



RETURNABLE PACKAGING AS PART OF REVERSE
LOGISTICS IN THE AUTOMOTIVE PART INDUSTRY

By
MS. SIRIPEN BOONKAEW

A Proposal of the Six-Credit Course
SCM 2202 Graduate Project

Submitted in Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN SUPPLY CHAIN MANAGEMENT

Report SCM2202

Martin de Tours School of Management
Assumption University
Bangkok, Thailand

May 2011

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Martin de Tours School of Management
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May 2011

Assumption University
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Master of Science in Supply Chain Management

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I, Siripen Boonkaew, declare that this thesis/project and the work presented in it are my own and has been generated by me as the result of my own original research.

RETURNABLE PACKAGING AS PART OF REVERSE LOGISTICS IN THE AUTOMOTIVE PART INDUSTRY

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ABSTRACT

The automotive industry is affected by the world recessive economy, consumers' purchasing power decrease, so it is hard to generate sales in this difficult situation. The only way to survive and maintain profits is cost and expenses reduction in the supply chain. Applying reverse logistics concept through implementation of returnable packaging in the outbound logistic between distribution centre and dealerships can reduce packaging expenses for a company. In addition, utilizing running empty trucks to pick up empty returnable packages from dealerships to the distribution centre creates more transportation efficiency.

The purpose of this project is to explore knowledge of reverse logistics and reduce cartons consumption and purchase amount. The result of this study provides guidelines and suggestions for the company for decision making in the implementation of returnable packaging.

The result from trial period indicated that consumption of cartons reduce 34,528 pieces to 12,672 pieces or 63 percent in average. Packaging cost of cartons also reduced drastically from 319,278 baht to 110,728 baht or 65 percent. With this reduction, the company can cover an initial investment for returnable packaging and operating cost within 1.93 years.


The conclusion of this project is that the company in this case study should implement returnable packaging as a strategic tool to reduce packaging consumption and expenses in outbound logistic.

ACKNOWLEDGEMENTS

I would like to convey my special thanks to my project advisor, Dr. Peeratarat Ittarattanachoke for excellent support and recommendations. Without his dedicated contribution, I might not have been able to complete my graduate project.

I would also like to thank my supervisor and my colleagues in the warehouse and transportation who supplied me with information.

Lastly, a big thanks you to my family and friends, who were always by my side, encouraging me to pursue my best efforts to finally complete my graduate project and receive the Master's Degree.

The logo of Assumption University of Thailand is a circular emblem. It features a central shield divided into four quadrants: top-left (blue with a white lily), top-right (white with a blue sailboat), bottom-left (white with a blue star), and bottom-right (red with a white cross). The shield is flanked by golden laurel branches. Below the shield is a golden banner with the Latin motto "LABOR OMNIA VINCIT". Above the shield, the letters "A M" are visible. The outer ring of the logo contains the text "ASSUMPTION UNIVERSITY OF THAILAND" at the top and "มหาวิทยาลัยอัสสัมชัญ" at the bottom, with "SINCE 1969" in the center of the bottom arc. Two small golden stars are positioned on the left and right sides of the bottom arc.

Ms. Sirip en Boonkaew
Assumption University
May 2011

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CHAPTER I

GENERALITIES OF THE STUDY

Recently, the automotive industry was faced with a sales drop in every region in the world. This was due to the oil price rising dramatically and the financial crisis which affected many industries and were created the world economic down turn. Car manufacturers in Europe and North America and Asia offer strategic campaigns to boost sales as much as possible.

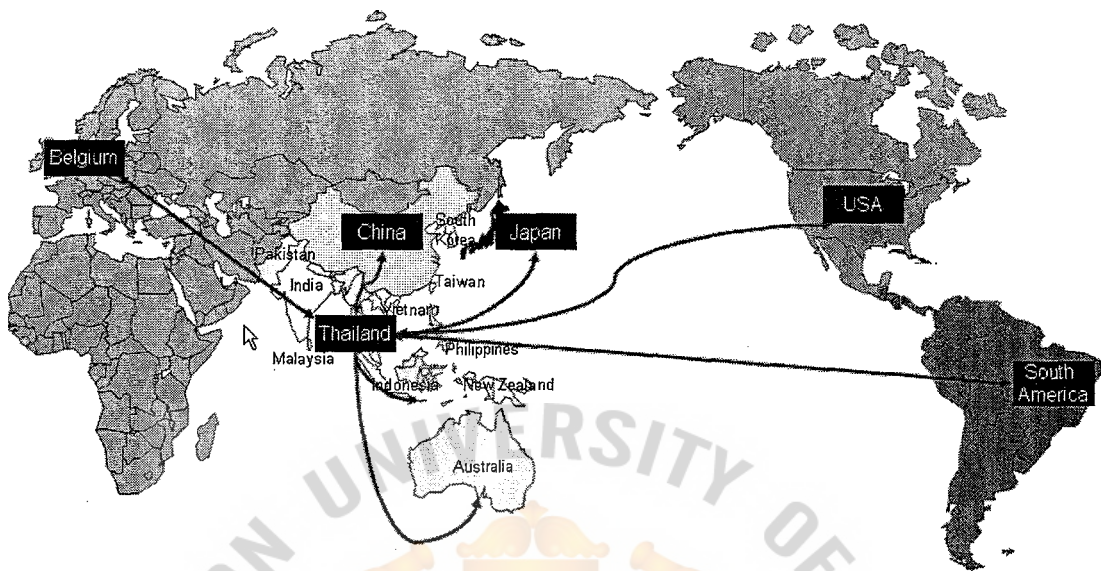
Thailand as the automobiles manufacturing base had also been affected. Markets, both domestic and export were slowing down. Although many promotional activities had been launched, consumers' purchasing power decreased. Also finance firm were strict for approval of financial leasing for vehicles resulting in the car market expected to slowing down continuously.

It is not only car makers that were affected by the world economic recession, but also the auto parts manufacturing which is known as OEM (Original Equipment Manufacturing) and other businesses throughout the supply chain. While sales are difficult to boost up, many firms' look for cost reduction strategies and methods in order to survive in a difficult situation and some found their value added and sustainable profitability from their efforts in the supply chain management.

The reverse Logistics which is included in the supply chain is one of the methods that industry has discovered. It is all about the recycling and reuse of products and materials. Besides increasing environmental responsibility awareness, many companies realize benefits of recycling and reusing products and materials (Kroon & Vrijens, 1994).

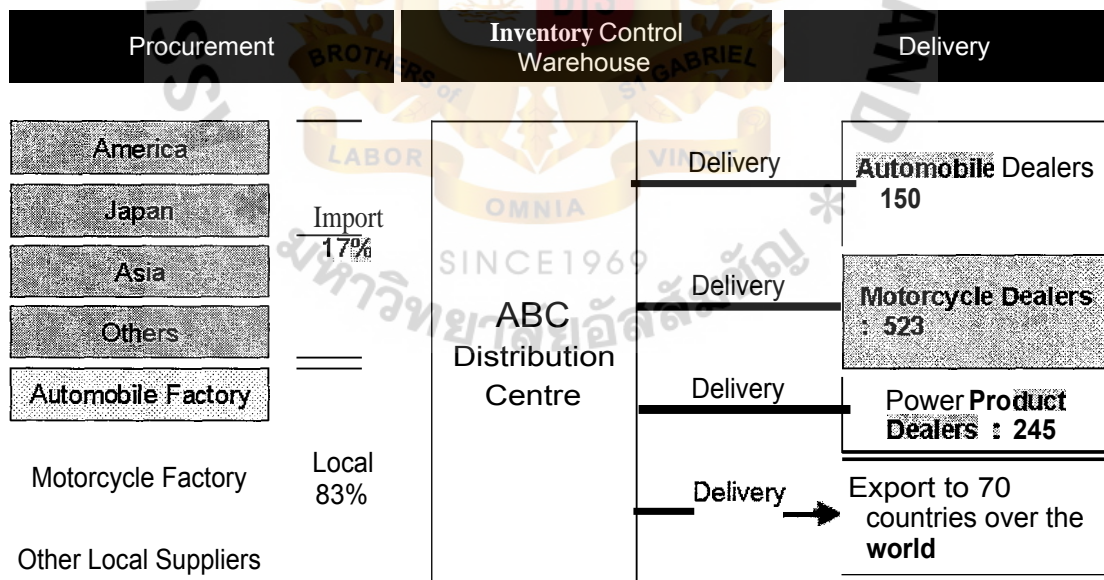
Contrary to quick-fix cost saving methods, such as reducing payrolls by layoffs or using substandard materials, which will not last long, reverse logistics provides strategic cost saving and sustainable developments (Dowlatshahi, 2000). In this case

Figure 1.2 Global Markets



Source: ABC Company

Figure 1.3 Parts Supply in Thailand

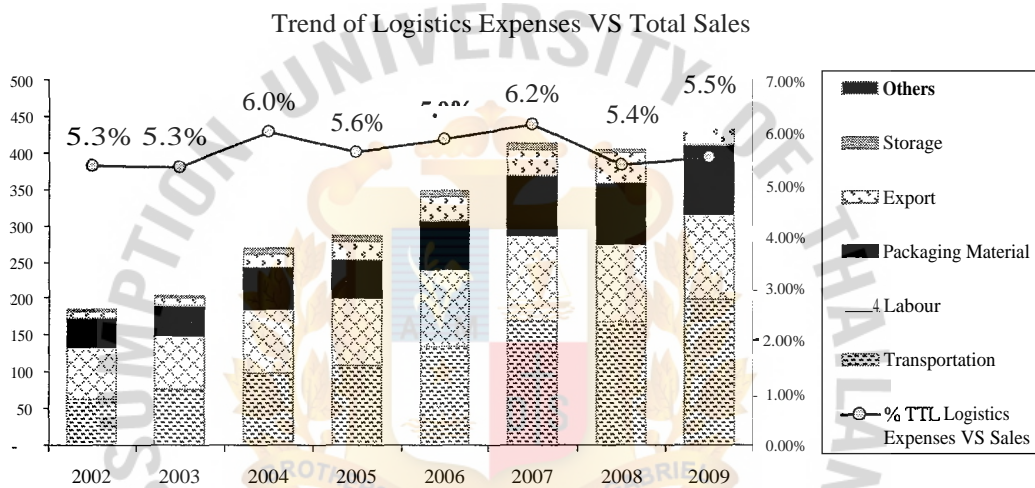


Source: ABC Company

During the recent economic recession, the ABC Company has been finding ways to reduce cost in order to survive and stay competitive in the industry. As mentioned earlier, one of the main responsibilities of the ABC Company is to manage the

distribution of spare parts of automobiles, motorcycles and power products nationwide. Therefore, almost all the cost of ABC company come from logistics activities which comprise of labor cost of warehouse operations, storage, inventory management, freight transportation and packaging materials. Trend of logistics expenses of ABC Company had been increased continuously as demonstrated in Figure 1.4

Figure 1.4 Trend of logistics expenses VS Total Sales

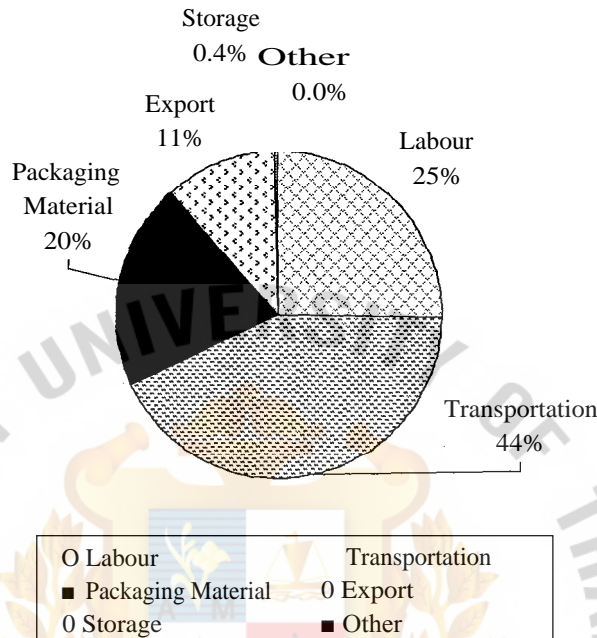


Source: ABC Company

Expenses by category included 44 percent of total logistics expenses shared by transportation cost, 25 percent shared by labor cost, 20 percent shared by packaging material, 11 percent shared by export expenses and very small portion shared by storage cost and others cost as demonstrated in Figure 1.5

Figure 1.5 Logistics expense in 2009 shared by category

2009 Logistics Expenses Share by Category



Source: ABC Company

Transportation expenses are major expenses for logistic. If reduction of expenses is carried on it may hardly succeed because current transportation is managed by the third party logistics who have already offered the best cost and got this job when the company conducted annual bidding. Labor expense category is sensitive as it is concerned with labor unions which produce negative response from both the internal and external organization. Packaging material is one of three major logistics expenses. In this category it is most possible to reduce cost and it has the more strategic value.

1.2 Statement of Problem

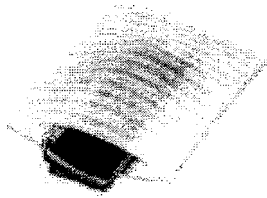
Recently, the head quarters in Japan had released the company mission in 2020; one of key mission is to be an environmental friendly company. All affiliates globally are required to adopt the head quarter policy. The ABC Company, an affiliate in Thailand

accepts the head quarter's policy by finding ways to reduce cost that are in line with an environmental friendly scheme

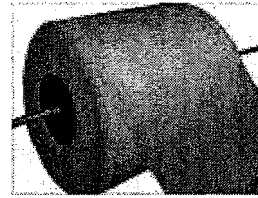
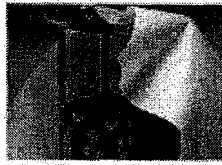
In the review of packaging material, the possible way to reduce cost with is concerned with reducing natural resources such as paper. Currently, there are 8 categories of packaging materials used at the distribution centre which consist of cartons or corrugated boxes, paper pallets and paper cases, air bubbles, labels and printer ribbons, OPP tape, form sheets, PP bands and anti-rust bags. Figures 1.6 illustrate samples of packaging materials.

Figure 1.6 Samples of Packaging Materials

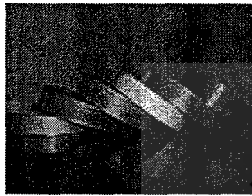




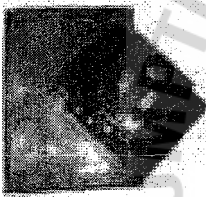
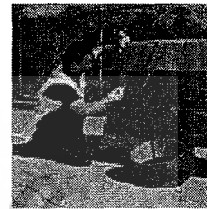
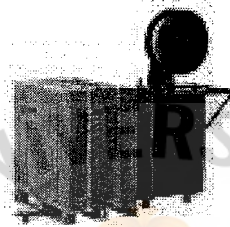
Form sheets



Form rolls

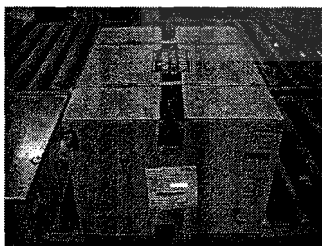


PP Band



Anti-rust bag

Source: Retrieved October 20, 2010, from
http://www.google.co.th/images?hl=th&source=imghp&q=carton+boxes&gbv=2&aq=f&aqi=g3&aql=&oq=&gs_rfai=



Finished Packaging

Source: ABC Company

Table 1.1 indicate that the ABC Company spends about 98 million baht in 20.09 and the major cost for packaging materials come from cartons that account for 57 percent of the total packaging material costs. In terms of quantity, cartons consume about 5 million boxes which could create thousands tons of waste on the landfill.

Table 1.1 Purchase Amount of Packaging Materials

Description	Quantity (pcs.)		Purchase Amount (Baht)	
Carton	5,346,268	11%	55,432,358	56%
Paper case & pallet	12,120	0%	16,107,280	16%
Air Bubble	1,766,579	4%	11,226,426	11%
Label & Ribbon	40,849,754	81%	7,423,236	8%
OPP Tape	183,266	0%	2,448,938	2%
Foam	654,700	1%	2,318,123	2%
PP Band	2,300	0%	944,000	1%
Anti Rust (bag)	1,521,478	3%	490,592	0%
Grand Total	50,433,516	100%	98,186,930	100%

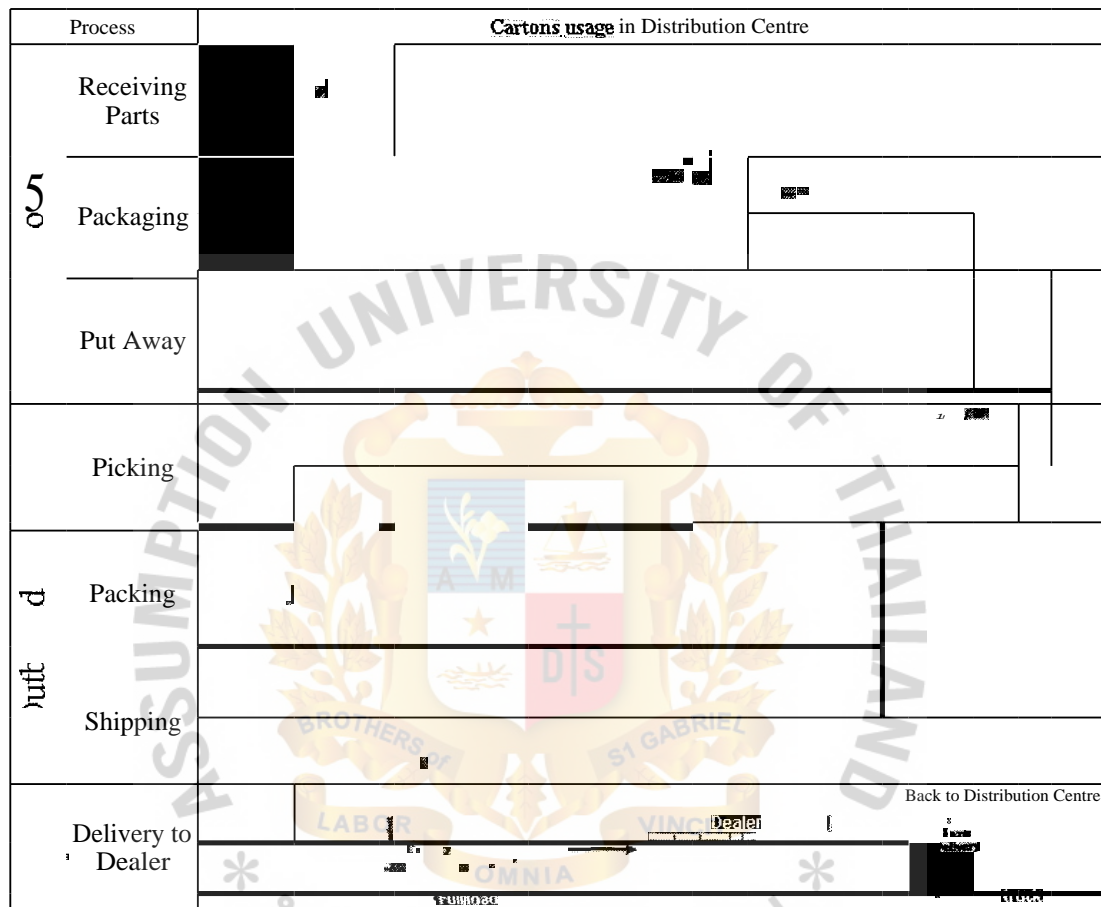
Source: ABC Company

Cartons are used for both inbound and outbound logistics activities. Inbound activities; include supplier delivery parts to the distribution centre and unloading it at the receiving area. Those parts then move to the sealing area. At this process, all pieces of parts are packed for storage purposes. Small and medium parts are packed into plastic bags or cartons according to packing standards. After finishing at the sealing process, those packed parts are moved to the shelf and stay until parts are allocated for some specific order from dealer:

Order received from dealers can be in full case or broken-case quantities as the nature of spare parts businesses. Orders from dealers are usually mixed orders because one broken car may require only one piece of element air or spark plug. Outbound activities start when the picking slip is issued. Operators pick parts from the shelf and it move to the packing area. For full case order, operators only print labels and shipping document attached with the case, but broken-case order require more processes. Pieces of parts and small cartons of broken-case order are combined and

packed into a bigger carton for ease of handling and can be used as one-way packaging from transport to dealers.

Figure 1.7 Carton usages in Distribution Centre



Source: ABC Company

The above mentioned inbound and outbound logistics activities consume about 5 million cartons pieces per year. As it is a one-way packaging, it creates thousand tons of waste and results in a problem of pollution and waste disposal.

Reducing consumption of carton seems to give positive results in term of reduction in purchase and less damage to the environment. This is a reason why packaging materials has been addressed as one of the strategies to be aligned with the head quarter policy and achieve the company cost reduction goals.

1.3 Research Objectives

During the recent economic down turn, the company faced with a difficult situation to boost up sales. Logistics expenses; transportation, warehouse labor cost and packaging material costs, increase continuously. The ABC Company had been finding ways to maintain profit in order to survive and stay competitive in the industry. Additionally, the company is required to adopt the environmentally friendly policy, where is the policy from the head quarters in Japan. Reducing consumption of packaging material is one of the best ways possible ways in responded to the headquarter policy and reduce costs.

This project attempts to attain two objectives which are as follows:

1.3.1 To explore the reverse logistics practices for the return trip of returnable packaging utilized in outbound logistics

1.3.2 To be able to reduce packaging material cost and consumption by utilizing returnable packaging

1.4 Scope of the Research

This case study focuses on returnable packaging for outbound logistics at ABC Company. The last three months consumption of cartons of outbound transportation to dealers all nationwide is used as the database for analysis and evaluation. The criteria used for the case study are the reduction of consumption and cost of cartons, one of packaging materials used in ABC Company.

The financial analysis is the methodology to be used in this study and provides details of the purchase amount of packaging materials in the latest 3 months, carton consumption in outbound logistics and items of carton to be replaced by returnable packaging.

1.5 Significance of the Study

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This study enhances the knowledge and awareness of applying reverse logistics practice for returnable packaging utilized in outbound logistics of APC Company. The results obtained from the study can be used as a guideline and suggestion for the company for decision making in the implementation of returnable packaging.

Expected results of applying reverse logistics practices for return trip of returnable packaging is the reduction of cost and consumption of packaging material in outbound logistics. The lesser packaging materials, the less damage to the environment. Lastly, this study can be used to provide knowledge in any business that is looking for a practical application that helps companies maximizing profit and sustainable development scheme.

1.6 The Definition of Terms

Broken-case order is an order placed by dealer in which the order quantities do not reach packaging lot size.

Full case order is an order placed by dealer in where the order quantity reaches packaging lot size.

One-way packaging is a onetime used packaging. It is usually disposed after it has been used once.

Returnable Packaging is one of the packaging materials which can be used more than one time in the same form. The ABC Company expects to use this as a tool to reduce cost and consumption of the cartons.

Reverse Logistics is a backward flow practice that the ABC Company uses for the return trip of packaging materials from the dealer to the distribution centers.

CHAPTER II

REVIEW OF RELATED LITERATURE

In this chapter, literature review is presented in 9 parts as per the following;

2.1 Reverse Logistics

Reverse logistics, this wording is not new and it has long been paid attention to over the years and gained increased interest recently. Dowlatshahi (2000) stated that reverse logistics is a process in which the manufacturer accepts the recycling or reusing, remanufacturing or disposal of delivered products or parts from the market.

Reverse logistics also refers to abilities to manage the logistics and activities related to reducing, managing and disposing of both dangerous or non-dangerous waste from products and packaging which can be applied to many logistic processes both material management and the physical distribution which are potential areas of application (Kroon & Vrijens, 1994).

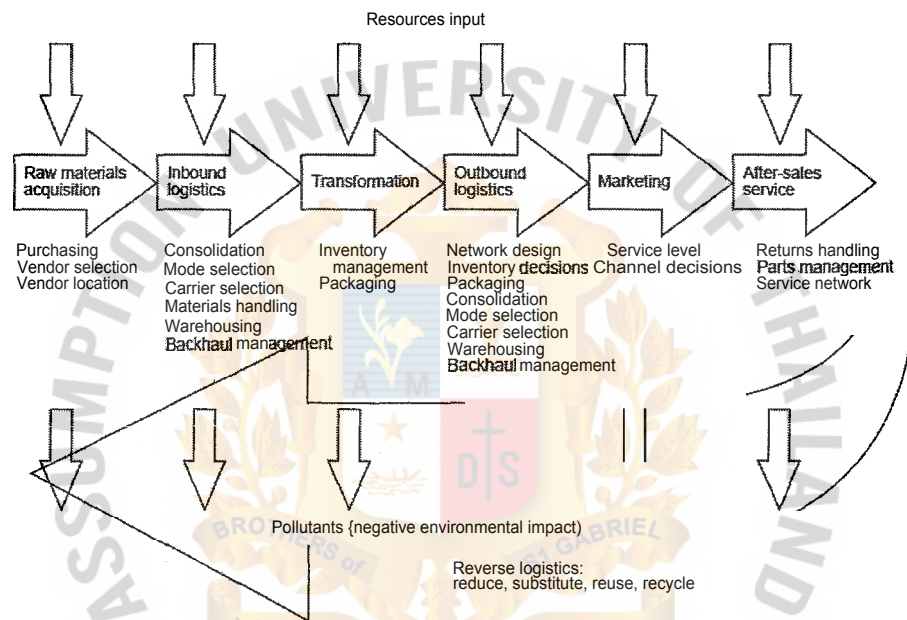
Additionally, Wu and Dunn (1995) mentioned that activities or efforts that reduce these reverse flows are considered as parts of the reverse logistics system which includes packaging wastes' shipments, recyclable packages, and customer returns in the logistics system. Figure 2.1 shows the reverse of logistics flow and the principle of reverse logistics: reduce, substitute, reuse and recycle.

Reverse logistics focus is on the reduction of source and substitution by reusing and recycling.

- Source reduction is to do the same things with less resources.

- Substitution is the replacement of materials that create waste at the end of its life and using more environmentally friendly materials.
- Reuse means utilizing the same item many times in the same form for fewer disposals (Wu & Dunn, 1995).

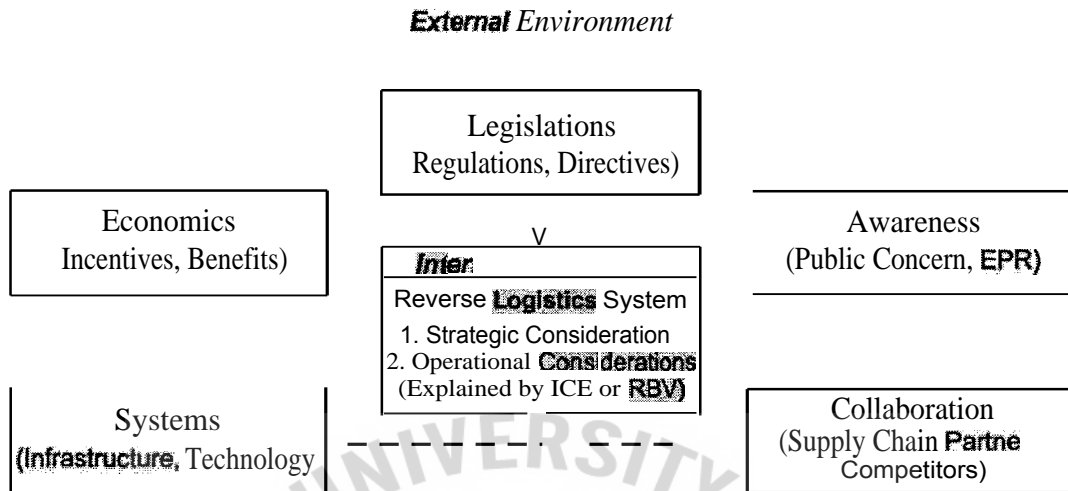
Figure 2.1 Reverse logistics in the logistics system



Source: Wu & Dunn (1995)

Many industries are forced to implement reverse logistics. Lau and Wang (2009) studied factors that influence the implementation of reverse logistics system in China. Five factors derived from the literature, consist of awareness such as public concern, legislations such as regulation, economics such as benefits and incentives, systems and collaboration from supply chain partners or competitors. Figure 2.2 illustrated how five factors are related.

Figure 2.2 Conceptual models of factors affecting reverse logistics system



Sources: Kenmeyer et al. (2002)

Whatever the factors are, it's clear that by using reverse logistics, the firm can make profits by reusing, recycling or remanufacturing their products or packaging while maintaining in the environment and achieving the sustainable development. Reverse logistics is a practice in many industries.

2.2 Packaging

Packaging can be defined as "all products made of any materials of any nature to be used for the containment, protection, handling, delivery and preservation of goods from the producer to the user or consumer. (http://www.ni-environment.gov.uk/waste-home/regulation/regulations_packaging/definition_of_packaging)

Lockamy (1995) defined packaging as an essential element of domestic and international trade and business. Functions of packaging consist of six parts; which are containment, protection, apportionment, unitization, convenience and communication. These functions impact the product design, manufacturing, transportation, distribution, warehousing, marketing and is also linked to a company's competitive edges.

Sara (1993) stated that there are two different important functions of packaging related to products. Protection and containment of product from factory to end user is one and the other is an essential tool in the marketing mix which must attract customer's attention when it stands out on the supermarket shelf, create customer's impression and sell the product into customer's trolley.

2.2.1 The three major packaging categories

Opportunities for reducing the amount of material used in packaging systems vary, depending on the type of packaging involved. There are three categories of packaging, which may overlap:

- **Primary or consumer packaging** is the basic package which contains a product such as coke can, wine bottle, seasoning powder box) and is used by the end user until that product is all consumed. It is very important that primary packaging is well-designed in order to contain and protect the product itself and at the same time to catch consumers' attractions which finally could stimulate sales
- **Secondary packaging** is somehow different from primary packaging as it is an additional packaging designed to make self-service sales easier, to prevent shoplifters, as well as to advertise and market the product. Another function of secondary packaging is to facilitate use by the consumer e.g. Coke can case, six-pack in a case). Usually secondary packaging is disposed when the product is opened.
- **Transport or distribution packaging** is used to deliver goods from a factory or farm, to its destination, manufacturers, wholesalers, retailers, or consumers. The examples of distribution packaging are pallets, boxes, banging and crates. The key factor whether to use distribution packaging or not is emphasized on protective functions such as handling, opening, closing and shipping. The box or crate which protects and contains the product is also known as the shipping

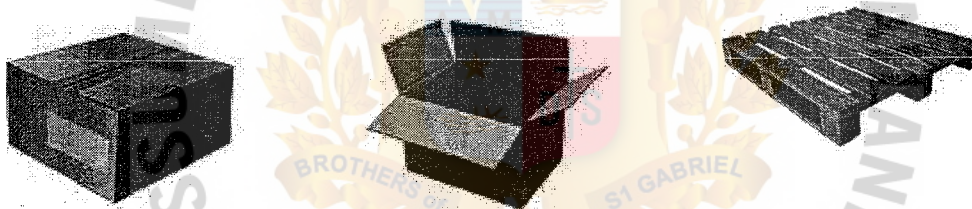
container. It could be designed either for single or multiple uses (Saphire, 1994).

This case study is concerned with transport packaging which contains pieces of spare parts from distribution centers to dealers.

2.3 One-way Packaging

Over the years, cardboard boxes, carton or corrugated boxes are used as secondary packaging material. Since these can be use once, it is defined as one-way packaging (Kroon & Vrijens, 1994). One-way packaging can be made out of other materials, for example wood and it is usually disposed after it has been used once.

Figure 2.3 Example of one-way packaging



Cardboard boxes, Carton or Corrugated boxes Wood Pallet

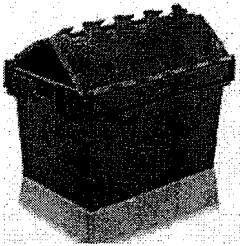
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2.4 Returnable Packaging

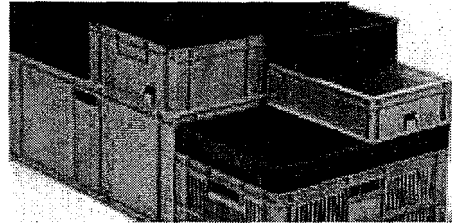
Kroon and Vrijens (1994) stated that returnable packaging is a type of secondary packaging that can be used many times in the original form.

Returnable packagings are of various types. There are many shapes, size and materials. It can be designed to fit any specific need.

Figure 2.4 Examples of Returnable Packaging/Containers



Attached Lid Container



Stacking Containers



Bulk Container



Folding Containers

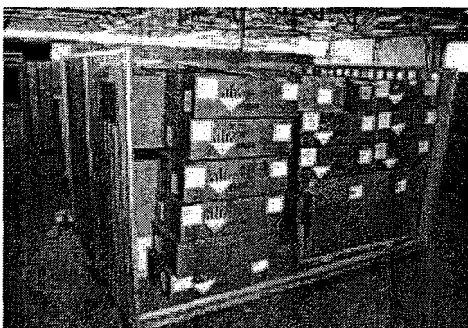
Source: Retrieved October 21, 2010, from <http://www.linpac.com>



Collapsible Returnable Racks



Source: Retrieved October 21, 2010, from <http://www.cm.thaiconst.com>



Collapsible Returnable Racks (Whirlpool Corporation)

Source: Retrieved October 21, 2010, from <http://www.choosereusables.org>

Although the costs of returnable container is higher than one time-use packaging, if a returnable container is reused multiple times, the cost per trip of returnable container becomes cheaper than one-way packaging (Rogers & Tibben-Lembke, 1999).

Saphire (1994) reported that whatever reusable containers are made of i.e. corrugated cardboard or other materials such as plastic. Reusing them can reduce the amount of materials used to ship and reduce waste into waste stream. For example, through its returnable lifetime, a 2-cubic foot plastic reusable shipping container weighing 5.5 pounds and making 250 trips is replaced by 1.5-pound single-use corrugated boxes weighing a total of 375 pounds. The waste from the single-use containers could be 98.5% more than the reusable containers compared in weight (5.5 pounds versus 375 pounds).

Any companies which use large numbers of containers could benefit a lot from reusable containers as shown in Figure 2.5 A company that ships 1 million shipments a year could cut 50% of the total weight of containers if that company uses those containers twice and could be up to 70% if the company decided to change to heavier corrugated containers which could be used 5 times instead of 1. The same company could reduce the containers' total weight by 98.5% if it decided to switch from single-use corrugated boxes to plastic containers as plastic containers can be used up to 250 times. The reason why the total material's weight is important is because it shows the amount of material which must be recycled or disposed of at the end (Saphire, 1994).

Figure 2.5 Comparing number of boxes, weight of boxes, and total weight of boxes.

Materials made 1 million shipments of equal volume in one-way and reusable corrugated boxes and reusable plastic boxes.

Box material and number of times used	Number of boxes used for 1 million shipments (thousands)	Weight of box (pounds)	Total weight of box material used per million shipments (tons)
One-way corrugated, one time	1,000	.5	750
One-way corrugated , two times	500	1.5	375
Reusable corrugated, five times	200	2.2	220
Reusable plastic , 250 times	4	5.5	11

Source: Saphire (1994)

Saphire, (1994) reported that the distribution packaging system in the United States clearly shows that by using returnable containers the company's costs can be reduced as seen in Figure 2.6 Compares to the cost of three types of shipping containers, the initial cost of a single-use corrugated container is 95.2 percent less than the initial cost of a reusable plastic container. However, if the plastic container can be used 250 times, the reusable container costs 91.7 percent less' per use than the single use corrugated container. However there are many factors which need to be taken into consideration apart from the cost of packaging when we decide to use either single use or reusable transport packaging such as protecting issues, shipping container issues or number of distribution activities which the products have to pass through, etc.

Figure 2.6 The comparison of one-way and reusable or returnable 2-cubic feet of shipping container's lifetime cost.

	Corrugated One-way	Corrugated Reusable	Plastic Reusable
Weight (pounds)		2.2	5.5
Initial cost	1.5	\$1.06	\$11.03
Estimated life (number of trips)		5	250
Cost per trip (average)	\$0.53	\$0.21	\$0.044

Source: Buckhorn, Inc., Milford, Ohio 1991

2.5 Returnable packaging as a part of Reverse Logistics

Wu and Dunn (1995) explained that attempts to reduce reverse flows are considered as part of the reverse logistics system because they reduce the total of waste in the system. In this context, the returnable packaging is considered as the reverse logistics in terms of reuse. It can be employed multiple times in its original form.

Nowadays, both product quality and packaging design are improving in order to enhance competitiveness. Some companies design protective packaging resulting in consuming more materials and higher transportation costs. Moreover, enhanced environmental regulation are pushing companies to reduce, reuse, recycle packaging

materials which is considered as a part of reverse logistics and it becomes the best practices in many industries.

For example, in the automotive industry, Toyota works together with their suppliers collaboration and logistics to improve packing and reusable metal shipping containers rather than disposable cardboard and wood pallets (Nunes & Bennett, 2010)

Wu and Dunn (1995) explained that there will be a growth of reusable and returnable packaging, and regular one-way logistics will be adapted to handle reverse logistics. In Denmark, all beverage companies are required to reuse their containers for years. Distribution centers and retail stores must handle pickups of reusable packaging and delivery of normal goods. With reverse logistics, vehicle routing planning will become more complicated, and longer lead time of delivery due to pickups time is included.

2.6 Benefits of Returnable Packaging

McKerrow (1996) stated that there are economic benefits of utilizing reusable packaging. Using reusable packaging can reduce product damage; improve vehicle utilization, especially for mixed loads, ease of handling and stacking at break-bulk. The most obvious cost saving are the purchasing reduction and waste disposal costs of one-trip packaging.

Twede (2003) stated that benefits of returnable crates can be divided into two groups, one is economical benefits and another is operational benefits. In term of economical benefits, the cost of re-purchasing packaging can be saved. In term of operational benefits, this can be done through its functional designed which provides the ease of use, handling, stocking and unpacking. Automation can also be used which leads to the reduction of logistical operation costs since saves transportation costs and storage spaces.

Kroon and Vrijens (1995) mentioned about the result of an ecological comparison between one-way packaging and returnable packaging investigated by the

Frauenhofer Institute, which specializes in studies of material flows and packaging logistics, in 1993. It can be seen clearly that returnable containers are more environmental friendly as they are used several times more than normal containers which are used only once.

Maslennikova and Forley (2000) explained and clarified how Xerox Europe could save 4 million a year by only changing from normal packaging to reusable packaging advised by its supplier. In 1990, Xerox noticed many advantages by using reusable packaging therefore they started to standardize their packaging worldwide. The changes are as follows: two standard reusable Euro-pallets replaced their existing 25 pallet styles, designed and launched eight standard modular to replace 8,000 sent by suppliers, established packaging reuse centers in the UK, the Netherlands, and the US.

Saphire (1994) mentioned about the benefits of reusable shipping containers or returnable packaging in manufacturing and supermarket industries.. Automotive, electronic goods and appliance manufactures together with their suppliers have come and worked together in order that their suppliers can ship parts in reusable containers. For example, Toyota, Japan's largest car manufacturer began making cars in the United States in 1988. Toyota implemented its reusable shipping container system by using three keys features as follows.

- Redesign and standardize their current containers and pallets to maximize transportation space vehicles.
- Create containers that perfectly fit into its assembly-line operations
- Choose reliable carriers which run daily deliveries, pickups of empty containers and hauling back of containers smoothly.

As a result of using reusable shipping container, Toyota can save at least in two areas which are reduction in freight cost more than \$3 million yearly and unnecessary disposal costs.

Another example in retails industries is the Bergen Brunswig Drug Company in Orange, California; the company replaced one-way corrugated cartons with 120,000 returnable plastic containers. The company has 37 distribution centers and has to ship

their goods to around 10,000 pharmacies which are located in 40 states. Utilizing returnable plastic containers resulted in saving the company's money for packaging and labor. It also increased truck space utilization, which fitted to Brunswick's new automated distribution centers (Saphire, 1994).

2.7 Cost of Utilizing Returnable Packaging

2.7.1 Cost of Returnable Packaging

Wu and Dunn (1995) explained investments on returnable containers make working capital tied up in the logistics stream. The faster cycle time of returnable packaging usage, the better the system performance can be improved.

2.7.2 Transportation Cost

Transportation cost can be divided into two parts, transportation for carrying products from manufacturer or distribution center to retailer or market and the return transportation of empty packaging or containers.

Rogers and Tibben-Lembke (1999) stated that changing to reusable containers was heavily affected many company's costs like handling, transporting, and tracking shipments and materials costs. Transportation costs are a major obstacle for reusable containers. Because shipping costs can be weight-related, returnable containers are sometimes heavier than the corrugated materials or cardboard boxes they previously replaced. This could cause higher costs in outbound transportation. If trucks are over weighted, it means that fewer containers can be put on each truck which also results in higher shipping costs. But in some cases, reusable containers can reduce the costs of transportation. The strength of reusable container, allows double-stacking, unlike the expendable corrugated or cardboard boxes which were replaced. The other major transportation cost is the backhaul transportation of reusable containers. If the containers are sent to the customers on company trucks, bringing the empty containers back can cause an increase in transportation costs which may be high enough to make the use of reusable uneconomical

2.7.3 Other Costs of Utilizing Returnable Packaging

Wu and Dunn (1995) explained that additional storage space and handling equipment are needed to handle those returnable packaging back which definitely increases the logistics cost. However, manufacturers normally add the extra packaging costs into their products and charge it to their customers already. Therefore the supply chain cost can be reduced because reusable packaging can be used several times and disposal costs can also be reduced.

Many companies forgot to consider other costs involved in a returnable process. Other costs are forward transportation, reverse transportation, cleaning, inventory, inspection, cleaning, repair cost and costs when applying for future use (Rogers & Tibben-Lembke, 1999).

Utilizing returnable container or packaging requires some maintenance. When the packaging is returned to the distribution centre, it needs the inspection to prevent the use of damaged packaging. Furthermore it needs to be cleaned before they are reused. Container inventory management must also be considered. The companies who implement the returnable packaging have to maintain the supply of empty packaging and prepare storage space. Additional labor cost for controlling returnable packaging increases as well.

2.8 Ownership of Returnable Packaging

There are several ways to be owned returnable packaging.

Owned by Manufacturer

Manufacturers who own the returnable packaging are responsible for recovering and filling the empties from his customers. A good example of this case would be the UK's food producer, 40x32 inch pallet pool in the UK which we referred to earlier; all the pallets are marked and never changed the ownership to others.

Owned by Customer

In this case packaging is owned by the receiver who returns the returnable packaging to the suppliers. Some automotive assemblers could be very good examples. This would apply where the equipment was produced specifically such as a body parts' rack. Although, if some suppliers produce common or same products to many customers, they must think carefully about the costs of the packing process, storage cost and transportation costs.

Jointly owned

For jointly owner, agreements must be stated by an industry association or independent organization. The agreements could be in many areas such as maintenance, cleanliness, etc. Then users may buy sufficient equipment, exchange or sell among themselves. The good example could be the Europallet pool. However the problems could rise as the size of company grows and as the equipment ages. When the internationalization begins, the Europool starts to cause some problems due to differing quality of pallet purchases and implementation of repair standards (Mckerrow, 1996).

2.9 Success factor in the past practices

The features of systems compatible with reusable shipping containers are important. Reusable shipping containers generally work best when the following features are present. These features may overlap:

- **Short distribution distances** It is clear that shorter distances need lower back hauling costs and also be returned containers to their suppliers faster.
- **Frequent deliveries** mean that empty containers are ready to be collected at the time of delivery are result in inventory which turns over very quickly. Therefore it is possible to minimize the number of containers kept in the storage and reduce the cost of purchasing new containers and maintenance.

Small number of parties It is obvious that companies can control the number of the containers returned easily as the number of parties are small. One example of this case could be a small bakery store. A bakery can send a cake directly to a grocery store without intermediate storage in a warehouse.

Company-owned vehicles if companies own their own vehicles, there is no extra charge for returning the shipping especially when vehicles would otherwise return empty containers back to the companies after completely delivery. Companies may work with delivery companies to send their products to and from the customers (Saphire, 1994).

According to the literature review, reverse logistics is a practical concept that many industries can adopt. However it is not easy to adopt this reverse logistic successfully without taking the following into consideration i.e. transportation cost, delivery frequency, number of parties involved and etc. It has also been proved that using returnable packaging can benefit many companies in term of profits, environment and sustainable development.

CHAPTER III

RESEARCH METHODOLOGY

This chapter will guide the readers through the research methodology. The section will include methods of research used, data collection, initial investment and investment decision for this project, review of company's current outbound logistics processes, and new outbound logistics processes for handling the return of empty packaging between distribution centers and dealers as a method to fulfill research objective. The last part includes a summary of the expected results.

3.1 Methods of Research Used

This research study used a financial analysis to evaluate the economic feasibility of returnable packaging utilized in outbound logistics at the ABC Company. There are visualized tables, figures and analytical information for easy understanding the current situation in the company. The objective of the study is the result that provides the realistic outcome which enables the company to make decision in the returnable packaging implementation.

3.2 Collection of data

The research study concentrates on the purchase amount and consumption of packaging materials in the cartons category, focusing on outbound logistics processes in order to select the applicable items to be replaced by returnable packaging. To be accurate and realistic, the data of the last three months is used in this study.

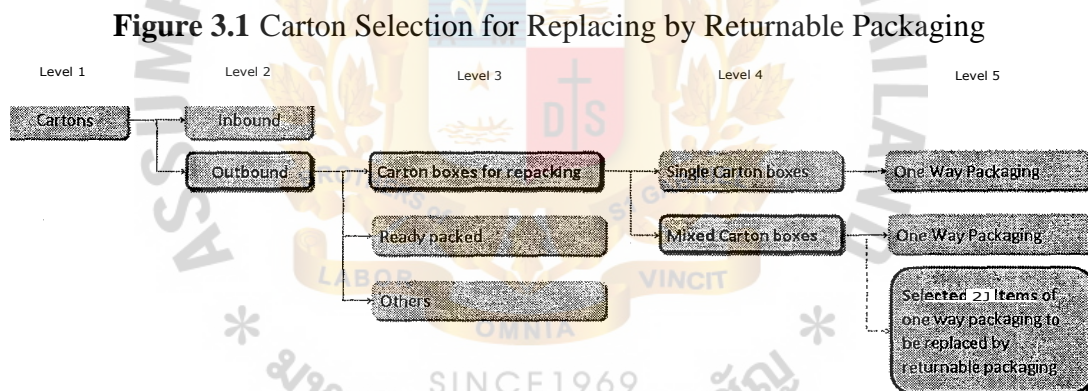
Required data used in this research study are listed as per the following;

1. Purchase quantity and amount of packaging materials
2. Carton unit cost and consumption in outbound packaging
3. Items to be replaced by returnable plastic packaging

4. Initial investment and investment decision techniques

3.3 Selection of Items to be replaced

This study aims to minimize the company's packaging material cost and consumption by using returnable packaging to replace one-way time use of cartons. The selection of items to be replaced and the amount of carton uses or its functions in the ABC Company are Level 1, starts from packaging material in cartons; level 2 focuses only cartons on used in outbound logistics. Level 3 categorizes the purposes of cartons used, which are carton for repacking, ready packed and others. Level 4 is breaking down cartons for repacking into single and mixed cartons. Level 5 is the selection of items to be replaced from one-way to returnable packaging. Figure 3.1 illustrates a diagram of cartons category selection for replacing by returnable packaging.



Level 1: Packaging Material by Categories

Based on the last three months data, total cost of purchased packaging materials was 24,450,732 Baht, as demonstrated in Table 3.1. A major cost of packaging material shared by carton account for 13,709,158 Baht or 56 percent of total, followed by air bubble which are used as a dunnage in carton, paper case and paper pallets that are used for export packing. The amount of packaging cost is calculated based on unit cost per piece of each item.

Table 3.1 Purchase quantity and amount of packaging materials by categories in 2010

No.	Packaging Materials	Data in 2010	Jul	Oct	Sep	Total	
1	Carton. boxes	Q'ty (Pieces)	544,947	489,547	359,796	1,394,290	11%
		Amount (Baht)	4,836,586	4,875,545	3,997,027	13,709,158	56%
2	Air Bubble	Qty (Pieces)	221,516	173,352	135,252	530,120	4%
		Amount (Baht)	1,251,422	1,155,745	705,297	3,112,463	13%
3	Paper case & pallet	Qty (Pieces)	1,040	740	640	2,420	0%
		Amount (Baht)	1,382,960	939,420	772,600	3,094,980	13%
4	Label & Ribbon	Qty (Pieces)	4,821,969	2,977,907	2,052,512	9,852,388	76%
		Amount (Baht)	850,392	435,621	534,301	1,820,314	7%
5	Preprint document	Qty (Pieces)	180	300,040	295,450	595,670	5%
		Amount (Baht)	47,540	360,400	312,752	720,692	3%
6	OPP Tape	Qty (Pieces)	19,360	13,456	15,304	48,120	0%
		Amount (Baht)	275,805	178,533	196,883	651,221	3%
7	Foam	Qty (Pieces)	40,500	36,200	43,700	120,400	1%
		Amount (Baht)	180,990	192,800.	164,940	538,730	2%
8	Bin box	Qty (Pieces)	12,200	24,000		36,200	0%
		Amount (Baht)	166,200	321,000		487,200	2%
9	PP Band	Q'ty (Pieces)	200	100	200	500	0%.
		Amount (Baht)	84,000	42,000	84,000	210,000	1%
10	Anti Rust (bag)	Q'ty (Pieces)	130,500	120,000	83,000	333,500	3%
		Amount (Baht)	42,150	40,205	23,620	105,975	0%
Total Q'ty			5,792,412	4,135,342	2,985,854	12,913,608	100%
Total Amount			9,118,045	8,541,268	6,791,420	24,450,732	100%

Source: ABC Company

As demonstrated in Table 3.1, costs of cartons are obviously high compared to other packaging materials. This is because cartons are used both inbound and outbound for logistic activities as mentioned earlier in chapter 1. Focus on total costs of cartons, indicates that packaging costs account for 9,123,231 Baht or 67 percent of the total. The total quantity was 649,406 pieces in three months. Details are shown in Table 3.2.

Level 2: Cartons use in inbound and outbound packaging process**Table 3.2** Carton consumption in inbound and outbound packaging

Area Usage	Data in 2010	Jul	Oct	Sep	Total	
Inbound packaging	Q'ty (Pieces)	319,415	281,951	143,512	744,884	53%
	Amount (Baht)	1,655,894	2,028,413	901,585	4,585,891	33%
Outbound packaging	Q'ty (Pieces)	225,532	207,590	216,284	649,406	47%
	Amount (Baht)	3,180,692	2,847,132	3,095,442	9,123,267	67%
Total	Q'ty (Pieces)	544,947	489,547	359,796	1,394,290	100%
	Amount (Baht)	4,836,586	4,875,545	3,997,027	13,709,158	100%

Source: ABC Company

Level 3: Purposes of Cartons Use

There are three main types of cartons in the outbound logistics. The purposes of using cartons are explained below.

- Carton for repacking; this carton is for mixed order packing or broken-case order. It can be used as single carton packing for medium and big parts. It can also be used to group small pieces of spare parts or many small plastics bags or many small cartons for ease of handling transportation.
- Ready Packed; this type means that parts are packed by the supplier and are ready to be shipped when the dealer place the order. Cost of packaging is added up into the cost of spare parts already.
- Other; this type is not the regular packaging. It is used for others purpose, so we do not go into details for this type of cartons.

Table 3.3, indicates that almost 100 percent of cost of packaging material for outbound logistics come from carton for repack.

Table 3.3 Outbound Packaging Materials

1 ape	Data in 2010	Jul	Oct	Sep	Total	
Carlton Boxes for Repacking	Q'ty (Pieces)	225,521	207,590	216,284	649,398	73%
	Amount (Baht)	3,180,692	2,847,132	3,095,406	9,123,231	100%
Ready Packed	Q'ty (Pieces)	-	4,815	12,137	22,277	3%
	Amount (Baht)	-	-	-	-	0%
Others	Q'ty (Pieces)	-	-	6	6	0%
	Amount (Baht)	-	-	36	36	0%
Total Qty		230,857	212,405	228,427	671,689	100%
Total Amount		3,180,692	2,847,132	3,095,442	9,123,267	100%

Source: ABC Company

Level 4: Use of Carton for **repacks** in outbound logistics

Cartons for repacking are used for 2 purposes which are mixed carton packing and single carton packing. A mixed carton packing shares by 21 percent or 137,903 pieces of the total carton for repacking and accounts for 2,246,320 baht of the total amount of cartons for repacking or 25 percent, as indicated in Table 3.4.

Table 3.4 Use of cartons for repacking for outbound logistics

Use of Carton Type	Data in 2010	Jul	Oct	Sep	Total	
Mixed Carbons Repacking	Q'ty (Pieces)	47,501	43,783	46,619	137,903	21%
	Amount (Bald)	803,714	722,664	719,942	2,246,320	25%
Single Cartons Repacking	Q'ty (Pieces)	178,031	163,807	169,665	511,503	79%
	Amount (Bahl)	2,376,978	2,124,469	2,375,464	6,876,911	75%
Total Q'ty		225,532	207,590	216,284	649,406	100%
Total Amount		3,180,692	2,847,132	3,095,406	9,123,231	100%

Source: ABC Company

There are 783 items of cartons in various sizes and dimensions used for outbound logistics. In order to reduce the cost and consumption, standardization of packaging is needed. Mixed cartons are targeted to be replaced as it is most commonly used for small and medium parts unlike single cartons which are usually used for packing specific spare parts only. The company plans to replace these mixed cartons by utilizing returnable packaging, one of the reverse logistics practice.

Level 5: Selection of Items to be replaced by Returnable Packaging in Mixed Cartons Repacking

The total items of mixed cartons are 144. At the trial stage, 20 items of the total mixed cartons are selected to be replaced by 3 sizes of returnable plastic packaging; small, medium and large. The selection of items is based on consumption quantity, size, dimension and shape which are able to be replaced by the returnable packaging. Details are shown in Table 3.5

	20	103,585
es Packing	124	34,317
	144	137,902

SC Company

indicates that items to be replaced by returnable plastic pack
consumption and cost of each item. Those selected 20 item
or 957,835 baht of the total mixed carton cost. In terms of
h as 75 percent or 103,585 pieces of total consumption of mi
logistics. Details are illustrate in Figure 3.2

Figure 3.2 Cartons to be replaced by Returnable Plastic Packag

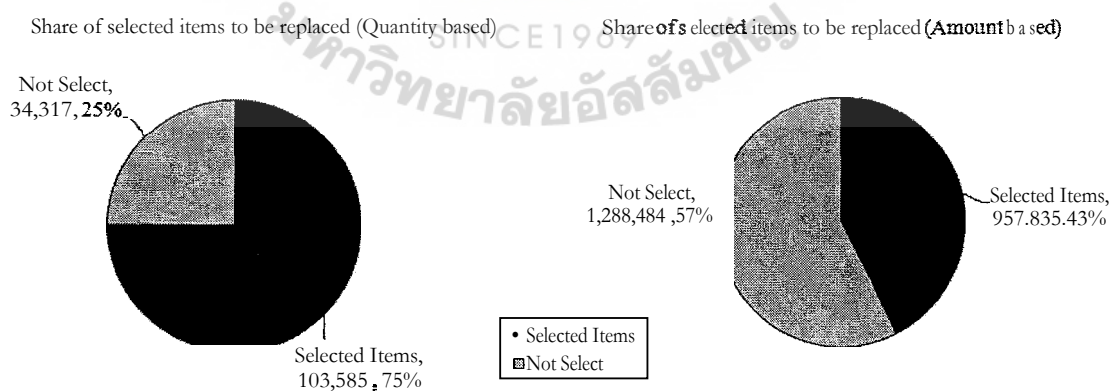
Source: ABC Company

Table 3.5 indicates that items to be replaced by returnable plastic packaging, its size dimension, consumption and cost of each item. Those selected 20 items account for 43 percent or 957,835 baht of the total mixed carton cost. In terms of quantity, the share is high as 75 percent or 103,585 pieces of total consumption of mixed cartons in outbound logistics. Details are illustrate in Figure 3.2

Figure 3.2 Cartons to be replaced by Returnable Plastic Packaging



OMNIA



3.4 Initial Investment and Investment Decision




3.4.1 Initial Investment

To calculate an initial investment for the project, requires information as per the following.

1) Unit Price of Returnable Plastic Packaging

Table 3.6 illustrates the sample of three different sizes of returnable plastic packaging and its cost per unit.

Table 3.6 Sample of Returnable Plastic Packaging

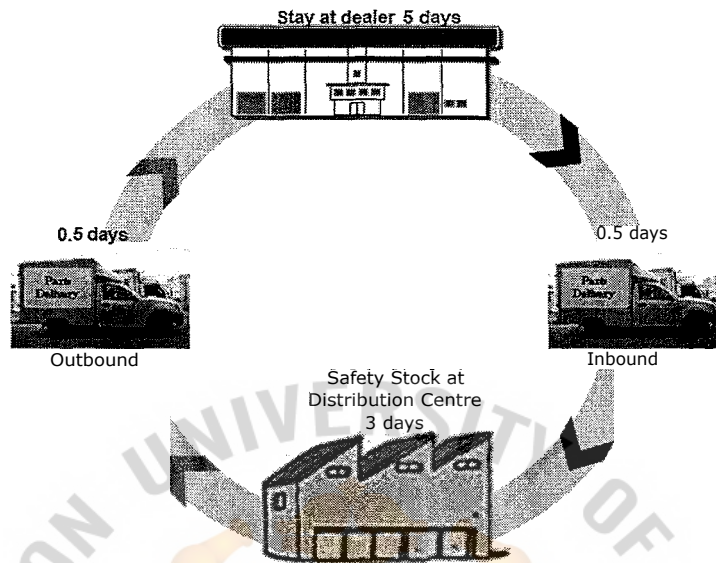
Size	Sample	W (mm)	L (mm)	Height (mm)	Weight (kg)	Unit Price (Baht)
Small		320	400	280	0.50	130
Medium		320	495	260	0.80	205
Large		360	530	280	1.10	330

Source: ABC Company

2) Cycle time an estimate time of each transaction is as per the following;

- Transportation lead time from distribution center to the dealer: 0.5 days
- Time allowance for returnable packaging stay at dealers: 5 days
- Transportation lead time from distribution centers to the dealers: 0.5 days
- Safety stock: 3 days
- Total cycle time 9 days

Figure 3.3 Cycle time



3) **Purchase Quantities of Returnable packaging**

To know how many returnable packaging containers are to be used in this project, an analysis of cartons consumption and purchase amount is done and used. A total of three months of average consumption from data collection during July-September 2010 multiply total cycle of outbound logistics process, required quantities are then calculated.

3.4.2 Investment Decision

To utilize returnable packaging in outbound logistics, the company has to invest money for this project. This study applies 3 types of capital budgeting techniques which are Payback Period (PP), Net Present Value (NPV) and Internal Rate of Return (IRR). These 3 techniques are used to evaluate the economic feasibility of a proposed investment in a capital asset or returnable packaging containers (Siad, 2007)

1. Payback period (PP) technique involves the determination of the period of time it takes for a project to be returned its initial investment amount. The less

number of payback period, the better as it has lower risk and more liquidity in the long term.

2. Net present value (NPV) technique is a measure of a project's economic profit or value added. The proposed project will be accepted if NPV is a positive number.

$$\text{NPV} = \text{total PV of cash inflows} - \text{Initial Investment}$$

3. Investment Internal rate of return (IRR) technique is a project's economic breakeven rate of return. This study used a spreadsheet to calculate IRR of a project. The project is accepted if $\text{IRR} > \text{WACC}$

Implementation of returnable packaging in outbound logistic, there are additional operating cost that used for consideration and calculation of investment decision. They are;

- 1) Labor cost for controlling returnable packaging at the distribution centers
Two operators are assigned to be responsible for controlling returnable packaging. The jobs include returnable packaging inspection, cleaning and supply of packing lines. Labor cost for this job is 6,600 Baht, per person, per month.
- 2) Handling cost of the return of returnable packaging to the distribution centre
Current transportation cost pay to the third party logistics by charter trips and trucks run empty after delivery of the parts to the dealer. Therefore, the company utilizes this empty truck for the return of returnable packaging. Therefore there is no transportation cost of the return for returnable packaging. However, the third party logistics company will charge a handling fee for bringing those returnable packaging back and its cost is 5 Baht per piece.
- 3) Depreciation rate is the depreciation ratio 20 percent per year is set by the company standard.

4) Weighted Average Cost of Capital (WACC) of the ABC Company is 10%

In summary, there are expenses involved in the implementation of returnable packaging, starting from an initial investment of returnable packaging followed by operating costs which are the handling fees, labor fee and depreciation of packaging. Table 3.7 presents the list of expenses of one-way packaging and returnable packaging.

Table 3.7 List of Expenses of One-way Packaging and Returnable Packaging

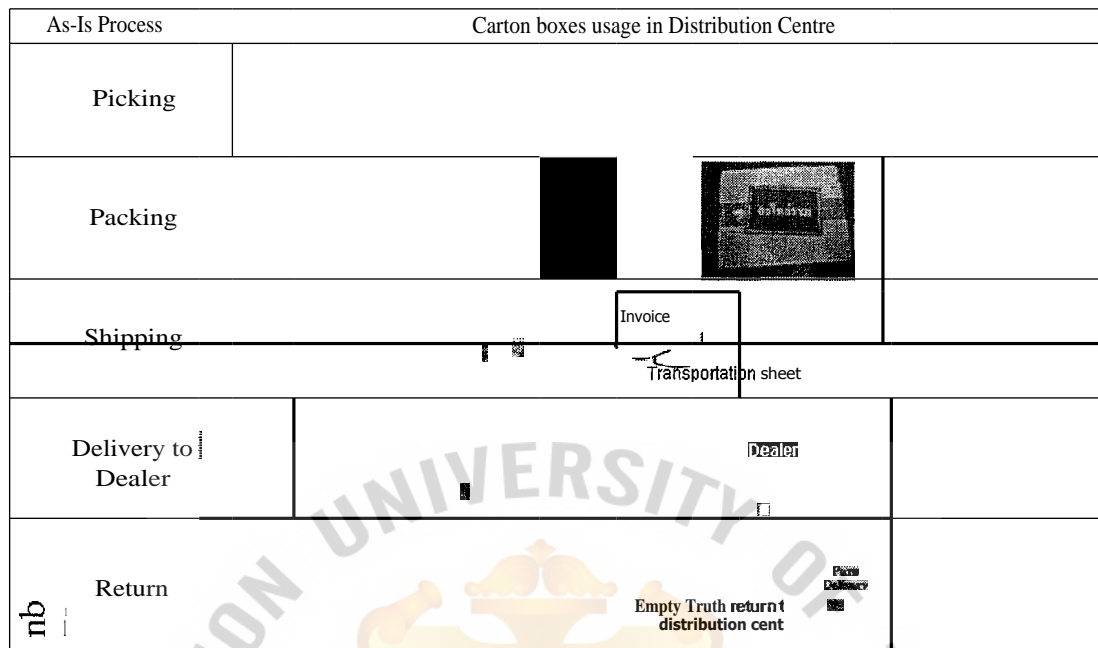
One-way packaging	Returnable packaging
I) Cost of cartons	1) Handling fee 5 baht/box for return trip to distribution centre 2) Labor fee 6,600 baht/person (required 2 persons) 3) Depreciation 20% of initial investment for 5 years

3.5 Review Current Outbound Logistics Process

Figure 3.1, indicates that outbound logistics activities start when the picking slips are issued for orders from the dealer. As mentioned in chapter 1, orders from the dealer can be both full-case and broken-case. Warehouse operator pick parts from the shelf as per order details indicated in the picking slip. Details in the picking slip includes customer order number, code and name, parts number, order quantity, shelf location, picking slip number. After that, parts are moved to the packing line.

For full-case orders, the warehouse operator needs only printed label, invoice and transportation sheet but for broken-case orders, the warehouse operator needs to combine small cartons or plastics bag into bigger size of cartons. Finished packed cartons are loaded into truck and delivery to the dealers. One truck may need to deliver parts to more than one dealer, depending on which route they serve. After unloading cartons at the dealer store, the empty trucks are returned to the distribution centers.

Figure 3.4 As-Is: Outbound-Inbound logistics activities between company and dealer



Source: ABC Company

3.6 Apply Reverse Logistics Concept for designing the return trip of returnable packaging

The research study applied reverse logistics concept for designing the return trip and utilizes returnable packaging as a tool to reduce cost. Figure 3.2 demonstrates how to utilize returnable packaging for outbound logistics activities and how to take the empty packaging back including administrative work when units are returned to the distribution centre.

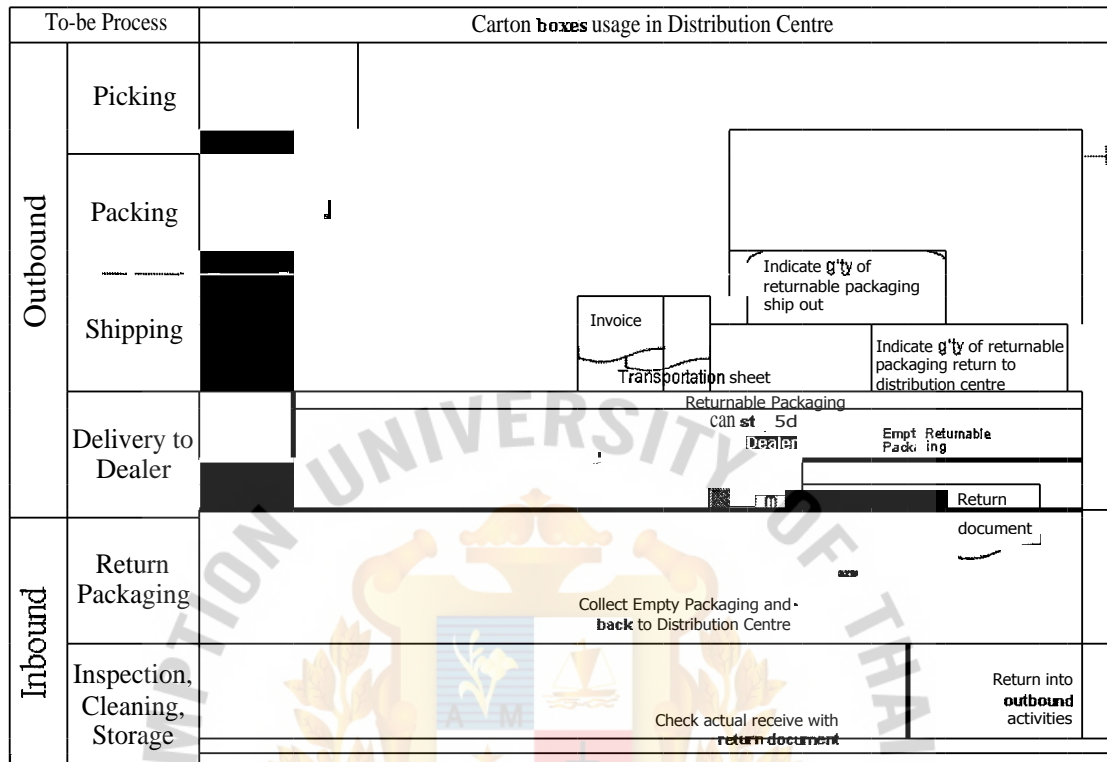
Returnable packagings replace the use of cartons for mixed parts in outbound packing line. Packing method remain the same as using cartons; warehouse operator put parts into returnable packaging until the volume fits into the package. Returnable packaging, OPP tape does not require for this packing anymore, because the returnable packaging is attached with a lid are consist of two plastic flaps, one on both side of the opening, that are interlocked in the middle when the package is closed and

then wrapped for the returnable packaging by the PP band. After finishing the packing process, returnable packages are loaded into a truck and delivered to dealers.

After the dealer receives the parts, it is kept in the store. A normal mixed carton can stay at the dealer's parts store forever or dealers can also dispose it as waste. However, the replacement of cartons by returnable packaging is required to return units when it becomes empty, write down the quantity to be returned on delivery sheets and return the packaging with the ABC company's assigned truck in the next trip. For more flexibility, the company allows the dealer to keep returnable packaging at their store for a maximum 5 days.

The ABC Company utilizes the empty running trucks of the return trip for carries the empty returnable packaging back to the distribution centers. Warehouse operation need to check an actual received return quantity against the delivery sheets from the dealers to ensure numbers of returned goods equal to numbers of delivered. Packaging inspection and cleaning are required to prevent the use of damaged returnable packaging and waiting in the storage area.

Figure 3.5 To-be: Outbound-Inbound logistics activities between the company and the dealers



3.7 Expected result

Through an analysis of consumption of cartons for outbound logistics, the replacement of mixed cartons utilization of returnable plastic packaging, usage of current empty running truck for the return trip of packaging and the practice of backward flow of packaging are expected to help the company saving purchase packaging material costs and reducing the consumption of mixed cartons. Furthermore, the implementation of reverse logistics practice by using returnable packaging is expected to help to achieve company's cost reduction goal.

CHAPTER IV

PRESENTATION AND CRITICAL DISCUSSION OF RESULTS

This chapter discusses the results after implementation of the returnable plastic packaging. The aim of using returnable packaging is to reduce packaging material consumption and purchase amount as well as to explore the reverse logistics practices for the return trip of returnable packaging utilization in the outbound logistics.

Data analyses are categorized into 4 sections. An analysis of cartons consumption and purchase amount of selected 20 items to be replaced by returnable packaging are in the first and second part, followed by results of 3 months after implementation of the project and overview comparing before and after implementation. An initial investment is explained in the last part.

4.1 An Analysis of Cartons Consumption of Selected 20 Items

According to the selection of mixed cartons 20 items which are used for repacking in the outbound logistics processes. These 20 items are replaced by 3 sizes of returnable plastic packaging; small, medium and large.

An average consumption of small size is 10,912 pieces per month, medium size is 12,913 pieces per month and large size is 10,704 pieces per month. The average consumption of small, medium and large sizes is 34,528 pieces per month. Details are presented in Table 4.1.

Table 4.1 Monthly Consumption of Selected 20 Items to be replaced by Returnable Packaging in the Small, Medium and Large Sizes

	Item Code	UNIT PRICE	Small	Medium	Large	Total	Months
		Baht	Pieces	Pieces	Pieces	Pieces	Pieces
Small	RBA021	3.36	2,329	2,778	2,762	7,869	2,623
	RBA029	3.11	3,768	3,132	3,770	10,670	3,557
	RBA329	5.95	2,047	2,045	2,326	6,418	2,139
	500003	2.1	3			3	3
	500006	325	2,757	2,441	2,578	7,776	2,592
	Sub Total		10,904	10,396	11,436	32,736	10,912
Total			10,904	10,396	11,436	32,736	10,912
Medium	RAA112	6.45	1,431	1,417	1,409	4,257	1,419
	RBA248	7.85	344	377	437	1,158	386
	SAR002	6.75	1,750	1,548	1,593	4,891	1,630
	SAR003	8.21	2,217	2,212	2,305	6,734	2,245
	W00001	7.95	2,138	2,074	2,194	6,406	2,135
	W00002	8.25	1,392	1,525	1,623	4,540	1,513
	W00003	14.55	1,955	1,820	2,134	5,909	1,970
	YAA990	6.53	1,667	1,523	1,653	4,843	1,614
	Sub Total		12,894	12,496	13,348	38,738	12,913
	Total		12894	12496	13,348	38,738	12913
Large	500007	7.65	1,778	1,567	1,652	4,997	1,666
	S00008	6.22	1,108	966	1,059	3,133	1,044
	SAR006	19.9	3,456	3,187	3,247	9,890	3,297
	W00004	14.2	1,348	1,287	1,357	3,992	1,331
	YAA036	18.88	1,367	1,146	1,177	3,690	1,230
	YBB592	18.45	1,325	1,249	1,353	3,927	1,309
	YBB621	18.5	813	787	882	2,482	827
	Sub Total		11,195	10,189	10,727	32,111	10,704
Total			11,195	10,189	10,727	32,111	10,704
Grand Total			34,993	33,081	35,511	103,585	34,528

When implementing returnable packaging containers, the cartons consumption of the selected 20 items should be reduced because this leads to a lower packaging cost.

4.2 An Analysis of Purchase Amount of Selected 20 Items

As mentioned in Chapter I that major cost of packaging come from the 56 percent of total cartons. If the company could reduce cartons consumption, it would reduce packaging cost directly.

An average purchase amount of small size is 42,585 baht per month, medium size is 110,277 baht per month and large size is 166,416 baht per month. Average packaging

cost of small, medium and large is 319,278 baht per month. Details are presented in Table 4.2

Table 4.2 Monthly Purchase Amount of Selected 20 Items to be replaced by Returnable Packaging in the Small, Medium and Large Sizes

	Material Name	Unit Price (Baht)	Unit	Material (Unit)	Unit Price (Baht)	Total (Baht)	1 month (Baht)
Small	RBA021	3.36	7,825	9,334	9,280	26,440	8,813
	RBA029	3.11	11,718	9,741	11,725	33,184	11,061
	RBA329	5.95	12,180	12,168	13,840	38,187	12,729
	S00003	2.1	6	-	-	6	2
	S00006	3.85	10,614	9,398	9,925	29,938	9,979
	Sub Total		42,344	40,640	44,770	127,755	42,585
	Total		42,344	40,640	44,770	127,755	42,585
Medium	RAA112	6.45	9,230	9,140	9,088	27,458	9,153
	RBA248	7.85	2,700	2,959	3,430	9,090	3,030
	SAR002	6.75	11,813	10,449	10,753	33,014	11,005
	SAR003	8.21	18,202	18,161	18,924	55,286	18,429
	W00001	7.95	16,997	16,488	17,442	50,928	16,976
	W00002	8.25	11,484	12,581	13,390	37,455	12,485
	W00003	14.55	28,445	26,481	31,050	85,976	28,659
	YAA990	6.53	10,886	9,945	10,794	31,625	10,542
	Sub Total		109,756	106,204	114,871	330,832	110,277
	Total		109,756	106,204	114,871	330,832	110,277
Large	S00007	7.65	13,602	11,988	12,638	38,227	12,742
	S00008	6.22	6,892	6,009	6,587	19,487	6,496
	SAR006	19.9	68,774	63,421	64,615	196,811	65,604
	W00004	14.2	19,142	18,275	19,269	56,686	18,895
	YAA036	18.88	25,809	21,636	22,222	69,667	23,222
	YBB592	18.45	24,446	23,044	24,963	72,453	24,151
	YBB621	18.5	15,041	14,560	16,317	45,917	15,306
	Sub Total		173,705	158,933	166,611	499,249	166,416
	Total		173,705	158,933	166,611	499,249	166,416
Grand Total			325,806	305,777	326,252	957,835	319,278

4.3 Result of Implement Returnable Packaging in Outbound Logistics

This part presents result of the implementation of returnable packaging from October – December 2010. The ABC company announced to both automobile and motorcycle dealers to adopt the returnable packaging system to replace the cartons. After dealers received the returnable plastic packaging, the dealer can use units at the service center for 5 days and return empty packaging with the ABC' assigned truck in the next trip.

Results after the implementation of returnable packaging are presented in terms of reduction of cartons consumption and packaging costs.

43.1 Reduction of Cartons Consumption

After implementation of returnable packaging, the consumption of cartons obviously reduced. Small size of returnable packaging replaces 5 items of cartons. An average consumption of these 5 items from July – September 2010 was 10,912 pieces per month. After implementation of returnable packaging, an average consumption from October – December 2010 was 4,421 pieces per month. Compared to before and after implementation, there was 59 percent reduction. Returnable packaging consumption is utilized and an average consumption from October – December 2010 was 2,443 pieces per month. Details are presented in Table 4.3

Medium size of returnable packaging replaces 8 items of cartons. An average consumption of these 8 items from July – September 2010 was 12,913 pieces per month. After implementation of returnable packaging, an average consumption from October – December 2010 was 4,261 pieces per month. Compared to before and after implementation, there was 67 percent reduced. Returnable packaging consumption in utilized and an average consumption from October – December 2010 was 7,109 pieces per month. Details are presented in Table 4.3

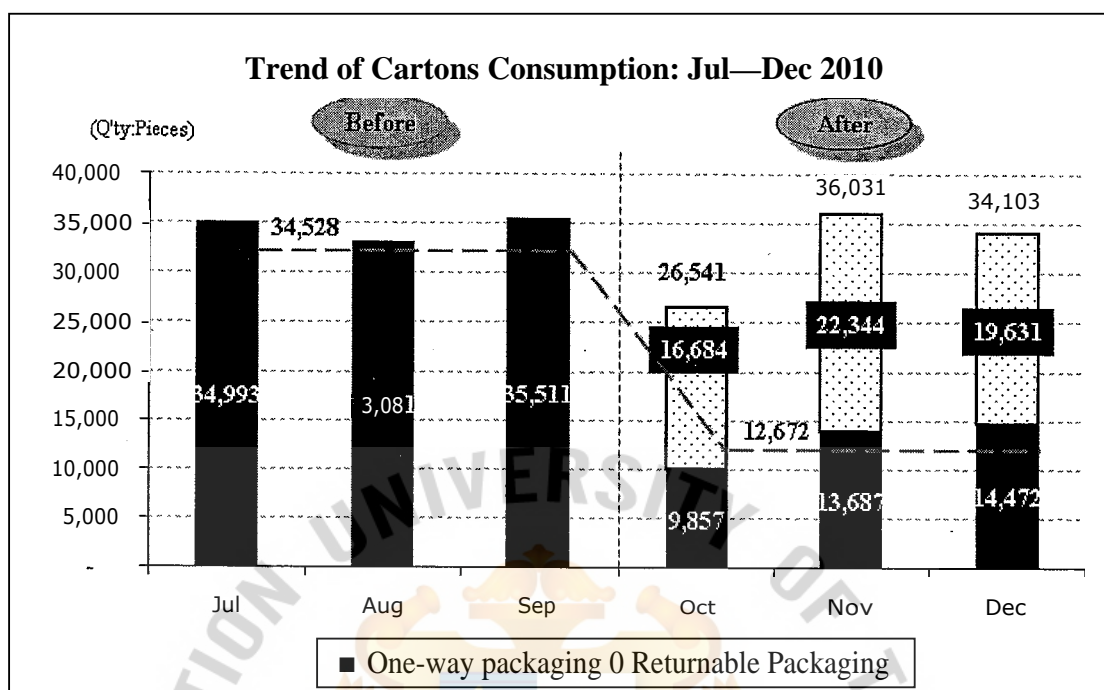
Meanwhile, a large size of returnable packaging replaces 7 items of cartons. An average consumption of these 7 items from July – September 2010 was 10,704 pieces per month. After implementation of returnable packaging, an average consumption from October – December 2010 was 3,990 pieces per month. Compared to before and after implementation, there was 63 percent reduced. Returnable packaging consumption is utilized and an average consumption from October – December 2010 was 10,000 pieces per month. Details are presented in Table 4.3

Table 4.3 Monthly Consumption of Selected 20 Items after being replaced by Returnable Packaging in the Small, Medium and Large Sizes

					Before					After				
Small	RBAU21	3.46	2,329	27	2,762	7,869	2,633	1,119	2018	1,983	5,182	1,72/	2,687	34%
	RBA029	3.11	3,768	3,132	3,770	10,670	3,557	1,106	1,525	1,934	4,565	1,522	6,105	37%
	RBA329	595	2,047	2045	2326	6,418	2,139	550	768	770	2088	696	4,330	67%
	S00003	2.1	3			3	3	73	21	17	111	37	108	3600%
	S00006	3.85	2,757	2,441	2,578	7,776	2,392	326	343	649	1,318	439	6,438	83%
	Sub Total		10,904	10396	11,436	32,736	10,912	3,234	4,675	5,355	13,264	4,421	19,472	59%
	Returnable Packaging													
Medium	Total		10,904	10,396	11,436	32,736	10,912	5,309	2,273	2,699	2,356	7,330	2,443	37%
	RAA112	6.45	1,431	1,417	1,409	4,257	1,419	655	744	821	2,220	740	2,037	48%
	RBA248	7.85	344	377	437	1,158	386	143	238	247	628	209	530	46%
	SAR002	6.73	1,750	1,548	1,593	4,891	1,630	431	785	1,051	2,267	756	2,624	54%
	SAR003	8.21	2,217	2,212	2,305	6,734	2,245	426	515	635	1,576	525	5,158	77%
	W00001	793	2,138	2,074	2,194	6,406	2,135	452	693	686	1,831	610	4,573	71%
	W00002	823	1,392	1,525	1,623	4,340	1,513	269	377	441	1,687	362	3,433	76%
	W00003	1433	1935	1,820	2,134	5,909	1970	472	545	587	1,604	535	4,305	73%
	YAA990	633	1,667	1,523	1,653	4,843	1,614	533	717	320	1,570	523	3,273	68%
	Sub Total		12,894	12,496	13,348	38,738	12,913	3,381	4,614	4,788	12,783	4,261	25,955	67%
Large	Returnable Packaging													
	Total		12,894	12,496	13,348	38,738	12,913	9,917	12,633	11,561	34,111	11,370		12%
	S00007	7.63	1,778	1,559	1,659	4,997	1,656	385	416	543	1,344	448	3,633	73%
	S00008	622	1,408	966	1,058	3,133	1,044	657	947	813	2,417	806	716	23%
	SAR006	19.9	3,456	3,187	3,269	9,890	3,439	870	1,273	1,193	3,338	1,113	6,552	66%
	W00004	14.2	1,348	1,239	1,339	3,992	1,331	236	379	353	970	323	3,022	76%
	YAAU36	18.88	1,367	1,146	1,177	3,690	1,231	458	367	646	1,671	557	2,019	55%
	YBB592	18.45	1,325	1,249	1,336	3,927	1,305	359	379	448	1,186	395	2,741	70%
	Y01621	183	813	839	832	2,482	832	277	435	331	1,043	348	1,439	38%
	Sub Total		11,195	10,189	10,727	32,111	10,704	3,242	4,398	4,329	11,969	3,990	20,142	63%
O - Way Packaging	Returnable Packaging													
	Total		11,195	10,189	10,727	32,111	10,704	11,115	16,024	14,831	41,970	13,990		-31%
	Grand Total		34,993	33,061	35,511	103,585	34,528	9,857	13,687	14,472	38,016	12,672	65,569	63%

Although cartons consumption obviously reduced, the usage of packaging in outbound logistics did not reduce. Returnable packaging could to replace the usage of cartons and remaining functions of containers containing spare parts from the distribution center to the dealers as depicted in Figure 4.1 Cartons consumption reduced from 35,511 pieces in September 2010 to 9,857 pieces in October 2010 and returnable packaging used 16,684 pieces. Total 26,541 pieces of packaging were used in the same month.

Figure 4.1 Trends of Cartons and Returnable Packaging Consumption



4.3.2 Reduction of Purchase Amount of Cartons

From July – September 2010, carton costs was 13,709,158 baht which shared 56 percent of total packaging costs. The selected 20 items replaced by returnable packaging shared 6 percent or 830,559 baht of carton costs. After implementation of returnable packaging in October 2010, consumption of carton obviously reduced and it decreased the packaging cost.

According to a data correction from July – September 2010, cost of selected 5 items was 127,755 baht. After replacing selected 5 items by small size of returnable packaging from October – December 2010, cartons' cost reduced by 61 percent or 78,415 baht. Details are presented in Table 4.4

Medium size of returnable packaging replaced 8 selected items. Total cartons' cost from July – September 2010 was 330,832 baht. After implementation of returnable packaging, cartons' cost of those selected 8 items was 104,605 baht and reduced by 226,227 baht or 68 percent compared to before the implementation. Details are presented in Table 4.4

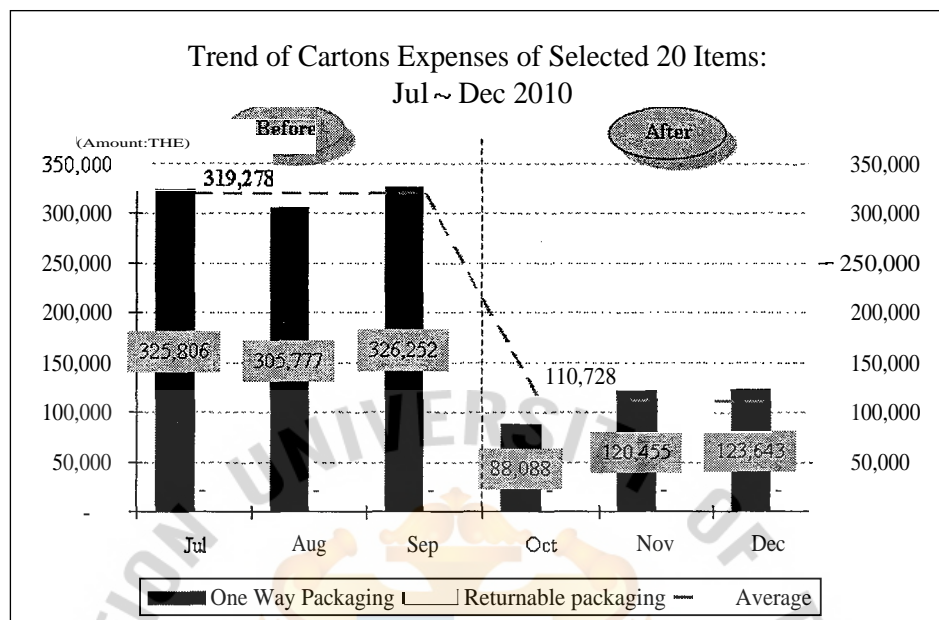
Meanwhile, a large size of returnable packaging replaced selected 7 items and total cartons' cost was 499,249 baht in July – September 2010. After implementation of returnable packaging container, total cost in October – December 2010 of selected 7 items was 178,241 baht and reduced 321,008 baht or 64 percent. Details are presented in Table 4.4

Table 4.4 Monthly Purchase Amounts of Selected 20 Items after Replaced by Returnable Packaging in the Small, Medium and Large Sizes

				Before				After					
		Q3/10	Q4/10	Q3/10	Q4/10	Q3/10	Q4/10	Q3/10	Q4/10	Q3/10	Q4/10	Q3/10	Q4/10
Small	05A029	3.11	11,718	9,741	11,725	33,184	11,061	3,440	4,743	6,015	14,197	4,732	18,987
	RBA329	595	12,180	12,168	13,840	38,187	12,729	3,273	4,570	4,582	12,424	4,141	23,764
	S00003	2.1	6			6	2	153	44	36	233	78	227
	S00006	3.85	10,614	9,398	9,925	29,938	9,979	1,255	1,321	2,499	5,074	1,691	24,863
	Sub Total		42,344	40,640	44,770	127,755	42,585	12,082	17,457	19,800	49,340	16,447	78,415
	Returnable Packaging												
	Total		42,344	40,640	44,770	127,755	42,585	12,082	17,457	19,800	49,340	16,447	78,415
Medium	RAA112	6.45	9,230	9,140	9,088	27,458	9,133	4,225	4,799	5,295	14,319	4,773	13,130
	RBA248	7.85	2,700	2,959	3,430	9,090	3,030	1,123	1,868	1,939	4,930	1,643	4,160
	SAR002	6.75	11,813	10,449	10,753	33,014	11,005	2,909	5,299	7,094	15,302	5,101	17,712
	SAR003	8.21	18,202	18,161	18,924	55,286	18,429	3,497	4,228	5,213	12,939	4,313	42,347
	W00001	7.95	16,997	16,488	17,442	50,928	16,976	3,393	5,509	5,454	14,536	4,852	36,371
	W00002	8.25	11,484	12,581	13,390	37,453	12,483	2,219	3,110	3,638	8,968	2,989	28,487
	W00003	14.55	28,445	26,481	31,050	85,976	28,659	6,868	7,930	8,541	23,338	7,779	62,638
	YAA990	6.33	10,886	9,945	10,794	31,625	10,542	3,480	4,682	2,090	10,252	3,417	21,373
	Sub Total		109,756	106,204	114,871	330,832	110,277	27,915	37,425	39,264	104,605	34,868	223,227
	Returnable Packaging												
Large	000007	7.65	13,602	11,988	12,638	38,227	12,742	2,945	3,182	4,154	10,282	3,427	27,945
	S00008	6.22	6,892	6,009	6,387	19,487	6,496	4,087	5,890	5,057	15,034	5,011	4,454
	SAR006	1.99	68,774	63,421	64,615	196,811	65,604	17,313	25,372	23,741	66,426	22,142	130,385
	W00004	1.42	19,142	18,275	19,269	56,686	18,895	3,331	5,382	5,041	13,774	4,591	42,912
	YAA036	18.88	25,809	21,636	22,222	69,667	23,222	8,647	10,705	12,196	31,548	10,516	38,119
	YBB592	18.45	24,446	23,044	24,963	72,453	24,151	6,624	6,993	8,266	21,882	7,294	50,571
	YBB621	18.5	15,041	14,560	16,317	45,917	15,306	5,125	8,048	6,124	19,296	6,432	26,622
	Sub Total		173,705	158,933	166,611	499,249	166,416	48,091	65,572	64,578	178,241	59,414	321,008
	Returnable Packaging												
	Total		173,705	158,933	166,611	499,249	166,416	48,091	65,572	64,578	178,241	59,414	321,008
One Way Packaging			325,806	305,777	326,252	957,835	319,278	88,088	120,455	123,643	332,185	110,728	625,650
Returnable Packaging													
Grand Total			323,806	305,777	326,252	957,835	319,278	88,088	120,455	123,643	332,185	110,728	625,650

After comparing before and after implementation of returnable packaging, trend of cartons' cost or purchase amount obviously reduced. Before implementation, an average cost of 20 selected items was 319,278 baht per month. After implemented, average cost of 20 selected items was 110,728 baht. This was a reduction by 65 percent. Details are presented in Figure 4.2

Figure 4.2 Trends of Purchase Amounts of Selected 20 Items from July ~ December 2010



4.4 The Overview of Finding between Before and After Implementation of Returnable Packaging is in Table 4.5.

Table 4.5 Comparison between Before and After Implementation of Returnable Packaging

Items	Period	Before	After	Reduce
		July, September 2010	October, December 2010	
1 Cartons' Consumption				
Unit		Pieces	Pieces	%
Small		32,736	13,264	59%
Medium		38,738	12,783	67%
Large		32,111	11,969	63%
Total		103,585	38,016	63%
Average 3 sizes		34,528	12,672	63%
2 Cartons' Cost				
Unit		Baht	Baht%
Small		127,755	49,340	61%
Medium		330,832	104,605	68%
Large		499,249	178,241	64%
Total		957,835	332,185	65%
Average 3 sizes		319,278	110,728	65%

Remark: Result of before has been collected from July - September, 2010

Result of after has been collected from October - December, 2010

4.5 An Initial Investment of Returnable Packaging, Operating Cost and Investment Measurement of the Project

4.5.1 An Initial Investment

The calculation of returnable packaging quantities is based on a monthly demand or consumption of 3 months from July - September multiplied total by cycle time. As a result, required quantities of returnable packaging of small, medium and large sizes are 3,274 pieces, 3,874 pieces and 3,211 pieces respectively. Required quantities of each sizes multiplied by the unit cost of returnable packaging of small size which is 130 baht per piece, medium size which is 205 baht per piece and large size which is 330 baht per piece. Purchase amount of small size is 425,646 baht, medium size is 794,129 baht and large size is 1,059,663 baht. Total investment of returnable packaging used in outbound logistics is 2,279,438 baht. Details are presented in Table 4.6

Table 4.6 Calculation of Returnable Packaging Purchase Quantities

Small	21	3,30	2,329	2, /8	4/02	2,623	8,813	KT	0			130	102,297
	RBA029	311	3,768	3,132	3,770	3,557	11,061	119	6	3	1,067	130	138,710
	RBA329	595	2,047	2,045	2,326	2,139	12,729	71	6	3	642	130	83,434
	SD0003	24	3			3	6	0	6	3	1	130	117
	SD0006	325	2,757	2,441	2,578	2,592	9,979	86	6	3	778	130	101,088
	Total		10,904	10,396	11,436	10,914	42,589	364	6	3	3,274		425,646
Medium	RAA112	6.45	1,431	1,417	1,409	1,419	9,153	47	6	3	426	205	87,269
	RBA248	725	344	377	437	386	3,030	13	6	3	116	205	23,739
	SAR002	6.75	1,750	1,548	1,593	1,630	11,005	54	6	3	489	205	100,266
	SAR003	821	2,217	2,212	2,305	2,245	18,429	75	6	3	673	205	138,047
	W00001	795	2,138	2,074	2,194	2,135	16,976	71	6	3	641	205	131,323
	W00002	825	1,392	1,325	1,623	1,513	12,485	50	6	3	454	205	93,070
	W00003	14.53	1,955	1,820	2,134	1,970	28,659	66	6	3	591	205	121,133
	YAA990	653	1,667	1,523	1,653	1,614	10,542	54	6	3	484	205	99,282
	Total		12894	12,496	13,348	12,913	110,277	430	6	3	3,874		794,129
	SD0007	7.65	1,778	1,567	1,652	1,666	12,742	56	6	3	500	330	164,901
Large	SD0008	622	1,108	966	1,059	1,044	6,496	35	6	3	313	330	103,389
	SAR006	19.9	3,456	3,187	3,247	3,297	65,604	110	6	3	989	330	326,370
	W00004	14.2	1,348	1,287	1,337	1,331	18,895	44	6	3	399	330	131,736
	YAA036	18.88	1,367	1,146	1,177	1,230	23,222	41	6	3	369	330	121,770
	YBB592	18.45	1,325	1,249	1,353	1,309	24,151	44	6	3	393	330	129,591
	YBB621	18.3	813	787	882	827	15,306	28	6	3	248	330	81,906
	Total		11,195	10,189	10,727	10,704	166,416	357	6	3	3,211		1,059,663
Grand Total			34,993	33,081	35,511	34,530	319,283	1,151			10,359		2,279,438

4.5.2 Operating Cost

As mentioned in chapter III, to implement returnable packaging, there are additions operating cost. Those are handling fee, labor fee and depreciation. Table 4.7 presents the comparison of operating costs between one-way packaging or cartons and returnable packaging. The calculation in this table is based on average monthly

consumption from July – September 2010. Then yearly consumption is calculated by multiplying into 12 months (1 year)

Average Monthly Packaging Consumption 34,530 pieces

Yearly Packaging Consumption $34,530 \times 12 = 414,364$ pieces

Table 4.7 Comparison of Operating Cost between One-way Packaging (Cartons) and Returnable Packaging

Unit in Thai Baht

One way packaging	Monthly Cost (Baht)	Yearly Cost (Baht)	Returnable packaging	Monthly Cost (Baht)	Yearly Cost (Baht)
1) Cost of cartons	319,283	3,831,392	1) Handling fee 5 baht/box for return trip to distribution centre	172,652	2,071,820
			2) Labor fee 6,600 baht/person (required 2 persons)	13,200	158,400
			3) Depreciation 20% of initial investment for 5 years	37,991	455,888
			Total operating cost of using returnable packaging 1) ~ 3)	223,842	2,686,108

Remark:

Cost of cartons is calculated based on average packaging (cartons) consumption from Jul ~ Sep 2010 and multiplied by unit price of each item. As indicated in to Table 4.6

Handling fee is calculated based on unit price which is 5 baht/piece multiplied by average monthly consumption

Labor fee is calculated based on unit price of 6,600 baht/person. This requires 2 persons for inspection, cleaning and supply processes.

Depreciation 20 percent of the initial investment in the ABC Company based and calculated for a 5 years period.

4.5.3 Investment Decision

This study uses three kind of investment decision techniques in order to evaluate these projects which are Payback period (PP), Net Present Value (NPV) and Internal Rate of Return (IRR).

1) Calculating Payback Period (PP)

The ABC Company forecast a business growth at 5% each year. The handling cost of a returnable box is 5 baht per piece.

As depicted in Table 4.7, cash in flow of year one is only 1,145,284 baht. To fully recover the initial cost, 1,134,154 baht is needed from year two. That is,

$$\begin{aligned}
 PP &= 1 \text{ year} + (1,134,154 \div 1,225,343) \text{ year} \\
 &= 1 + 0.93 \\
 &= 1.93 \text{ years}
 \end{aligned}$$

2) Net Present Value (NPV)

To measure a project's economic profit, the NPV is calculated as per the following.

$$NPV = \text{total PV of cash inflows} - \text{Initial Investment}$$

For this project:

$$\begin{aligned}
 NPV &= (1,041,168 + 1,012,680 + 983,775 + 954,627 + 925,388) - 2,279,438 \\
 &= 4,917,638 - 2,279,438 \\
 &= 2,638,200 \text{ baht}
 \end{aligned}$$

3) Internal Rate of Return (IRR)

This study calculated IRR by using a spreadsheet program. The IRR is 47 percent.

This rate is considerably high compared to WACC of the ABC Company which is 10 percent. Details are presented in Table 4.8.

Table 4.8 Investment Measurement of Returnable Packaging at ABC Company

Unit in Thai Baht							
	Items	Year 0	Year 1	2	3	4	5
Initial Investment	Returnable packaging's cost	2,279,438					
Cost of using cartons	Carton's cost		3,831,392	4,022,962	4,224,110	4,435,315	4,657,081
	Handling fee of returnable packaging (return hip)		2,071,820	2,175,411	2,284,182	2,398,391	2,518,310
Cost of using returnable packaging	Lab or fee		158,400	166,320	174,636	183,368	192,536
	Depreciation 20%		455,888	455,888	455,888	455,888	455,888
	Total cost of using returnable packaging		2,686,108	2,797,619	2,914,705	3,037,646	3,166,734
Cost Reduction if use returnable packaging	Cash in flow (Saving)		1,145,284	1,225,343	1,309,404	1,397,669	1,490,347
	Cumulative Cash in flow (Saving)		1,145,284	2,370,627	3,680,032	5,077,701	6,568,048
PP		1.93	years				
PV ₁		1,041,168	Baht				
PV ₂		1,012,680	Baht				
		983,775	Baht				
PV ₄		954,627	Baht				
PV ₅		925,388	Baht				
NPV		2,638,200	Baht				
IRR		47%					

Remark:

Cost of carton, handling fee and labor fees are calculated base on 5 percent increase each year.

Cost reduction is calculated by use cost of using cartons subtract cost of using returnable packaging.

CHAPTER V

SUMMARY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The findings in Chapter 4, explained the benefits of implementation returnable packaging at the ABC Company. This chapter aims to present the conclusion of this project in details analysis and previous recommendations for the further study.

5.1 Conclusions

Data collection from October – December 2010 indicated that both consumption and packaging costs of carton obviously reduced after implementation of returnable packaging. Comparing between before and after implementation of this project, cartons consumption reduced from 34,528 pieces to 12,672 pieces or 63 percent in average. Packaging cost of cartons also reduced drastically from 319,278 baht to 110,728 baht or 65 percent. Considering to the initial investment, the calculation of returnable packaging purchase amounts is 2,279,438 baht for 3,274 pieces of small sizes, 3,874 pieces of medium sizes and 3,211 pieces of large sizes. The company can cover the initial investment within 1.93 years as per the results of the payback period. The positive NPV indicates that its future cash inflows are large enough to cover the project's operating cost and generate economic profits of 6,585,478 baht with 71 percent of an internal rate of return or IRR. This made the project more attractive.

This study not only provides cost saving for the company but also explore reverse logistics practices for the return trip of returnable packaging utilized in outbound logistics in a firm. This provides knowledge of how to implement the project. The study shows that there are many factors that affected the success of the project and the most important factor being the negotiation of coordination and collaboration with warehouse operators and dealerships. Warehouse operators, use new packaging type it may cause an inconvenience in the initial state as they are accustomed with a paper packaging which is lighter than plastic packaging. Therefore this project does not

change all items of cartons into returnable packaging. Only 20 items were selected for pilot testing. The project members must work closely with the warehouse operators in order to emphasize the use of returnable packaging. The more frequent use the better. With dealerships, there are resistances to change because of adopting returnable packaging requires additional processes of returning the empty packaging. Dealers have to proceed to return documents when needed to return empty packaging unlike cartons which they do not need to be returned. Furthermore, they could earn some amount from selling unused cartons and some dealers do not return empty packaging after the unit was left for over 5 days in the storage. This may cause a shortage of returnable packaging supplies the packing line. Therefore, a clear policy of implementation and utilization of returnable packaging in the firm and penalty must be set. The implementation of this project could not succeed without coordination and collaboration from related parties in the chain.

In conclusion, the implementation of the returnable packaging in outbound logistics at the ABC Company brings benefits and cost reduction to the company. Although the project requires additional labors and working processes such as documentation, inspection and cleaning after empty packages are returned to distribution centre, the cost reduction still covers the initial investment and operating cost. Furthermore the payback period is within 1.93 years. Moreover, this project also promotes good image in adoption of returnable packaging and reduces papers used in the industry. This can promote the environmental friendly policy plan from the headquarters in Japan. It is recommended that the firm implement returnable packaging to maximize profits and sustainable development like the ABC Company.

5.2 Recommendations for Further Study

This study of returnable packaging utilized in outbound logistics at the ABC Company bring benefits to the company and explores knowledge of reverse logistics in the automotive parts industry. A few recommendations are suggested for future research.

5.2.1 This project studied only selected 20 items of cartons. This study used returnable packaging in outbound logistics from distribution centers to dealerships and returned empty packages to distribution centers with the next delivery is considered as successful specially for cost reduction. Further study to expand more items in order to maximize the use of returnable packaging should lead to potential cost reduction and efficiency for others companies.

5.2.1 Current returnable packaging is applied for outbound logistics only. To maximize the use of asset, reduce paper use in the industry and improve logistics flow, inbound logistic and storage are recommended for further study. The same returnable packaging can be used in the inbound activities to receive parts from makers or suppliers. The containers could be used for storage, once dealers order in a full case. The warehouse operators can pick a full case in returnable packaging and deliver it to the dealers without the repacking process. This can improve operation flow and reduce process in the warehouse.

BIBLIOGRAPHY

- Dowlatshahi, S. (2000). Developing a theory of reverse logistics. *Interfaces*, 30(3), *Sustainable Business*, 143-155.
- Knemeyer, A.M., Ponzurick, T.G. & Logar, C.M. (2002). A qualitative examination of factors affecting reverse logistics systems for end-of-life computers. *International Journal of Physical Distribution & Logistics Management*, 32(6), 455-79.
- Kroon, L., & Vrijens, G. (1994). Returnable containers: an example of reverse logistics. *International Journal of Physical Distribution & Logistics Management*, 25(2), 56-68.
- Siad, I. (2007). Applied Financial Management
- Lau, H.K., & Wang, Y. (2009). Reverse logistics in the electronic industry of China: a case study. *An International Journal of Supply Chain Management*, 14(6), 447-465.
- Lockamy, A. (1995). A conceptual framework for assessing strategic packaging decisions. *The International Journal of Logistics Management*, 6, 51-60
- Maslennikova, I., & Foley, D. (2000). Xerox's approach to sustainability. *Interfaces*, 30(3), May-June 2000, 226-233.
- McKerrow, D. (1996). What makes reusable packaging systems work. *Logistics Information Management*, 9(4), 39-42.
- Nunes, B., & Bennett, D. (2010). Green operations initiatives in the automotive industry: An environmental reports analysis and benchmarking study. *An International Journal*, 17(3), 396-420
- Rogers, D.S., & Tibben-Lembke, R.S. (1999). Going backwards: Reverse logistics trends and practices. *Reverse Logistics Executive Council*.
- Saphire, D. (1994). Delivering the goods: Benefits of reusable shipping containers. *The Informs Journal on the Practice of Operation Research*, 3(1)
- Sara, R. (2007). Packaging as a retail marketing tool. 29-30.

- Wu, H.J., & Dunn, C.S. (1995). Environmentally responsible logistics systems. *International Journal of Physical Distribution & Logistics Management*, 25(2), 20-38.
- Twede, D. (2003). Logistics issues in returnable packaging. *Material Handling & Logistics*, Retrieved October 20, 2010, from <http://www.mhlnews.com>



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