requirements back through the supply chain should help increase the overall efficiencies of the total system.

2.7. Emerging Technologies in Supply Chain

"Perhaps no single technological advancement has generated more simultaneous excitement and apprehension than Radio Frequency Identification (RFID). Now into the controversy comes the forward-thinking

and visionary voice of Claus Heinrich, who, with a cadre of business leaders and technology educators, step through the door that RFID has provided and reveals the potential of Real World Awareness". **Heinrich, Claus E. (2005)** The most notable is Radio Frequency Identification, or RFID in short. RFID tags contain memory chip with antenna in a label form. While barcodes only identify the product, RFID tags can tell what the product is, where it has been, when it expires and whatever information one wishes to program it with. The RFID technology will generate a tremendous amount of data about the location of pallets, cases, cartons and individual products in the supply chain. It will provide rich information about when and where merchandise is manufactured, picked, packed, and shipped. It will create numbers telling retailers the expiration dates of their perishable items – numbers that will have to be stored, transmitted in real-time and shared with warehouse management, inventory management, financial and other enterprise systems. In other word, it will have a really big impact.

Another benefit of RFID is that, unlike barcodes, RFID tags can be read automatically by electronic readers. Currently, the two biggest hurdles to widespread RFID adoption are the cost of building the infrastructure and the lack of agreed-upon standards.

2.7.1. Introduction to RFID

A lot has happened in the 53 years since Harry Stockman's work. The 1950s were an era of exploration of RFID techniques following technical developments in radio and radar in the 1930s and 1940s. Several technologies related to RFID were being explored such as the long-range transponder systems of "identification, friend or foe" (IFF) for aircraft. Developments of the 1950s include such works as F. L. Vernon's, "Application of the microwave homodyne", and D.B. Harris', "Radio

transmission systems with modulable passive responder". The wheels of RFID development were turning.

The 1960s were the prelude to the RFID explosion of the 1970s. R. F. Harrington studied the electromagnetic theory related to RFID in his papers "Field measurements using active scatterers" and "Theory of loaded scatterers" in 1963-1964. Inventors were busy with RFID related inventions such as Robert Richardson's "Remotely activated radio frequency powered devices" in 1963, Otto Rittenback's "Communication by radar beams" in 1969, J. H. Vogelman's "Passive data transmission techniques utilizing radar beams" in 1968 and J. P. Vinding's "Interrogator-responder identification system" in 1967. **An AIM Publication (2001)** *Shrouds of Time: The history of RFID*. **Available at URL: http://www.rfidconsultation.eu/docs/ficheiros/shrouds_of_time.pdf (Accessed :11 March 2008)**

RFID is a method of identifying an object using radio frequency transponders or RFID tags attached to objects. Passive or semi-passive radio tags will "identify" themselves when detecting a signal from a compatible device, which is known as a reader or interrogator by emitting a radio frequency transmission.

The RFID technology has been around in the industry more than half a century and why is it still an emerging technology in the supply chain?

August 13th 2003, world's largest retailer Wal-Mart requires its top 100 suppliers to put RFID tags. Other companies like Tesco, Metro mandate a change in this industry.

Ultra-High Frequency (UHF) RFID was deployed in Wal-Mart supply chain. This ISO (international Standard Organisation) 18000-6 A/B Air Interface Frequency **(refer to appendix B)** make notable news overnight over the Low-Frequency (LF) which is good for tagging live stocks and High-Frequency (HF) applications include ticketing, access control, library book

identification and electronic payment. It has been readily available and widely deployed in many industries for almost ten years.

"We have asked our top 100 suppliers to have products on pallets employing RFID chips and in cases with RFID chips," says Wal-Mart spokesman Tom Williams. "By 2006, we will roll it out with all suppliers." **RFID Journal (2003)** *Wal-Mart Expands RFID Mandate*. **Available at URL: http://www.rfidjournal.com/articleprint/539/-1/1/ (Accessed 12 March 2008)**

2.7.2. RFID Architecture

"For our purposes, an architecture defined as a decomposition of a particular computer system into individual components to show how the components work together to meet the requirements for the entire system. With this definition in mind, we can confidently say that there is no such things as a single, universal RFID architecture that fits all requirements for all systems. Likewise, there is no set number of variations on a single theme. Because of a recent of technologies, RFID systems now offer some key functionalities that have a distinct and predictable impact on the architecture of systems that use it" **Bill Glover and Himanshu Bhatt (2006), RFID Essentials: RFID Architecture, Oreilly pg 21**

RFID infrastructure is the backbone of the RFID architecture is the primary system when implementing RFID **(refer to appendix C).** Often a burden and high cost to carry for the small medium enterprise (SME) organization which end up giving up the idea of RFID implementation even with the support by the government agency prior to funding. The huge cost is adversely to bear, nevertheless the SMEs are still optimistic in RFID technology and pick the "wait and see" attitude. The whole RFID infrastructure require integration of Enterprise Application Integration

(EAI), Enhance Resource Planning (ERP), RFID middleware (see reference 2.7.3) and RFID information network (see reference 2.7.4).

2.7.3. RFID Middleware

RFID middleware provides the important function of filtering the highly fragmented data that comes from the RFID readers. By cutting down the volume of data that pass over wide area networks, even filtering also allows one to define application-level events and pass more meaning information to enterprise applications. This backend system integrated with the RFID components such as the antennas, readers and tags.

2.7.4. RFID Information Network

The RFID information network may be well known as the vision of EPCglobal network (refer appendix E) namely EPCIS (Electronic Product Code Information Service). The goal of EPCIS is to enable disparate applications to leverage Electronic Product Code (EPC) data via EPC data sharing, both within and across enterprises. Ultimately, this sharing is aimed at enabling participants in the EPCglobal Network to gain a shared view of the disposition of EPS-bearing objects within a relevant context.

2.7.5. Electronic Product Code (EPC)

Electronic Product Code (EPC) is the business application of RFID technology in the supply chain. EPC is the brainchild of EPCglobal, located in the U.S. EPCglobal consists mainly of a series of bodies which promote and lend impetus to the development and standardization of all the technologies needed for RFID in logistics and trade. All well-known manufacturers of RFID systems, including the large software companies.

Many RFID users (e.g. METRO or Walmart), are members of EPCglobal. Apart from technical standardization, there are so-called "Business Action Groups", which deal with the use of EPC in different branches of industry.

EPC is a unique object identifier function like a license plate on vehicle instead of a tag on the product. EPC is part of data format on a chip of the RFID tag. However, the tag carries string of data conform to the EPC class and data can be read by electronic reader. See example;

016.37000.123456.100000000			
Header	EPC Manager	Object Class	Serial Number

Taken from slide 26 January 2005 (GS1 Singapore Council)

2.8.   Reengineering Improvement into Supply Chain

Business Process Redesign is "the analysis and design of workflow and process within and between organizations" **(Davenport & Short 1990).** A critical part of streaming supply chains involves the key processes to meet customer needs. Reengineering is a process aimed at producing dramatic changes quickly. Michael Hammer and James Champy define it as the fundamental rethinking and radical redesign of business process to achieve dramatic improvements in critical contemporary measures of performance such as cost, quality service, and speed. Improvement through reengineering cannot be accomplished haphazardly. These changes must be supported at the top and driven through an overall management plan. A typical reengineering process proceeds through three stages; 1) Fact Finding 2) Identifying areas for improvement to business process redesign. 3) Creative improvements. The fact-finding stage is very detailed examination of the current systems, procedures, and work flows. Key focus is placed on separating facts from opinions. **J.L.**

Coleman, A.K. Bhattacharya, and G. Brace, "Supply Chain Reengineering: A Supplier's Perspective", The International Of Logistics Management, 6, no. 1 (1995), pg 85-92

As the old saying goes "Old wine in new bottle". The purpose of re-engineering is to "make all your processes the best-in-class" **Fredrick Taylor** suggested in the 1880's that managers use process re-engineering methods to discover the best processes for performing work, and that these be re-engineered to optimize productivity.

Chapter Three

Research Methodology

Research is to find a truth-seeking function that gathers, analyses, interprets, and reports information. Research information gives greater depth to investigation of the course study.   Adopting the right methodology prove essential for the techniques to the facts. The subsequent chapter attempts to identify and follow the most suitable research perspectives for the investigation and justifying the course taken.

3.1   Scope of Research

The scope of the research should be broad enough to discuss traditional wooden pallet moving toward standardisation which derive better cost saving and promote efficiency consumer response (ECR) in the FMCG industry. It looks into the emerging technology (RFID) in the supply chain that rapidly changes the way businesses tracking inventory and assets. It examines how we move ahead from traditional wooden pallet which is the fundamental of storage, transportation, export and shipping of goods in the supply chain toward global RFID-enabled supply chain.

3.1.1. From One-Way Pallet to Standard Pallet

FMCG manufacturers used low quality pallets to deliver its products to the Distribution Centre (DC). These pallets were mainly known as 'one-way' pallets as they will not be returned to their origin after they are delivered to the DC. In the DC, the palletised goods will be put on a slave pallet (DC customised size pallet) for the stacking and storage onto the warehouse racking purposed only. Usually, several types of palletized goods which come in different design and sizes were of low quality grade wood. Questions were raised on economy of scale as several damages on

pallets found during transportation and storage as movement of goods done by the forklifts were due to poor quality pallets.

In 1998, government agency named SPRING Singapore initiated the first standardisation pallets for the FMCG industry. Several key industries players were invited to participate in this project. The pilot project took 12 months to complete. A major local pallet manufacturer, LHT Holdings Limited, began to manufacture of ECR standard pallets for lease to the FMCG industry. Major FMCG manufacturers like F&N Coca Cola, Yeo Hiap Seng (YHS), Unilever Singapore and Grocery Logistics Singapore (largest retail outlets NTUC Fairprice) took the initiative to adopt the ECR standard pallets (size 1200mm x 1000mm) for their distribution chain by leasing them from LHT Holdings.

3.1.2. Moving to RFID Implementation

"In May 2004, IDA (Infocomm Development Authority of Singapore) launched a three-year, S$10 million plan to develop Radio Frequency Identification or RFID technology to augment Singapore's position as a key logistics hub. Through the RFID Initiative, IDA works closely with industry to increase adoption of RFID technology across the various industry sectors to enhance Singapore's competitiveness as a logistics hub and supply chain nerve centre.

The plan aims to build RFID-enabled supply chain clusters by bringing together manufacturers, logistics service providers, retailers, infrastructure providers and solutions providers across various industry sectors in Singapore". **IDA (2004) *RFID Initiative*. Available at URL:http://www.ida.gov.sg/Programmes/20060419001101.aspx?getP agetype=34 (Accessed: 15th March 2008)**

RFID is just one instance of a bigger concept. With the support and funding from IDA RFID initiative program, the standardized ECR pallet began its next greater challenge in RFID adoption on February 2005.

3.2   Qualitative Research

Qualitative research is the basic methodology applied in this study. It focuses on gathering information used in focus groups, case studies, depth interview, document analysis and product analysis. Data is information recorded with the intent of representing facts. Research data represents descriptions of things that are made without directly assigning numbers. Both primary and secondary data have been used in this study. The primary data were in the form of key interviews, while the secondary data was based on current theoretical and expert opinions and research through academic journal, government statutory and papers.

3.3 Research Design

"A research design provides provide the basic direction or "recipe" for carrying out the project. Following the principle of parsimony, the researcher should choose a design that (1) will provide relevant information on the researcher question and (2) will do the job most efficiently. Once the researcher decides on a study design, the information phase of the basic research process is complete". (**Joseph F. Hair, Jr., Barry Babin, Arthur H. Money, Philip Samouel ,2003)**

Business research design can be group into one of three categories. Researcher can choose (1) exploratory, (2) descriptive, or (3) casual design for his research project. The research design for this study will focus mainly on exploratory research as is useful when there are few theories available to guide predictions. A few of the more widely used exploratory are discussed below.

3.3.1. Focus Groups

Focus groups are one of the most widely used exploratory interview techniques. Hence, the research study on the focus groups are participants in the pallet standardization pilot, not-for- profit ECR organization, ECR pallet manufacturer, ECR pallet users and operation staff at the FMCG distribution centre. As the study extent to RFID technology, the sector involved the participants in the RFID implementation, government agencies (SPRING Singapore and Infocomm Development Authority (IDA) of Singapore) and other relevant RFID parties.

3.3.2. Depth Interview

Kvale (1996) details seven stages of conducting in-depth interviews. They include thematizing, designing, interviewing, transcribing, analyzing, verifying, and reporting.

1) Thematizing: This is the first stage of the process whereby clarify the purpose of the interviews and determine what require to find out.

2) Determining the questions needed. A key part of this process is designing an interview guide. An interview guide is a list of questions and probing follow-ups that guide you through the interview.

3) The actual interview consists of three main parts. (1) The first part involves introducing interviewer and the study. (2) It is critical to establish a good rapport with respondent and put the respondent at ease. (3) The main responsibility of the interviewer is to listen and

observe as he guides the respondent through a conversation until all of the important issues on the interview guide are explored.

4) Transcribing involves creating a written text of the interviews. This step involves bringing together all of your information-gathering approaches into one written form.

5) Analyzing: This important step involves determining the meaning in the information gathered in relation to the purpose of the study. Study the important information and look for themes, commonalities, and patterns to try to make sense of the information.

6) Verifying: involves checking the credibility and validity of the information gathered. A method called triangulation is used as a means of checks and balances (An article on triangulation is available at http://edis.ifas.ufl.edu). Basically, one type of triangulation would be to use multiple perspectives to interpret a single set of information.

7) Reporting: The final step of the process is to share what interviewer has learned from the in-depth interviews with other internal and external stakeholders. **Rubin, H.J. and Rubin, I.S. (2004) *Qualitative Interviewing: The Art of Hearing Data* 2nd Edn.Thousand Oaks, CA: Sage Publications.**

3.3.3. Delphi Techniques

The Delphi techniques is another exploratory interview approach. A Delphi interview seeks the input of some acknowledged expert, usually with respect to forecasting or predicting future events.

3.3.4. Projective Techniques

Projective techniques are based on the underlying principle that unconscious desires and feelings can be inferred by presenting a subject with an ambiguous situation in which he or she has to use the ego defence mechanism of projection. The subject is free to interpret and respond to the ambiguous stimuli (material that can be variously interpreted) from his or her own particular frame of reference **(Churchill, 1991:322; Kassarjian, 1974:3-86; Loudon & Della Bitta, 1993:300; Solomon, 1994:25).** As there are no right or wrong answers, it is hoped that the subjects will project their own unconscious feelings in their answers **(Solomon, 1994:25). 3.3.1**

3.3.5. Analysis of Interviewing

Under the opinion- based research perspective, interviewing is a worthy technique, which in every sense draws out the respondent personal attitude and thoughts on the topic. The ability to set boundaries impedes conferring on answers and enables the conversation to be tailored, increasing the quality of responses and reducing bias incurred.

3.4. Sources of Bias

Research within the grocery /FMCG industry is important with the rapid development of new technologies and best practice initiatives in ECR. By conducting research for the industry, external parties become a point of contact for their members and the public to seek advice and gain a common understanding and benefits of ECR. There was a general consensus across the research participants that the Singapore market is very different from overseas grocery markets.

For the purpose of this study, a multiple case study was used as it enabled us to collect rich information from various external parties in the FMCG industry regarding their involvement in ECR adoption. The unit of analysis used for this study was individual organisations that were considered external parties. Potential participants included trade associations, standard bodies and consultancies who also deal with the FMCG industry.

One of the key strategic decisions for organizations is selecting ECR business practices or technologies. Organizations naturally seek assurance that these concepts will deliver the claimed benefits

3.5.   Limitation of Research Process

The dissertation makes a contribution to the analysis the effects and efficiency of standardized ECR pallet in the FMCG distribution chains of firms. The centrepiece of the study is the description of the RFID technology in supply chain which widely use in Europe, and RFID Mandate (2003) focus Wal-Mart (world largest retailer) which had its top 100 suppliers to be RFID compliance when deliver consumer goods to its outlets will change and affect local supply chain.

The study focuses on the standard wooden pallet used in the FMCG distribution chain of products and is not concerned with general pallet for general cargo in the supply chain. It basically focuses on the dry grocery /FMCG industry distribution supply chain exclude frozen and chilled products.

The study is further limited in scope to a deliberate selection of industry case studies and to the environment in which they have been researched. This work is arguably strong in the application of RFID system which show gradually increase in RFID adoptions in countries in Asia, like China, Hong Kong, Korea are moving in pace with the technologies and Singapore has been one of the pioneer in Asia Pacific.

Chapter Four

Findings

Findings depend heavily on the methodologies employed so it is difficult to provide specific definition. It a way the collection of data presented from the respondents' answer to the interviews, focus group were combined and then further sectionalized, and grouping related questions together into coherent structure.

4.1. Pallet Life-cycle Management

An environment expert of the United Nation Climate Change commented deforestation is one factor that contributed to the rising of global temperatures. These are because trees play a very important role in the environment. Several countries have mandated their register loggers to have a "one-to-one" policy which mean that whenever they (the legal logger) cut off one tree, they would need to replant another.

Pallet life-cycle management is a process of the new wood pallet till it is decommission. Apart from renting of wooden pallets, customers can return the unused (access) pallets back to the owner (pallet pooling company). This process known as de-hire also can be known as Reverse Logistics, since the pallet (products) flow in the opposite direction from standard logistics channel. This time all pallets returned are require to be screened and sorted out. Pallet in good condition will be reused and damage pallets sent for repair or decommission (beyond repair).

4.2. Pick and Pack Process

Previously, FMCG food manufacturers used to buy low quality pallets to deliver their products to the Distribution Centre. The palletised products

will put on a slave pallet and placed it on the warehouse storage racking waiting for further distribution to the retail outlets. At the DC, once the loaded products removed from the storage racks, the slave pallet will be re-used but the 'one-way pallet' will be completely off load of goods that will be put into roll-container, a special design constructed with steel bar frame with attach roller at bottom. The roll container was said to be robust, easily to handle and maintain. The purpose is to convenience for pushing in and out of aisle at the supermarket, as well as stocking goods onto the retail outlets' shelves.

In the pick and pack process at DC the Just-In-Time (JIT) concept is applied for specific grocery such as bread, rice and dairy products where palletised goods are unpacked directly to lose ones from the manufacturer courier into the roll-container for its outlets' distribution. Cross docking applies as the manufacturer goods brought in are not stored in DC. Cross docking is only applicable to products with short lead times and order with large quantities.

Roll Cage/ Container – picture taken from
URL:http://ourlead.win.mofcom.gov.cn/en/plate01/product.asp?id=9340

4.3.   Case Study of ECR Wooden Pallet-In-Transit

In October 1999, recommended pallet standard based on ISO 6780 endorsed by ECR Asia and ECR Europe was imposed for the FMCG industry. With the switch from low quality pallets to leasing of standard heavy-duty ECR pallets (1000 kg load), there was no need for huge investments as it involved a hiring system. FMCG manufacturers usually stock large inventory of pallets a few months before the festive seasons to meet the consumers' needs and often after the festive seasons to return access pallets to the pallet leasing company. This saw significant results in reducing inventory and cost savings compared to purchase of large quantities of pallets. The advantage is that it takes up large storage space. During the pilot, local pallet pooling company like LHT offer trade-in for their existing low-quality pallets in term of leasing.

At the DC, goods received do not require staff to restack onto ex-slave pallets. Therefore, workload is reduced and time is saved. About twenty percent reduction in manpower costs is achieved. Further cost reduction came in form of ownership through leasing when the using standard pallets to transfer goods from non-standard pallets to the distribution centre. There were also Improved turnaround time for suppliers, which means better dock utilization. In addition, standardisation simplifies business process, enhances business practices and creates greater efficiencies and better effectiveness.

4.3.1. Download Case Study

SPRING Singapore *Pallet Standardisation for the FMCG Industry*. Available at URL: www.spring.gov.sg/Resources/LM_thrust3/SIP/document/Sip_Starter _Kit.doc (Accessed: 20th March 2008)

The Pallet Standardisation project is the first Standards Implementation for Productivity project undertaken by SPRING Singapore, formerly known as PSB. This is the first project since the inception of the national standardisation programme where definitive measurements of productivity gains from the use of a standard were carried out during actual industry operations. The project was undertaken with the industry initiative Efficient Consumer Response (ECR) Singapore. The ECR Working Group on Pallet Standardisation made its recommendation to adopt the 4-way 1000mm x 1200mm pallet as the standard for the FMCG industry.

A pilot study involving 3 supply chain members and one pallet leasing company was later conducted to objectively measure and illustrate the local benefits of pallet standardisation in the FMCG industry.

The four companies which participated in the pilot study – YHS (Singapore) Pte Ltd, Grocery Logistics Singapore Pte Ltd (logistics arm of NTUC Fairprice Co-operative Ltd), LHT Holdings Ltd and Unilever Singapore Pte Ltd.

4.4. First Successful Standard Implementation

In this highly globalised and infocomm environment, standards are essential to ensure interconnectivity and interoperability for efficiency and increased productivity. To have a competitive edge, companies, especially SMEs need to be aware of standards and the advantage of implementing standards. The successful quantification of the benefits of the adoption of the Standard Pallet was made possible with the cooperation and participants in the project with the same goal. These locally demonstrated benefits will help to further induce the industry to migrate to Standard Pallets.

4.5. The Next Standard Implementation

Radio Frequency Identification or RFID is an emerging technology in supply chain. RFID has more benefits to offer, track and trace are the main principle feature. By applying RFID technology on the ECR standard pallets, it will help in locating the pallets through the same network sharing by manufacturers, suppliers and retailers. However, RFID standards defined by EPCglobal standard (Specializes in the development of industry-driven standards for the Electronic Product Code) is closed to stabilized.

4.6. Challenges in RFID Implementing on ECR Pallet

RFID may be seen as the next logical step in the progression of tracking systems and sensor networks because of technological advances in several fields. In February 2005, with the support from IDA (Infocomm Development Authority), local pooling company LHT began its greatest challenge by implementing RFID on its ECR pallets for the purpose of asset tracking.

RFID has a wide and growing range of potential uses throughout the industries, commerce, education and the public sector more widely. The main driver for the development of the technology is the capability to identify and track the movement of products through the supply chains. This is important to retailers because it reduces the likelihood of items being out-of-stock, estimated, in retail, to have been around 4% of annual sales in 2003 (**McFarlane, 2003)** and reduces 'shrinkage' (loss of stock, including through theft) which is reported to have cost American companies $31.3 billion in 2003 **(Deutsch, 2003).**

The current method of product tracking within supply chains is the barcode, but passive RFID tags provide some simple, but fundamental, advantages. RFID tags are unlike barcode that have visible bars strips on label. Both using AIDC (Automatic Identify Data Capture) technologies, barcode is line of sight but RFID is not. Passive RFID tags has microchips and antennas attached to enhance better read range, store memory, security features unlike barcode has none.

Trials and errors were carried out on the standard ECR pallet at LHT warehouse. The twenty-four months RFID projected timeline included design and development of RFID middleware, RFID system components, and Pallet Lifecycle Management System completed on schedule.

4.7.   Myths and Hypes in RFID

The RFID technology includes several categories of frequencies, perhaps the notable RFID contribution to the Ultra High Frequencies (UHF) class for the purpose in supply chain efficiency. Myths and hypes are propaganda for which there is no evidences. One of myths stated that barcode will be replaced by RFID. Although RFID tags will cost US five cents, have seen a tremendously drop in prices recently. The hype for a one-cent microchip, a one-cent antenna, a one-cent glue, a one-cent label

and a one-cent labour cost will come true as several chip manufacturers move its wafer plants operation to China where labours, operating expenses are relatively low.

"The revolutionary technology will significantly affect the way supply chains are managed and lead to greater efficiency. RFID tags will not merely replace bar codes, but will allow real-time tracking of products". **Heinrich (2005, pg 220)**

4.8.   Towards Future RFID-enabled Supply Chain

Dr. Alan Kay once said, "The best way to predict the future is to invent it". This is truer now than ever. New and competing RFID technologies emerge almost daily, some of which are refinements to existing systems while others significantly different. Businesses are, for the most part, holding back and waiting for the dust to settle before deciding what, if anything, to do with RFID. The people working in the EPCglobal and ISO groups to forge standards are talking to Dr Kay on his challenge and choosing to define the future rather than attempting to predict which way it will go. **Bill Glover & Himanshu Bhatt (2006)** *RFID Essentials : The Future* **O'Reilly Media,Inc. pg 215**

Bill Glover and Himanshu Bhatt (2006, pg 6), wrote the five steps of RFID Eras;

I.   The Propriety Era - which begins from development of transistors in1947 was later uses by government and business entities to track items and animals.

II.   The Compliance Era – This was named due to the steep drop in semiconductor prices and widespread adoption of broadband networking at the end of the 20th century. Which see the US DoD, large retailers Wal-Mart and Tesco mandating their suppliers to

have all their goods to be RFID compliance and conform to emerging standard (EPCglobal & ISO18000).

III.   The RFID-Enabled Enterprise Era – A era begins when many organisations implement RFID tracking within their internal process due to component costs fall and standard stabilize. This allows them to measure the pulse of their distribution systems for materials, assets, and products and to keep real-time inventories of items, such as the location and age of perishable goods. However, even with the widespread internal adoption and tagging at the origin of the supply chain, it will take time for business to develop the agreements and security to allow organizations to share RFID information with one another (so-called business-to-business or B2B, communication).

IV.   The RFID-Enabled Industries Era – This is more on the establishment Of RFID standards, RFID information networks, business agreements, and comprehensive security and privacy policies will solidify to the point where entire industries and supply chains can share appropriate information reliably, trusting that only authorized users can see any sensitive information.

V.   The Internet Of Things Era – This will be the final era triggered by widespread adoption of RFID technology and the associated demand for easier management of distributed sensor networks, as well as by a reduction in the cost of smart devices and tags.

4.9.   Future Supply Chain 2016

"The Global Commerce Initiative (GCI) Executive Board strongly recommends the implementation of RFID technology based on open, global standards. The Auto-ID Centre worked for several years on a

concept for RFID and the Electronic Product Code (EPC), which is the key identifier and content of the RFID tag. The establishment of a new organization, EPCglobal^{TM} was approved in September 2003 as a joint venture of EAN International and the Uniform Code Council. It is a not-for-profit organization entrusted by industry to establish and support the Electronic Product Code (EPC) Network as the global standard for immediate, automatic, and accurate identification of any item in the supply chain of any company, in any industry, anywhere in the world."

GCI is the single unifying force that brings manufacturers and retailers together and enhances global commerce and improves consumer value in the overall value chain. GCI's mission is to lead global value chain collaboration through the identification of business needs and the implementation of best practices and standards to serve consumers better, faster and at less cost. **GCI :** *Future Supply Chain 2016.* **Available at URL:http://www.gci-net.org/ (Accessed: 18th March 2008)**

Chapter Five

Analysis

"By the time you get to the analysis of your data, most of the really difficult work has been done. It's much more difficult to: define the research problem; develop and implement a sampling plan; conceptualize, operationalise and test your measures; and develop a design structure. If you have done this work well, the analysis of the data is usually a fairly straightforward affair". **Research Method Knowledge Base:** *Analysis Available* **at URL:http://www.socialresearchmethods.net/kb/analysis.php (Accessed: 20th March 2008)**

5.1.   Key Interviewers Point Of View

With the recommended standard pallet for the FMCG supply chain endorsed by ECR Singapore Council in February 1999, subsequently endorsed by ECR Asia began its ECR pilot from January to December 2000. The twelve months saw significant improvement and benefits in;

- ➢ Reduction in multiple handling
- ➢ Reduction of damaged goods losses through minimal manual handling
- ➢ Reduction in number of transportation trips
- ➢ Minimization of wastage of pallets
- ➢ Elimination of the need for sorting of pallets
- ➢ Reduction of unloading time for suppliers
- ➢ Reduction in warehouse storage cost
- ➢ Facilities the concept of shared assets
- ➢ Facilities regional trade and pallet pooling activities

Interviews with some key participants in manufacturing revealed two keys benefits on leasing of standard pallet:

- Elimination of the maintenance costs of pallets, as it will be borne by the pallet leasing company. Thus, reducing recurrent annual operational costs.
- Reduction of capital investment on owning pallets and thus improve cash flow

Distribution Centre like Glossary Logistics Singapore (GLS) enjoyed further benefits in:

- Improve in productivity creates better service for consumers.
- Streamlining of warehouse and distribution systems.
- Single material handling systems using only ECR Standard Pallet
- Save more time and labour in transferring goods to ECR Standard Pallet from other non-standard pallets
- Improved turnaround time for suppliers, so better dock utilisation
- Better utilisation of working capital and human resources

5.2. Implement RFID On ECR pallet

The ECR standard pallet went to a greater height by having implementing RFID on its leasing pallets. According to Ms Yap, the challenges were much more than the previous ECR implementing. Ms Yap commented RFID was a niche market to tap and there were unclear issues, like the EPCglobal protocols still under developing, the high costs of the RFID infrastructure, its middle ware and challenges in the system development. Technically it sounds great but practically it's a pilot test. Nevertheless, RFID technology was not as bad. Getting the right people was vital and could expect several changes on the way. The RFID pilot took closed to twenty-four months to complete due to most of the RFID components were from Europe. The reason was fewer RFID manufacturers that led to low

stocks level that face high demand. At times it may take few months for the RFID stocks to arrive.

Efforts were not wasted being the pioneer to successfully implemented RFID on ECR standard pallet. It helped the company gain market share.

5.2.1. RFID Impact on Supply Chain

In view of RFID impact on supply chain. The first ECR movement concept was adopted by Wal-Mart, world largest retailer, recognized as father of ECR. In the early 1980s, the North American continent was hit by a deep recession and consumer expenditures were declining. The ECR movement had successfully pulled the retail sector of the USA out of the recession in the early 1990s. August 13th 2003, Wal-Mart spokesman Tom William required all his top one hundred suppliers to be RFID tags in delivery and mandated by 2006 to be RFID compliance. Its mandate affected the downstream suppliers across Europe. It did not stop then, the RFID wave has saw further adoptions in the Asia country likes Thailand, Malaysia, Hong Kong, Taiwan, Philippine, China and Singapore. The RFID adoptions also saw the increase in other sectors in health care, pharmaceutical, aviation, automotive, military and logistics supply chain.

"As mentioned this time round, it was the father of ECR, Wal-Mart who initiate the RFID movement which make wave in the emerging technology in supply chain across the world and the vision is clear" said Ms Yap.

LHT ECR-RFID pilot was in small scale and only some KPI (key performance indicator) customers were involved in the pilot. The pilot was co-funded by Infocomm Development Authority Of Singapore (IDA) and working closely with the RFID working group of GS 1 Singapore.

5.3. Summary

The examination of the key interviewers and case studies on the ECR movement clearly showed a distinctive choice in the grocery supply chain. The ECR adoption requires the commitment from various trading partners within the supply chain, which is difficult to achieve since trading partners usually have different and conflicting objectives. There was also no consensus in the industry about benefits. Furthermore, ECR can bring forward new concepts that need to be examined and encourage the testing of new ideas, such as RFID technology which play essential in this emerging electronic business model. ECR can also be used for packaging working concepts into best practices so that the knowledge can be spread. ECR can thus be very useful.

RFID adoption is still at the beginning stage, and RFID adoption is not without obstacles. Retail industry participants face a variety of issues, both technical and cultural, that need to be solved before RFID can develop to its full potential as a driver of business efficiency and profitability.

The good news is that it has been demonstrated throughout the years, technical challenges almost always work themselves out over time and cultural resistance to new technologies tends to weaken as they become more standardised and widely deployed.

Chapter Six

Conclusion

The ECR movement was adopted in Singapore to improve supply chain operations in order to enhance consumers' satisfaction. The concept of ECR strategies aims to get companies across a supply chain to work closely to serve their customers better and at lower cost. Consumers benefit from improved product availability and choice, while distributors and suppliers derive better efficiency and cost savings. Enable pilots to develop open standard that is globally adopt by all business partners would be needed to allow seamless information flow and physical goods flow.

6.1.   Focus for Change

"Each year, the wood pallet industry provides over 400 million new wood pallets into a total pallet pool of over 4 billion pallets. Users of these wood pallets face two distinctly different options for acquiring the use of these pallets: they can purchase them, or they can rent them for a cycle through the supply chain, what is commonly termed a "pallet-trip." Since the rise of the rental pallet systems in the United States in the early 1990s, conflicting claims of the cost effectiveness, and especially the true total cost of a pallet in each type of system, have become a source of much contention in the industry". **Goliath *Supply-chain system costs of alternative grocery industry pallet systems* Available at URL:http://goliath.ecnext.com/coms2/gi_0199-5888827/Supply-chain-system-costs-of.html (Accessed: 5th July 2008)**

By reusing the ECR standard pallets from de-hire to re-hire and vice-versa, the pallet pooling system indeed reduce significant the amount of new wood supplied to the industry. However, a survey conducted by Price Water House Cooper noted that not all companies enjoyed benefits from leasing pallets. Some companies involved in this pilot project have difficulty in optimising the usage of pallets. Currently, companies are finding difficulty using ECR pallets for export companies are not experiencing the full benefits of using standardised pallets as

not all companies in the supply chain are using them.

6.2.   Future Development In Supply Chain Management

As an emerging technology, RFID is a currently often-discussed topic when process optimisation, efficiency gains and better supply chain visibility and integration are sought after. In the aftermath of large retail companies, Wal-Mart which mandated their suppliers to use RFID technology and apparently affected the downstream to follow. More and more companies consider RFID technology as a way to reach long term strategic objectives.

"RFID is not a silver bullet, but it is here to stay (and its use will continue to grow). **Sandip Lahiri (2006) *RFID Sourcebook: Closing Thoughts,* Pearson plc.**

 A lot of companies in the FMCG industry are still in the early stages of defining their RFID strategy. There still seems to be a lack of knowledge among companies on how RFID at the case and pallet level is likely to affect supply chain processes in the FMCG industry. One indicator for this may be the still-growing interest in conferences on RFID.

This study of the pilot project has shown that adopting standard pallets will increase efficiency to the supply chain by improving the productivity of the participating companies' activities. Standardisation of pallets provides the platform for pallet exchange. Goods can be transported from the manufacturer, through the distributor, to retail store on the same pallet. By eliminating the need for manual transfer of goods to another pallet, productivity and work efficiency are improved. The reduction in both labour and handling of goods will reduce delivery and transfer costs.

The study also goes further to explore the future development of standards by adopting the RFID technology in the supply chain. Despite the efforts of the two large standardisation bodies EPCglobal and ISO, differences in regional standards represent a hindering factor in global RFID supply chain applications. As discussed in the literature review, this order is widely regarded as superior. Therefore, RFID integration can be regarded as the logical next step in supply chain integration and supply chain management system development.

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APPENDIX A

FMCG Distribution Chain
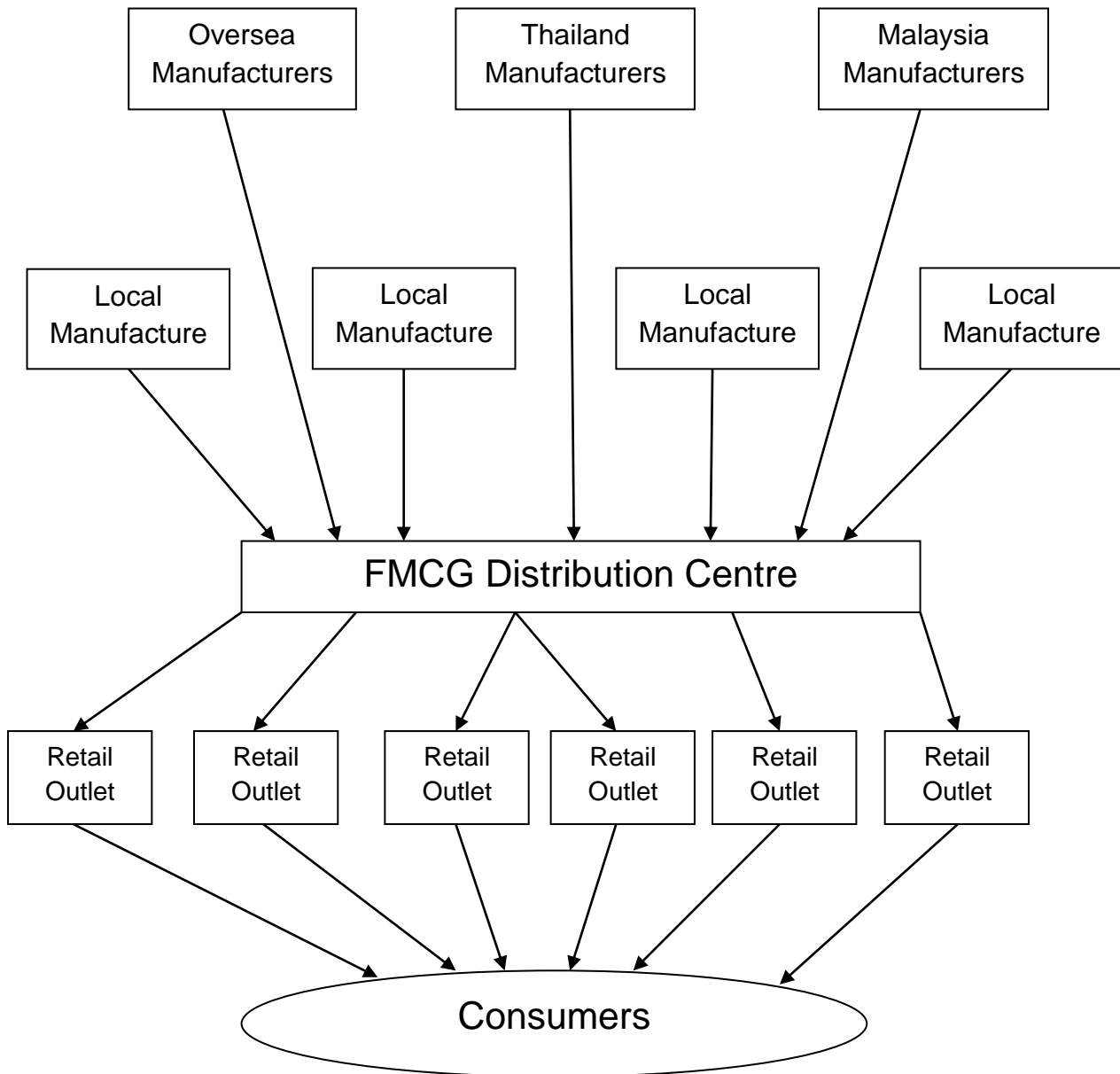
APPENDIX B

Types Of Operating Frequency

Frequency Band	Description	Read Range for passive tags	Application	Benefits	Drawbacks
125KHz to 134 KHz	Low Frequency (L.F.)	< 50 centimeters	• Access Control • Animal Tracking • Vehicle immobilizers • Product Authentication • POS Applications	Works well around water and metal products.	Short read range and slower read rates
13.56 MHz	High Frequency	< 1Meter	Smart Cards • Smart shelve tags for item level tracking • Library Books • Airline Baggage • Maintenance data logging	Low cost of tags	Higher read rate than LF
860 MHz to 960MHz	Ultrahigh Frequency (UHF)	< 10 Meter	Pallet tracking • Carton Tracking • Electronic toll collection • Parking lot Access	EPC standard built around this frequency	Does not work well around items of high water or metal content
2.4GHz	Microwave	< 10 meter	• Airline Baggage • Electronic toll collection	Most expensive	Fastest read rates

Note: Read range may vary due to environment conditions, surfaces tags are affixed to, and interference from outside sources. The above ranges are given to provide a guideline.

Air interface (frequency) standards
RFID frequencies are governed by the ISO 18000–RFID Air
Interface family of standards, and a complete set of standards was
released in

September 2004:
ISO 18000-1 – Generic Parameters for the Air Interface for Globally
Accepted Frequencies
ISO 18000-2 – for frequencies below 135 kHz
ISO 18000-3 – for 13.56 MHz
ISO 18000-4 – for 2.45 GHz
ISO 18000-6 – for 860 to 960 MHz
ISO 18000-7 – for 433 MHz

APPENDIX C

RFID Infrastructure