NEW BUSINESS MODEL FOR A FREIGHT FOR WARDING COMPANY

Miss Chanokpim Chanudomporn

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Engineering Program in Engineering Management
Regional Centre for Manufacturing Systems Engineering
Faculty of Engineering
Chulalongkorn University
Academic Year 2014

แบบจำลองธุรกิจใหม่สำหรับบริษัทรับส่งต่อสินค้า

นางสาวชนกพิมพ์ ฉันท์อุดมพร

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
สาขาวิชาการจัดการทางวิศวกรรม ภาควิชาศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต
คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2557

Thesis Title	NEW BUSINESS MODEL FOR A FREIGHT FOR WARDING COMPANY
By	Miss Chanokpim Chanudomporn
Field of Study	Engineering Management
Thesis Advisor	Oran Kittithreerapronchai, Ph.D.

Accepted by the Faculty of Engineering, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the Faculty of Engineering

(Professor Bundhit Eua-arporn, Ph.D.)

THESIS COMMITTEE

.....Chairman

(Assistant Professor Manop Reodecha, Ph.D.)

.....Thesis Advisor

(Oran Kittithreerapronchai, Ph.D.)

.....External Examiner

(Assistant Professor Boonwa Thampitakkul, Ph.D.)

ชนกพิมพ์ ฉันท์อุดมพร : แบบจำลองธุรกิจใหม่สำหรับบริษัทรับส่งต่อสินค้า (NEW BUSINESS MODEL FOR A FREIGHT FOR WARDING COMPANY) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: โอฬาร กิตติธีรพรชัย, 115 หน้า.

ในทศวรรษที่ผ่านมา การมีอยู่ของผู้ให้บริการโลจิสติกสร้างความเปลี่ยนแปลงการปฏิสัมพันธ์ระหว่างบุคคลต่างๆในห่วงโซ่อุปทาน บริษัทสามารถมุ่งเน้นไปที่การดำเนินงานในด้านที่ถนัดอย่างเต็มที่ ในขณะเดียวกัน ที่ผู้ให้บริการโลจิสติกก็จะให้บริการบริษัทลูกค้าแต่ระรายอย่างมืออาชีพและได้รับประโยชน์จากบริมาณด้วย ในขณะที่การให้บริการโลจิสติกกลายเป็นที่นิยมมากขึ้น ผู้ให้บริการโลจิสติกก็มีแนวโน้มที่จะขยายการบริการเพื่อให้ครอบคลุมในทุกๆด้านของห่วงโซ่อุปทาน วัตถุประสงค์ของงานวิจัยนี้คือการศึกษาความเป็นไปได้ในการการขยายตัวที่ของ บริษัทผู้ให้บริการโลจิสติกส์รายนึง ผู้มีความเชี่ยวชาญในการให้บริการโลจิสติกข้ามพรมแดน ลูกค้ารายใหญ่ของบริษัทนี้มีความต้องการให้บริษัทมีบริการคลังสินค้าเพิ่มเติม บริษัทจึงเผชิญกับการตัดสินใจครั้งใหญ่ดังนี้:

· บริษัทได้ประโยชน์ทางธุรกิจจากการขยายตัวนี้หรือไม่?

· บริษัทควรมีบริการคลังสินค้าหรือไม่ แล้วควรให้บริการอย่างไร?

เพื่อตอบคำถามเหล่านี้ บริษัทจึงจำเป็นต้องมีแบบจำลองธุรกิจเพื่อใช้เป็นกรอบการทำงานในการระบุคุณค่ารวมถึงกระแสรายได้และโครงสร้างค่าใช้จ่าย หลังจากระบุประโยชน์ทางธุรกิจแล้ว ข้อมูลย้อนหลังต่างๆรวมถึงข้อมูลสาธารณะจะถูกรวบรวมไว้ และทำหน้าที่เป็นค่าสำหรับใช้กำหนดการออกแบบพื้นที่แรงงาน และอุปกรณ์ต่างๆที่จำเป็นสำหรับสคลังสินค้า ค่าเหล่านี้มีความสำคัญสำหรับการตัดสินใจสุดท้ายเป็นอย่างมาก เพราะการตัดสินใจนี้จะเป็นตัวกำหนดความเป็นเจ้าของ ของคลังสินเค้านี้ การเลือกสถานที่ตั้งของคลังสินค้าให้เช่าจะผ่านการประเมินโดยผู้ทรงคุณวุฒิผู้มีประสบการณ์ โดยตัวแปลที่สำคัญคือ ราคา, สภาพ, ระยะทาง, ความสะดวกต่อการเข้าถึงของรถ, ความคล่องตัว และความน่าเชื่อถือของผู้ให้เช่า

โกดังให้เช่าที่ถูกเลือกจะนำไปเปรียบเทียบกับกับโกดังที่บริษัทวางแผนจะสร้างขึ้นบนที่ดินไกล้ท่าเรือซึ่งเป็นที่ดินของบริษัทเอง โดยเครื่องมือประกอบการตัดสินใจจะใช้เครื่องมือทางเศรษฐศาสตร์ต่างๆในการคำนวน เช่นมูลค่าปัจจุบันสุทธิ, อัตราผลตอบแทนภายใน, และระยะเวลาคืนทุน ในช่วงกรอบเวลา 20 ปี การเปรียบเทียบระหว่างการเช่าคลังสินค้าและการจัดการคลังสินค้าที่บริษัทสร้างเองแสดงให้เห็นว่า บริษัทควรบริหารคลังสินค้าที่สร้างเอง เนื่องผลจากการวิเคราะห์ความอ่อนไหวของธุรกิจแสดงให้เห็นว่า ความเสี่ยงที่ยิ่งใหญ่ที่สุดของบริษัทคือปริมาณเข้าออกของสินค้า

ภาควิชา ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต ลายมือชื่อนิสิต .....

ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

สาขาวิชา การจัดการทางวิศวกรรม

ปีการศึกษา 2557

5471224721 : MAJOR ENGINEERING MANAGEMENT
KEYWORDS: WAREHOUSE / DESIGN / SENSITIVITY ANALYSIS

CHANOKPIM CHANUDOMPORN: NEW BUSINESS MODEL FOR A FREIGHT FOR WARDING COMPANY. ADVISOR: ORAN KITTITHREERAPRONCHAI, Ph.D., 115 pp.

For few decades, an emergence of logistics providers has changed interactions of parties and stakeholders in a supply chain. Instead of operating and owning capitals, manufactures have focused on their core competency, while logistics providers have offered professional services and benefited from economy of scales. As logistic services become more popular, a logistics provider tends to expand its services to cover additional aspects in a supply chain. The objective of this thesis is to study a possible expansion of a case study freight forwarder company that spacialises in cross-border logistics services. Requested by its major customer to provide an additional warehousing service, the freight forwarder faces with the key decisions:

- What are the business merits of this expansion to the freight forwarder?

- Should the freight forwarder provide the warehousing service? If so, how?

To answer these questions, the standard business model is used as a framework to identify the value proposition as well as its revenue streams and cost structure. Having identified the business merits, historical data and public information are gathered and served as design parameters to specific space, workforce, and equipment required in a warehouse. These parameters are critical for the last decision as they are independent of the ownership of a warehouse. The site selection of a rent warehouse is evaluated by panel of experts on key dimension, particularly rental fee, condition, distances, accessibility, flexibility and credibility. The best rental candidate site is compared with the private warehouse that may be constructed on a company's own land near a seaport using Economics matrix such as Net Present Value, Internal Rate of return, and pay-back period. During the 20-year time horizon, the comparison reveals the freight forwarder should build and operate its own warehouse. The sensitivity analysis shows that the greatest risk to this logistics endeavor is the volume of freight.

Department:	Regional Centre for Manufacturing Systems Engineering	Student's Signature	.....
		Advisor's Signature	.....
Field of Study:	Engineering Management		
Academic Year:	2014		

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisor, Dr. Oran Kittithreerapronchai, whose has constant guidance and encouragement. I encounter many problems throughout this research but my advisor is very patient with me. He drives me through to the completion of this thesis. I am also very grateful for the Chairman and the examination committee for taking their time to comment and made suggestion to my presentation. I appreciate the administration help from Ms. Pornsuda Potaya who has been guiding me all the way throughout my academic year.

Finally, I would like to express my thanks to my father for the understanding and the assistance I need when I encounter a problem throughout this research.

CONTENTS

Page

Page

Page

Page

CHAPTER I
INTRODUCTION

Trade is important to Thailand's economy. More than one third of the nation's GDP comes from manufacturer sector. Thailand plays an important role as an assembly hub for many international companies. International trade also provides some resources as well as products.

Recently the development of transportation systems, including rail, road, ship, and air transportation has resulted in tremendously stronger trade competition. As new firms enter the market, the emerging companies can no longer achieve target sales with local demand. Trading activities, therefore, expand to other countries.

Nevertheless, international transportation of products and services are challenging and the procedures are complex. The firms may encounter some problems, for example transport intermediaries, levying customs duties and law constraints. As a result many companies outsource the task to freight forwarder whose responsibilities expands to cover the entire supply chains.

Products involving in import and export activities can be raw material, work in process, or finished goods. Products are considered as inventories. Many companies use cross dock warehouse to minimise inventory in terms of holding period and carrying

cost (Faber et al, 2002). However, firms have to hold inventory for buffering, covering possibly demand during lead-time, preparing stocks for batch order with large volume discounts, unexpected seasonal demand, or holding anticipation and investment stocks (Krijewski & Ritzman, 2005). For this reasons, warehouse is essential for business to provide better customer service in order to improve firm's competitiveness in the market.

1.2 Problem Statement

This thesis discusses a freight forwarder company located in Thailand's second largest commercial port, Laem Chabang Port. The company provides both delivery and consulting service: delivering goods overseas and supporting the clients to handle law issues, as well as rules and trade regulations.

Since the freight forwarder focus on delivery and customer service, the company has little experience with the warehouse, it is unnecessary for them to own a warehouse. However, customer A, who is their major customer, was disappointed with poor performance of the former logistic provider so they requested the freight forwarder to provide them a warehouse which was additional service that the company had no experience in. As a result, the freight forwarder company must answer the following demands. By offering warehousing service, the company may be able to expand the business in the future.

1.3 Objective

The objective of this thesis is to determine the best decision to take for the freight forwarder company, as well as design a business model to operate in a new warehouse.

1.4 Scope

- Preliminary of the analysis and feasibility study
- Assume no growth rate
- Assume identical utilization rate of workers
- Does not include design alternatives
- Time horizon of 20 years

1.5 Expected Benefits

1) Suggest the suitable business model.
2) The guideline can be extent to suit other business.

3) Decrease the inventory for the customer

4) Sensitivity analysis and scenario analysis

5) Measure the feasibility of the project

1.6 Methodology

1.6.1 Building business model

Business Model are created to avoid confusion and focus more on serving on what is important to the company, for example, customer's value, which identifies what customer expects the company to do for them and what will make them happy. It is especially useful for company that undergoes adjustments, or has a new activity or operation, because it helps remind the company what are its revenue streams. Business cannot run if they do not have money.

1.6.2 Data collection

In this process, secondary data is used to discuss and analyze the case study. The number of monthly inbound and outbound during the past three years are collected from the company's fact sheets. Other secondary research focuses on discussions on literatures, books and journal that relevant to the topics: advantages and disadvantages of owning a private warehouse, how a warehouse should be designed, and effective warehouse management. The discussion also covers cost of warehousing operation and

cost incurred when applying alternative plan including renting a public warehouse. Scope and research objective are also identified in this part.

1.6.3 Cost elements of the warehouse

Overall cost of building and managing a warehouse, both fix cost and variable cost are evaluated in order to be able to set competitive and profitable price of service. The cost charged from customer who uses warehousing service are not easily shared. Therefore the cost used in the research is an estimate figured.

1.6.4 Testify the project

Building a warehouse is not the only feasible plan that the freight forwarder can put into action. There are other practicable strategies which have to be thoroughly considered in order to make the most suitable decision, for example renting a public warehouse or some equipment instead of investing in new construction. The company may proceed with expansion and further development plan if the current project is successful.

1.6.5 Run sensitivity analysis

After all the data are compute together, it can be given situations. This is so that the company can have an idea if it can survive certain situation. By considering the possibilities beforehand, the company can see its own limit, and therefore trying to prevent the casualties as the constraints allows.

CHAPTER II
CASE STUDY FREIGHT FORWARDER BACKGROUND

2.1 Background

It was the policy of the freight forwarder not to share certain data of the company, or the data of its customers. Their identity and information is enclosed.

Founded in 1988, the freight forwarder has its head office in Bangkok and branch offices in Laem Chabang Port, Suwarnaphumi Airport, and Mukdahan. The freight forwarder employs over 200 staffs who are experts such as retired customs director general and deputies. The operations of the freight forwarder is to facilitate customs, and port procedures and to move goods across countries with services to help clients handle the customs law, rules and trade regulations, to maximise tax incentives in the most appropriate practices to avoid any mistakes that could lead to tax complications later. Besides supporting the manufacturing plants and distributors in Thailand, the Mukahan branch is to support the inland transit of cargo container cross bordered to Savannakhet province of Lao People's Democratic Republic. The freight forwarder also provides logistics services, import and export goods, overland cross border transits, well as logistics consultancy services, acting as a Logistic Service

Provider (LSP). However, the freight forwarder do not have its own fleet of trucks and trailer carrier of its own, but rather uses a network of contract carrier providers.

The freight forwarder provides excellent services in customs, there are excellent advisors who are well accustoms to laws and regulations, as well as its ability to retain a good relationship with its customers and continuously improving its service.

2.2 Organization Chart

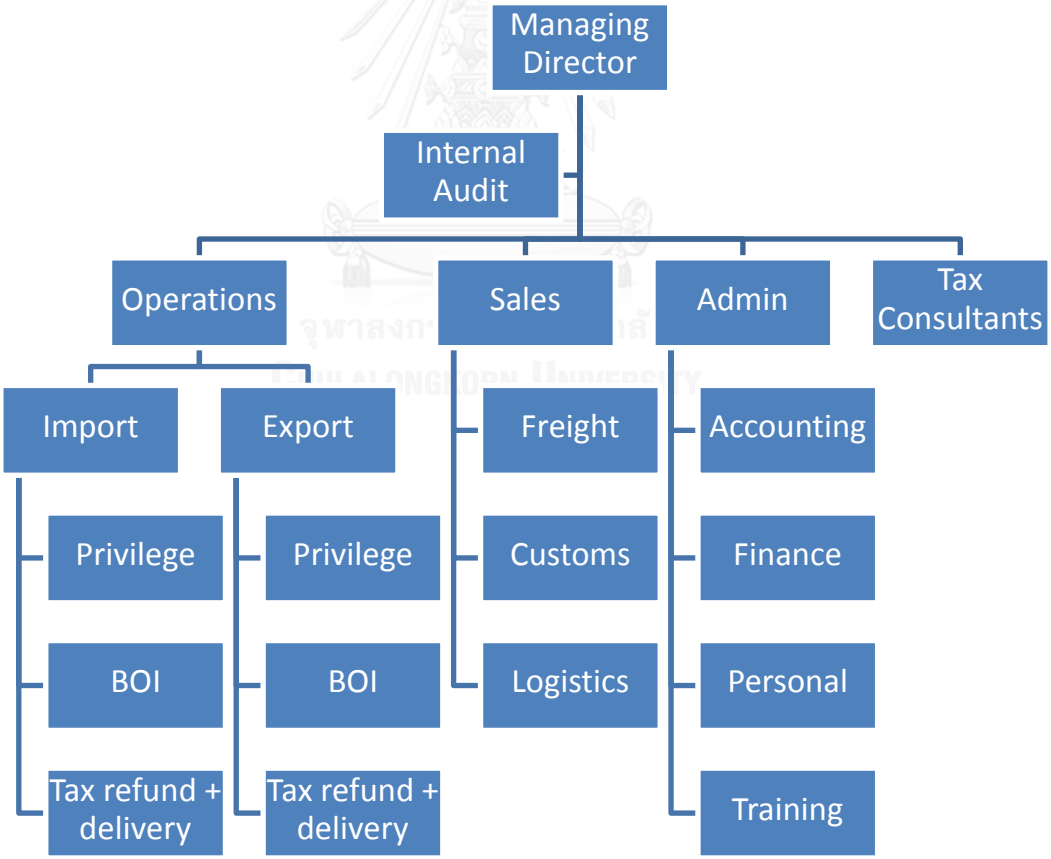


Figure 2-1: Organization chart of the freight forwarder

The head of the freight forwarder is the Managing Director, and there is an Internal Audit who is in charge of the quality approval. There are four main departments in the organization. Which are Operations, Sales, Administration and Tax consultant. The Operations department is made out of two sections, the export and the import sections, where the activities for both sections are similar, there are the privilege, the BOI and the Tax refund and the delivery. The Sales department consists of three sections, the Freight, Customs, and the Logistics. As for the Administration, the department is made up of four sub sections, the Accounting, Finance, Personal, and Training.

2.3 Customers

The freight forwarder has approximately 80 customers, ranging from manufacturers of electric appliances to automobiles and motorbikes. Most of their customers are international companies who have a production branch in Thailand and many SKUs have to be imported. The majority of the shipments came via ships through the Leam Chabang port. The rest of the small portion transported via air. Since, it is always more economical to ship in large volume. However, this often creates inventory for the company, and the inventories requires a place to store.

Customer	Type of business	Route	Service percentage
A	Electronic manufacturer	Korea → Seaport → Chonburi	69%
B	Assembles automobiles and motorcycles	Korea → Seaport → Lao	20%
C	Assembles of cars	Japan → Sea port → Phechaburi	7%
D	Produces knockdown furniture	USA → Suwanaphumi Airport	2%
Others (70+)	Mostly electronic assemblers		2%

Table 2-1: Major customers and their nature of business

The table above represents some of the freight forwarder's customers and the approximation of how the service of the company dispersed.

Most customers do not rely on the freight forwarder service alone, but other 3PL provider as well. One of the reasons is the freight forwarder does not have its own warehouse. The company's priority is to focus the service on it's a type customers according the 80/20 rule of the Pareto analysis. As can be applied in this situation, where 20% of its customer is the area where 80% of the income is generated. In this case, the 20% of the customer includes Customer A and B. Therefore the main focus of the company should pay attention in this area of customer.

2.3.1 Customer A

One of the freight forwarder's biggest customers is Customer A has a long, good relationship for over 18 years. Company A is a large electronics appliance manufacturer and has an assembly plant in Chonburi, Thailand. The most shipments of parts are transported via ships that arrived at Laem Chabang Port.

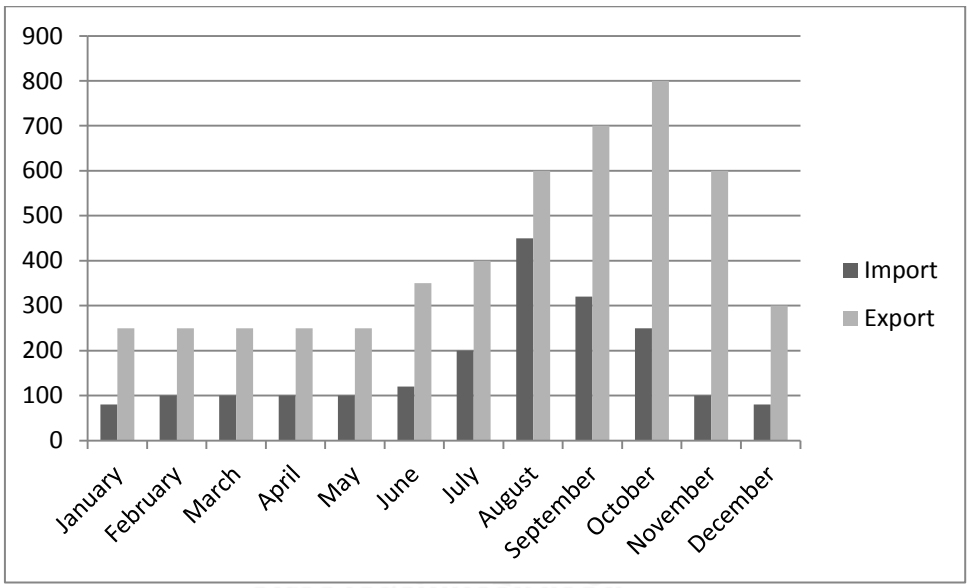


Figure 2-2: The annual shipments provides to Customer A in 2011 by the freight forwarder (number of containers)

The figure shows the amount of imported and exports that the freight forwarder had service Company A in 2011. The amounts of exports are larger then imports, where the peak of import is usually around August and the peak of export is around October. This trend is seasonal, which can be explained by customer demands for gifts during Christmas and New Year.

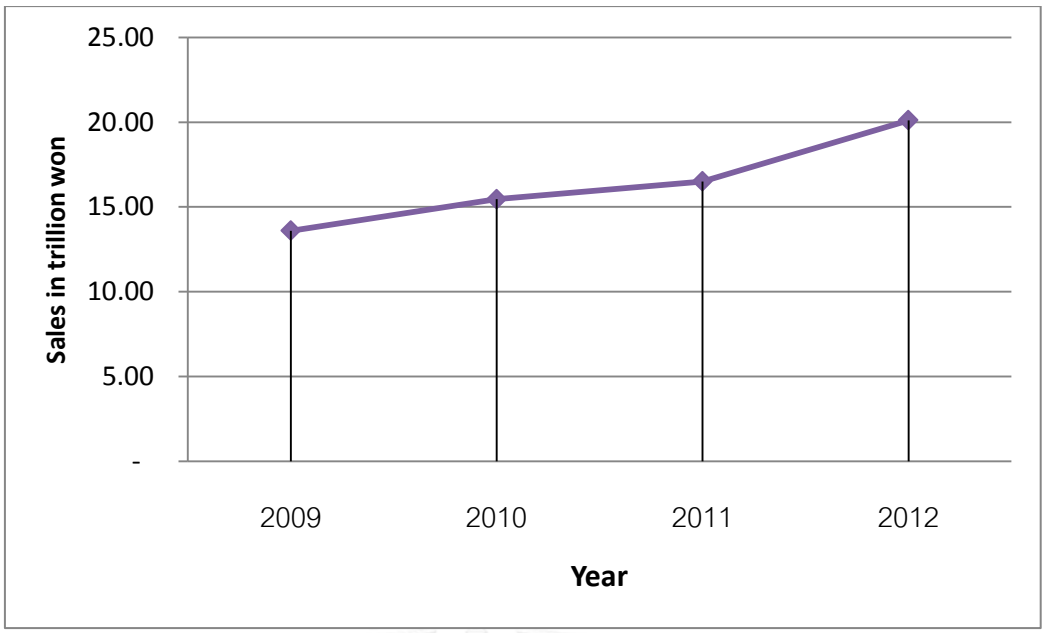


Figure 2-3: Customer A sales worldwide in trillion won from year 2009 to 2012

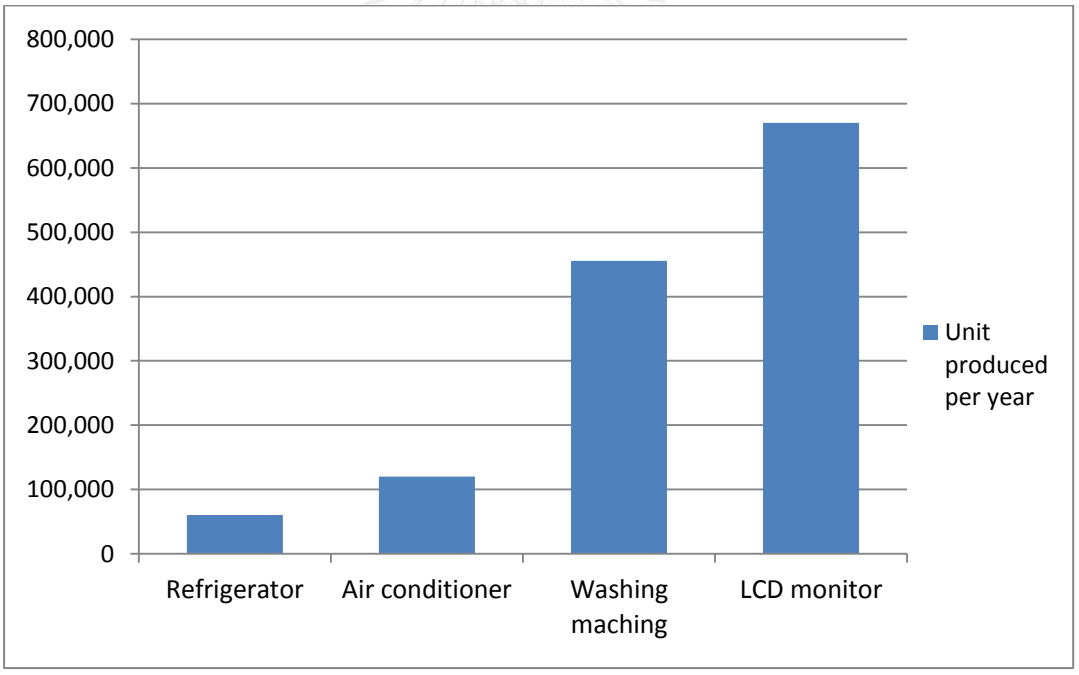


Figure 2-4: Average unit produced by Customer A between 2009-2012, categorised by product types annually.

Figure 2-3 represents the worldwide sales in Won of customer A from year 2009-2012. The next figure categorised the sales by product type using the average from year 2009-2012. The destination for export shipments includes the Middle East, Europe and Asia, where highest demand came from Middle East and Europe.

The agreement for purchase and shipping of international trade (INCOTERM) between the freight forwarder and Company A are CIF (Cost insurance and freight).

Many customers of the freight forwarder do not rely on the freight forwarder's service alone, a large portion of the imports are handled by other Third Party Logistics (3PL) companies

Table 2-2: Percentage of other party's service, Company A use to import their parts

3PL Service provider of Customer A	Percentage of service used
3PL Provider 1	45%
The freight forwarder	35%
3PL Provider 2	10%
3PL Provider 3	10%

Table 2.2, use Customer A to demonstrate how much services from each 3PL providers. As we can see 45% of the imports of Customer A are being carried by 3PL Provider 1. The 3PL Provider 1 is large and well known of its size. They have their own warehouse facilities and their own truck. This is the reason why most shipments are not handled by the freight forwarder.

2.3.2 Customer B

Customer B' company's main business involves the manufacturing and assembling of automobiles and motorcycles. Customer B is one of the biggest five Korea automotive companies in Lao, having a 40% market share in automotive industry and 35% in motorcycle.

The responsibility of the freight forwarder is to transport the goods from Korea to Lao is through Leam Chabang, Thiland. The goods arrived at Laem Chabang Port via ship, and then the freight forwarder assigns their out-sourced container carrier truck to pick the shipments up and distribute them to Laos.

2.4 Service / Operation

Custom clearance has a series of activities as the goods moves through the different stages. The process for import and export are done differently. The procedure steps of customs clearance for import goods are as follows.

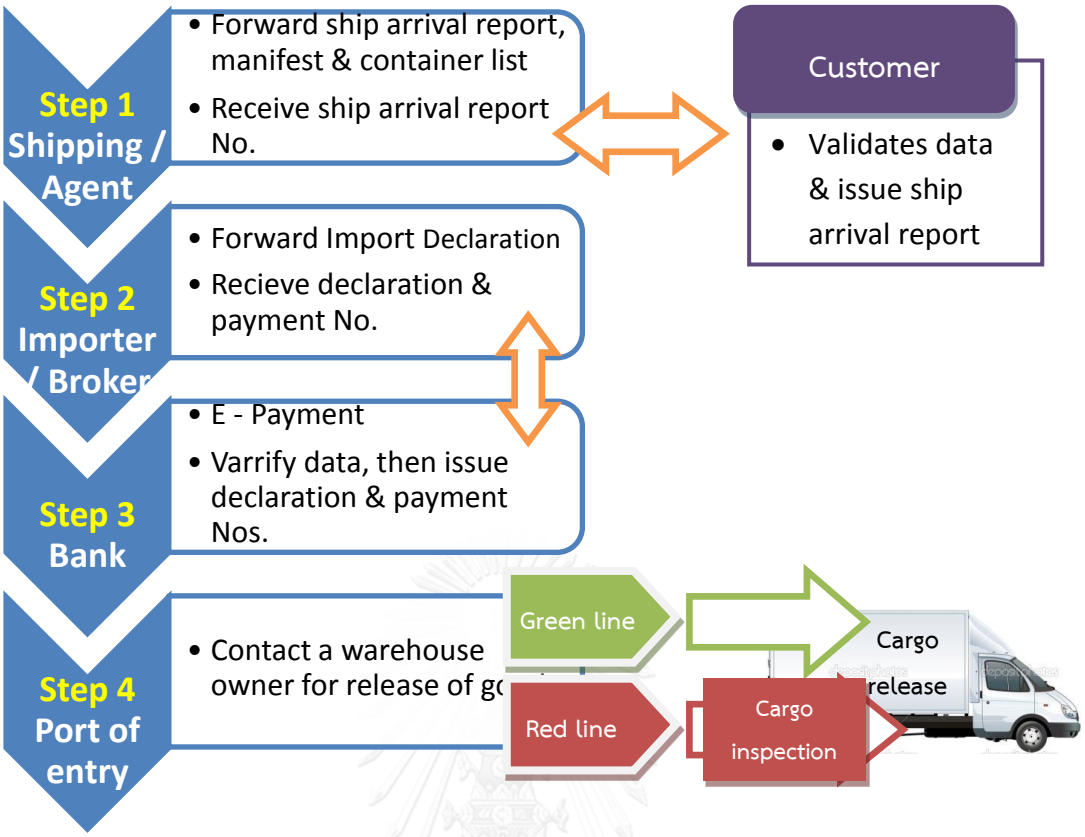


Figure 2-5: Import procedure (The Customs Department, Thailand, 2009)

Step 1: Submission of Declaration (paper work is to be done by customer and agent)

- Shipping agent submits the import declaration to the customs system via e-customs.

- Submit ship/aircraft report

Step 2: *Check and Verification of the Declaration* (paper work is to be done by broker)

- E-customs system issues a Declaration and Payment Numbers

- Selectivity profile system specify whether the Goods Declaration go through the Green Line or Red Line.

Step 3: *Payment of Import Duties and Taxes (conduct at the bank)*

- Payment can be done by two ways, either at the Customs Department or payment via e-Payment system.

Step 4: *Inspection and Release of Cargo* (conduct at the port of entry)

- Green line: - An importer submits the verified Declaration together with the payment receipt at the warehouses.

- The cargo status is electronically sent to both the Port Authority and the importer/Customs broker

- Red line: - The Port Authority removes the cargo container for thorough physical inspection by Customs before the release of the cargo.

After the imported container arrived, it is the freight forwarder role to do the customs clearance of the shipments. When it is done, they have the contracted trucks to deliver the containers to the customer's factory directly.

Clearance of export goods is also an important part of the company's job. Where the company sent the contract truck to pick up the container from its customer's factory and brings it to the port.

The customs clearance procedure for export goods are as follows.

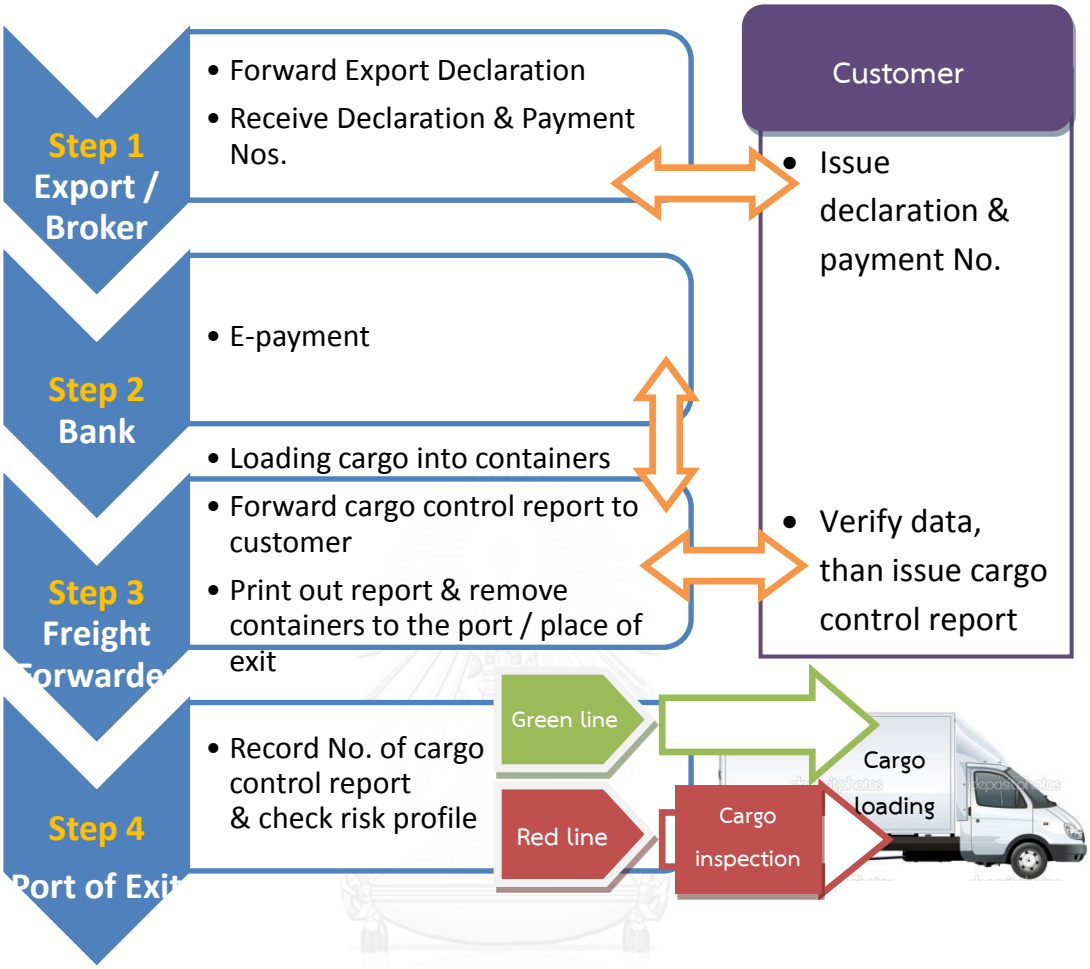


Figure 2-6: Export procedure (The Customs Department, Thailand, 2009)

Step1: Submission of Declaration

- Exporter/broker submits an Export Declaration in ebXML message to the e-Customs system.

Step 2: *Verification of a Declaration*

- Export Declaration data, such data is preliminary validated
- Goods Declaration ID is generated

- The response message is transmitted to the exporter/broker.

Step 3: *Payment of Duties and Taxes*

- Payment of export duties and taxes can be done in three ways payment at the Customs Department, payment via e-Payment system, and payment at banks.

Step 4: *Inspection and Release of*

- A freight forwarder loads cargo into containers and sends

Step 5: *Cargo*

- A cargo control report to the e-Customs system.
- The data is validates and reports any error for immediate online correction.
- The cargo control report number is automatically generated by the system to the exporter/broker.
- The freight forwarder may then remove the cargo to the port of exit. The Customs officer at a sub-gate checks the declaration whether it is a Red Line or a Green Line.
- Green line: - a shipping company/agent is required to submit, the manifest information to the e-Customs system. The system automatically loads the Goods Declaration and transmits the response message back to the exporter/broker.
- Red line: - the cargo is removed for physical inspection.

Most of the customer that the freight forwarder gave service to those business that that does not involves biologically perishable goods, nor products with short shelf life. So the company does not need to be overly concern about temperature or the cleanliness.

This section of customers are consists of over 70 small companies. They constantly use the service of the freight forwarder but with small volume.

2.5 Business Growth

Focusing on the main customers of the freight forwarder alone, their company is having a growth of 10% a year, and there is a high tendency to increase the production of the plant in Thailand, therefore the shipment of the parts are meant to increase.

Not only does the situation at hand drive the freight forwarder to have a warehouse, a future contract with a new costumer, a car assembler, also plans to use the warehousing services of the freight forwarder. The problem is the exact volume is currently unknown.

Additionally the freight forwarder's business owner has also owed other business concerning knockdown furniture. The current manufacturing is taking place in Mexico, which the finish products are distributed and sell in USA. In the near future, the owner wishes to expand his furniture business to Asia by doing a joint venture with a furniture

manufacturer in Vietnam and sell the finish products of his design to Thailand and the regional.

CHAPTER III

LITERATURE REVIEWS AND RELATED ARTICLES

The freight forwarder saw an opportunity to expand range of activities and improve customer service. The questions mentioned above must be answered in order to make appropriate decision.

The current delivery volume the freight forwarder provides to customer A is approximately 50-80 containers per month. Customer A has become a loyal customer of the freight forwarder due to excellent performance of the company. The increasing delivery transaction between the freight forwarder and customer A is the reason they decided to build their own warehouse in order to boost service level and gain more customer satisfaction.

Although the freight forwarder did occasionally use public warehouse when warehousing was implicated in a certain delivery transaction, they are in experienced in real warehousing operation. However, the continuous increase of demand eventually outdid available capacity of the rental public warehouse so the firm decided to build their own warehouse in 20 rai block of land located in Laem Chabang district.

. Expanding the range of offering service activities is a challenging task that the firm has to go through in order to grow and stay competitive, especially in today's high competition. In this case, the freight forwarder decided to accept customer A's request:

providing a warehousing service to customer A. Before the company could go right to building a warehouse, there are aspects that that one needs to understand before it can start with any other step.

3.1 Literature Reviews

3.1.1 Warehouse design

Before the facility design process can be taken place, it is requires that all the functions of the warehouse should be overlooked. It is stated in literature that functions in the warehouses are interdependent, overlooking of certain functions can result in an incomplete design (Tompkins and White 2010). Warehouses can be functions as a distribution center. They can be categorised into two categories. The first category is the receiver of the incoming products, where it must organise and store them properly. Second, is the shipping, where it receives orders from customers and should be able to ship the orders. The activities in the warehouse generally common in most literature, some, in-depth than another, the activities includes: 1. Receiving, 2. Identification, inspection and sorting, 3. Put away, 4. Storage, 5. Order Picking, 6. Packaging, Labeling /Pricing, 7. Shipping.(Frazelle 2002)

There are several researches concerning warehouse operation planning and designs. The most common framework belongs to Gu et al. (2007), which is divided into five different categories. “The design related issue concerning the overall structure of

the warehouse, department layout, operational strategy, equipment selection and sizing and dimensioning of departments." In the past, organization only concentrates on operational planning problem, how to improve the activities in the warehouse, such as order picking and operation and storage. These two operations have always had the most influence on warehouse utilization measures.

The related articles are gathers, which consists of other people's researches and other online articles. However, a number of reviews in literature have shown that there are very few statements in academic journals on which systematic approach warehouse designers should follows. The conclusions gathers are as follows.

- "A search of the literature shows that very few papers deal with the general warehouse design problem" (Ashayeri and Gelders 1985);

- "In general, however, there is not a procedure for systematically analysing the requirement and designing a warehouse to meet the operational need using the most economic technology" (Rowley 2000);

- "a sound theoretical basis for a warehouse design methodology still seems to be lacking" (Rouwenhorst, Reuter et al. 1999);

- "a comprehensive and science-based methodology for the overall design of warehousing systems does not appear to exist" (Goetschalckx 2002).

(Info gathered by (Baker P. and Canessa 2009))

For example, Baker & Canessa (2009) which formulate an approach based on reviews from specialised warehouse design companies. Another approach is from the studies of related literatures, concentrated on operation optimization in some areas of warehousing. For example, layout designs, equipment to be used, or picking policies.

However, there is no acrylic method on how the warehouse design process should be done. The way it is usually done is by trying to optimise the performance within the limited range of given functionalities. Warehouse design was created and adapted throughout the years and have been adapted to best suit each company's nature.

Some of the frame work where selected because they are best fit approaches for the overall warehouse design phrase and development. The result can be shown in Table below.

Table 3-1: Warehouse design framework by Baker & Canessa

Step	Design tools, techniques and key references
1. Define basic requirements and identify role of the warehouse	overall system, business strategy requirements and constraints, Oxley (1994) Distribution network assessment (Baker & Canessa, 2009)
2. Define and obtain data	Checklist on goods' nature (Jones et al., 1997)
3. Analyze and characterise data	Activity profiling and benchmarking (Frazelle, 2002)
4. Consider possible operating strategies	Layout planning (Hassan, 2002) Item allocation policies (Frazelle, 2002) Picking method evaluation (Petersen et al., 2005) Storage vs. picking requirements (Phillips, 2010)
5. Identify preferred design alternative	SWOT analysis System functionality Standards assessment Financial estimation

3.1.2 Levels of decision making

Although there is no finite framework concerning warehouse design, most articles have somewhat suggested a similar structure concerning warehouse designs aspect. First of all, before the physical layout is to be concern, there are methods the phases has to run through. “Data collection, functional specification, technical specification, equipment choice, layout planning, order picking policies.” (Rouwenhorst et al., 2000). This method act as the overall guidelines to the overall warehouse designs. Further detailed that this method lacks, the warehouse designers developed their own approach. These decisions are then situated at different level of decision making based on the process of concern and the level of automation. The description of each level of decision is as follows.

Table 3-2: Level of decision making and description

Level	Description
Strategic	The decision concerns the long term impact and involves high investments. The decisions can be divided into two main groups, the first one concerns the overall designs of process flow and the second group concerns the selection of warehousing system.
Tactical	This level is a mid-term decision that requires smaller investments and should not be of concern too often and the impact is lower than at the strategic level, however the decision of this level are based on the outcome of the strategic level. The decision concerns allocating resources, the size of storage systems, number of employees needed, layout designs, and etc.
Operational	Concerns process carried out with the constraints set by the strategic and tactical decisions. Problems that occur in this level has to be handle independently because the policies of the operational level are not related to the decision from two higher levels. Assignment to pickers, picker route and control of people and equipment are the main decisions of this level.

For this thesis, the design focuses mainly on the Strategic level of decision making. The decision is long term, and taking place in the introduction level, so the operational levels are not of concern.

3.1.3 Material Handling Equipment in the Warehouse

Before the goods from manufacturing reach the hand of customers, they are moved around several times, the processes includes manufacturing, distribution, consumption and disposal. Throughout the movement of goods, the material-handling equipments are required for such actions. The material handling equipments comprised of several types of vehicles, storage unit, and other accessories. The equipments can be separate into four main categories, which are storage, engineered systems, industrial trucks and bulk material handling. (Wikipedia, 2013)

Storage equipments are used to hold or buffer materials in the downtime. The long-term storage allows for the buildup of stocks when they are not being used or transported.

Warehouses is an infrastructure to store items, the more unit that can be stored is likely the better. It would be able to make better use of the warehouse if we can utilise the available space in the warehouse, especially the high advantage. However, it is not possible for some products to be able to be stacks on top of one another and not get damaged. It is more likely that items are store in large packs, and inconvenient to move

them around with man-power alone, therefore material handling equipment should be use.

A pallet is a flat staging platform for support the handling and storage of goods. The top areas are for placing the goods and are made into stingers, with are leveled, which allows for efficiencies when picked up by forklifts and pallet jack. This is so because they can be stack on top of each other thus saves space and the traveling time of forklifts. With pallet in use, it is safer and much faster especially when goods need to be move, whether it is for storing purpose or loading into the transport trucks. Pallets are made from wood, paper, plastics and steel. They are categorised into two-ways and four-ways pallets, where four-ways are bigger, heavier and generally used for heavier loads. Pallets varies in dimensions, however, there are ISO standardization pallet size. As for the ones use in Asia, the dimensions are 1,000 x 1,200 mm (W x L), and 1,100 x 1,100 mm (W x L). So the rack should be made so that the pallet can fit in with ease.

For a warehouse to be able to store items using the height advantages effectively, a rack is needed. The important thing to always keep in mind is that, no matter how high the rack is, it should not exceed the lift height that a forklift can reach, in this case, 300 meters. Moreover, the rack should be able to withstand the weight of the item to be store on them. The standard weight capacity for a rack is 2 tons. For the warehouse case, a double deep rack is use.

3.1.3.1 Engineered Systems

Engineered systems are material handling system that are engineered to be able to automated with integrate ability of many tools in one. Some of the machine includes handling robots, conveyer, AGV, processing machines. The utilization of picking and storage systems are called pick modules and sortation systems, which is widely use in distribution centers.

3.1.3.2 Industrial Trucks

Industrial Trucks refers to the motorised vehicles that need to be driven manually. The vehicles are powered by propane, gasoline or electricity. It can be said that industrial trucks are vehicles that requires operator with skills. Some of the example of industrial trucks are forklift trucks, stock chasers, and tow tractors. These equipments help do the jobs where engineered system cannot. However, some warehouse without the installation of engineered system may solely rely on forklift trucks to retrieve and put-away the goods.

Forklift trucks and hand forklifts. Forklifts came in various price, size, engine, power type, load capacity, etc. The common purpose is that it could reach higher and makes moving heavy items around the warehouse easier. However, to be able to use the forklifts or the hand forklifts, it is necessary that we also use a pallet.

3.1.3.3 Bulk Material Handling Equipment

Bulk material-handling equipments are equipments used in moving and storing materials in bulk. The materials are in large quantities for example liquid, cement or ore. These equipments are required on mines, refineries, shipyards and farms.

3.1.4 Warehouse operations concepts and cost structure

After understanding the level of decisions that has to be reviews, the next topic that should be looked into is the topic related to costs. Likewise to warehouse design, there are several ways to calculate how much to charge customers. However, there is no significant costing system that is correct. Thomas W. (2009) has designed the model so that no item is overlooked. Assuming that further customizations done by different users regarding the allocation of administrative costs. There are costs involved in every activity in the warehouse. The various costs can be separate into 4 different categories. Which can be explains in the following table.

Table 3-3: Category of warehouses' cost and description

Category of warehouse costs	Description
Handling	The expense related to moving product into or out of the warehouse. The activities include receiving, put-away, order selection, loading, or even repackaging or refurbishment of product that are damaged. Labor plays a large part in the handling of products throughout the warehouse. Equipment used to handle the products are also the cost of this category. For example, the cost of fuel and electricity to run the equipments, the depreciation of equipments, etc.
Storage	The expense that involved "goods at rest". The storage expense is the cost of occupying the facility, usually charge on a monthly basis.
Operations and administration	The expense that are paid to support the operation of the warehouse. The example of these costs includes insurance, information technology, supervision, taxes, etc.
General administrative expense	This category involves the expenses that are not directly incurred to the warehouse itself. This includes non-operating staff, general management, office expense, etc.

Trying to improve these processes and insure the minimization of capital and operating costs over time, warehouse systems are put to use. These systems are designs to help optimise the processes, which can includes storage systems, material handling systems, sorting systems, etc. The problem in the design is to define these

specifics and the relationships between information and material flow throughout the warehouse, and identify the system to be used. The formulation decision is a top-down approach (e.g., Ashayeri and Gelders, 1985; Gray et al. 1992, Rouwenhorst et al. 2000), which are further review later in the Theory section.

The desire pricing should be able to cover the entire stated costs totaled, adding the desire profit margin percentage to create a price per square foot that is charged. This is also be counted as the storage price per unit.

3.1.5 Feasibility Study

A Feasibility Studies are pieces of research done before the main study (Arain, Campbell et al. 2010). Usually before the main study was to be carryout, important parameters are to be research beforehand, and so the Feasibility Study is use to estimate their ability to complete certain project. It is important for managers to know the possible negative and positive outcome of the project or idea before execution, because they want to avoid spending money on project that does not have a chance to finish, should the project be continued?

The application of feasibility study can be applied to many areas on parts of the business ventures. One of the purpose is to determine if the business ventures remain viable in long-term. The venture can either be a new start-up project, buying existing business, or business expansion. Usually this step is done after managers' discussion of

future plans for future development. They can also be used to access different scenarios and impacts that the project may cause. The Feasibility Study Outline by Don et al., 2009, includes.

- Identification and exploration of business scenarios
- Define the project and alternative scenarios
- Relationship of the impact to the surrounding area
- Industry competitiveness
- Market potential identifications
- Access to market outlets
- Sales projection
- Facility needs
- Suitability of production technology
- Estimate the total capital requirements
- Estimate equity and credit needs
- Budget expected costs and returns of various alternatives

- Business structure identifications

- Business founders identifications

Because there is a similar term called ‘pilot study’, it is important that we have a clear understanding between the two terms. A research by Thabane et al., 2010, has given a useful explanation of a pilot study. The definition he gave is the kind of study that sample size should be used in the calculation. There are various purposes to the study; it may be tasting estimation of parameters, validity of tools, etc. Usually the outcome of the study does not have enough power to test powerful hypothesis, it can also be called medical trial, a 'proof of concept' a studies in Phrases. The different between 'pilot' and 'feasibility' study can be explain in the research by Arain et al., 2010. Study reports that are ‘pilot’ usually have a pre-study sample size.

3.2 Other Related Articles

3.2.1 Business model structures

Because the aim of this thesis is to create the business model, the topic of research also involves business model. The business model of each company varies. Some may be more complex than others because different company varies in size and functions, there are no single design to a business model.

Base on the reviews from Academic Journals, the team Business Model has never been studies as explicitly define concept. The term “business model” has been included in over 1,203 articles in academic journals. Most Journal only talks about its meaning by stating its components, and only 19% of the reviews defines the concepts, (Christoph, Raphael, & Lorenze , 2010). “From the journals, the Business model has been seen as a ‘statement’ (Steward & Zhao, 2000), a ‘description’ (Applegate, 2000; Weill & Viale, 2001), a ‘representation’ (Morris, Schindehutte, & Allen, 2005; Shafer, Smith, & Linder, 2005), an ‘architecture (Dubosson-Torbay, Osterwalder, & Pigneur, 2002; Timmers, 1998), and ‘conceptual tool for model (Osterwalder and Pigneur 2009), a ‘structural template’ (Amit & Zott, 2011), a ‘method’ (Afuah & Tucci, 2001), a ‘framework’ (Afuah, 2004), a ‘pattern’ (Brousseau & Penard, 2006), and as a ‘set’ (Seelos & Mair, 2007).” (Christoph, Raphael, & Lorenze, 2010).

The lack in common conceptual base could cause confusion. The studies carryout by the University of Navarra has suggest that, the business model should consider at least three concepts: 1) Business model archetype, 2) Business model as activity system, and 3) Business model as cost/revenue architecture. Because these three concepts are related under the umbrella of business model theme, they should be carefully investigated individually.

The Business Model Generation developed by Alexander Osterwalder & Yves Pigneur (2009) is easy to follow yet complete. The following items are the components of a good business model:

- Customer Segments
- Value Propositions
- Channels
- Customer Relationships
- Revenue Streams
- Key Resources
- Key Activities
- Key Partnerships
- Cost Structure

The framework introduced by Alexander Osterwalder & Yves Pigneur (2009) gives a very clear picture of how, and what component to include in the business model. The structure is easy to understand and the labeling is clear. This framework is going to be useful for this thesis.

3.2.2 Engineering Economy Tool

When dealing with investment, it is necessary for the companies to use some tools to help in the decision making process. According to the time value of money, the money we have right now is worth more than the same amount of money in the future. The idea means that the investor is left to choose if they would like to receive the money today or a year later. This is so because there is interest rate involves. It is only make sense that the money receive later should worth more than what it is worth today, or there would be no point investing. To determine if the investment would give you the return you are looking for, investor use some tools.

3.2.2.1 IRR

One of the tools that are very useful is the RR, Internal Rate of Return. The IRR measures how well an investment, project or, capital expenditure performs over time. This is especially useful when a project covers a long horizon of time. The purpose of using the IRR is to determine if the capital expenditure, project, investment is worth investing. The IRR is also a tool to compare the profitability of one project over the other or to see if the project is worthwhile for the company. Often, companies usually use IRR to measure one or more potential projects. This is done so by choosing the project that gives the highest IRR. Or if the exceeds the company's cost of capital, then, it is viable.

The IRR analysis begins with a series of stream of cash flows, the positive figures for the net inflows, and the negative for the net out flows. A stream set of cash flow made

up a cash flow profile. A decision taken place changes the cash flow stream, and therefore makes a new cash flow profile. Each cash flow profile can be compare with each other.

The disadvantages of using IRR are that, over the time horizon in the cash flow profile, the interest rate does not change. Where in real life, the interest rates all the time. It also does not consider the cost of capital, so it shouldn't be used to compare projects which have different duration.

Another useful tool for calculating how profitable the project would be is NPV, Net Present Value. It shows the difference between the present values of future cash flow from the original investment. The Net Present Value of the cash flow is calculated by summing of all cash flows that the project generates divided by the discounting rate, or it can also be said, the opportunity cost that the investor could earn investing on other things.

3.2.2.2 NPV

The NVP is positive when the money inflows exceeds the outflows, the NVP is positive, thus adds value to the investor. The result can be used to compare with other projects and usually the one with highest NVP is most preferred. NVP is most useful when the inputs are accurate, which is usually difficult.

3.2.2.3 Sensitivity Analysis

Doing business, often, something unexpected is prone to happen. Other business tools and model are used to aid the decision making; they only report the single outcome, and lack the dynamic of the ever changing real life situations. The events that occur in the economy are not something the investor can control. For example what if there is a recession, which then leads to the drop in sales. When that happens, what happens if there isn't enough amounts of pallets? If that happens, the company may not be enough to pay all the expenses.

The sensitivity analysis lets investor access how sensitive the model impact, had a parameter change from the original conclusion. The analysis helps the investor identify which parameters are the key drivers of such result. By studying the sensitivity analysis, it helps building confidence to the investors, since there are many parameters in the model that represents the value that is very difficult find the accurate figure in the real world. Therefore, usually when investor builds a dynamic model, they are aware that some parameter can be uncertain. Outcomes of the sensitivity analysis are display in the later chapter.

3.2.2.4 Break Even

Another available tool is using Breakeven Point analysis, because this is how we know how many sales the firm needs to make in order to cover its expenses and not making any profit or loss. If its sale can exceed the breakeven point, then it is making a

profit, at the same time, if the sale is not enough to hit the breakeven point, then it is taking a loss. This analysis helps firm determine when they make enough money to cover the expenses.

To be able to calculate a breakeven Point, we need three variables, which are fixed costs, variable costs, and the price of the product. The formula is:

Fixed Costs/Price - Variable Costs = Breakeven Point in Units

Fix costs are costs which does not change no matter how much sales the company makes, for example are overhead costs. Variable costs are costs that changes with depending on how much sales the company makes, for example the cost of goods sold.

CHAPTER IV
BUSINESS MODEL

A business model can be explained as the logic of the firm, how it operates, how it use its resources, the relationship of structures, coming in contact with its customers, and how it generates value for its stakeholders (Ulrich et, al., 2008). Business represents the firm strategy, which is important to include all aspects beyond the boundaries of the firm alone. This means that all the partners, suppliers and customers should always be taken into account.

A business model has no standard format; varies from firm to firm depending on its nature and industries. For different company, the content of business model differs, and so does the diagram used. It can be changed later on as it develops to best suit its company.

The freight forwarder needs the business model for the same reason other firm needs it. The following sections represent each focus point of the company, and thus is used to construct the diagram later.

4.1 Customer segments

This is where the company identifies who we are creating value for, who are our important customers are; who does the company serve. What value and benefit does the partners and customers received.

4.1.1 Customers

The freight forwarder, it already has their existing group of customers that use their 3PL services. Therefore the customers that are relying on the service of the new warehouse are Customer A, as well as other extension of the customs consulting and the new ASEAN intra trade services and cross border services of existing customers of The freight forwarder.

4.1.2 Customers Benefit

The new warehouse serves as buffering of inventories. Customer A, who is using its service benefits from not having to manage the import and export goods by themselves. It also saves them the complication of supervising with many 3PL at the same time any more.

4.2 Value Propositions

Value Propositions includes what job you solved, or deliver for our customers. As for the freight forwarder with the addition of the new warehouse,

- Enhance the Custom Clearance capability and is able to use the warehouse as a buffer during public holidays, thus reduce and delays in the flow of goods and services especially during the rush peak seasonality.
- Another value to the customer is that they don't have to coordinate with additional providers when there is an overflow of materials which occurs from time to time.
- Customer are now assured that they can launch new products without having to worry if there is sufficient space available for the import parts that the customers is using in the production.
- There is now standby buffer to accommodate Inventory storage for finish goods that are later exported.
- This extra buffer space is also accommodate the anticipation stock for possible domestic sales
- One of the company's strong values of the company's model is its ability to provide customs and tax advisory services with its top experts. (The company hires retired director and deputy directors of the Customs Legal department to analyse specific case and find best customized solutions within the legal framework for clients .
- The company continue its strength with the license of providing logistics support to carry dangerous goods and classified goods the military which has stringent safety requirements.

4.3 Channels

Channels refer to whom do customers want to be reached. How the company reached them. Where is the meeting point? As stated earlier that the new warehouse rely heavily on the existed data of the freight forwarder. However, with the additional services, it could be promoted. The owner discussed the company's unique channel and could be summarized as follows.

- The company continues to maintain its competence for carrying classified dangerous goods and enhance it international competence with heir studying in west point military cadet school in the US (but this in not for public and need to be very low profile).
- Key account channel must be maintained with existing clients as such clients are growing in volume and new requirements which prompted the company to continue to improve and expand alongside with the key accounts.
- New emerging channels via cross border trade with Myanmar for cross border trade developes along with cross border trade the customers for Laos and Cambodia
- General public clients is expected to grow with the addition of one stop logistics services including warehousing services added to the portfolio.

4.4 Customer Relationships

The freight forwarder has done a good job maintaining a good relationship with its current customers. This is a good practice for its warehousing business as well. Each section of customers would be expecting the company to establish something in order to maintain a relationship. In which case, for most companies, it is important to give extra care to the customer with the greatest value.

- Maintaining competence and relationship with government clients including relationships with the ongoing requirement of classified dangerous good in compliant with international standard
- Maintaining key account relationships with existing clients as these clients are growing in volume and in variety of businesses
- Maintain and develop general clients relationship and conduct Tax and Duty Consultancy and free seminar to clients to let know more about tax and customs practices to avoid any potential tax liabilities in the future

4.5 Revenue Streams

Refers to where do the revenue the company receives come from. For what are they paying and now they prefer to pay. Additional to the current services that the company provides, adding a warehouse adds to more revenue streams to the company.

- Increasing customs clearance and logistics service fees due to the increasing volume from existing clients
- Additional, monthly fees for storage and handling additional income is not expected to be significant but is necessary to expand the services to keep current key accounts happy.
- Once the main services are stable, other services such as repacking for redistribution services offered.

4.6 Key Activities

Key Activities let the company ask themselves what value the value proposition, distributional channels, customer relationship and revenue stream requires to have.

- Tax/duty and advisory services
- Additional warehousing storage
- Provides one stop uninterruptable logistics services

- Warehousing and distribution control systems
- 24 hours service especially during client's peak season
- Advise on logistics improvement and communication interfaces
- Developing more online system and reduce paper based system
- Continue to develop a network of other freight forwarders in other ASEAN countries to facilitate smooth logistics service for clients.

4.7 Key Resources

The Key Resources are closely linked with the other sections. The value proposition, distribution channels, customers relationships, value stream requires some kind of key resources to operate.

- Collaborate with Systems Provider
- Additional Financial investment
- Continuous Internal process improvement
- Communication system to reduce time and administration cost,
- Invest in training and hiring qualified personnel
- Investing in security process and system as in compliance with new regulations

4.8 Key Partnerships

Partners are very important to the business. Aside from customers, they involved key suppliers and stake holders. The business could not run smoothly without the assistance and corporation of its partners. We should understand what each partner does. The following are the motivations for partners.

- Truck providers, because the company does not have its own truck.
- Systems providers
- Carriers
- Customs
- Other Government Agencies
- Banks

4.9 Cost Structure

There are many sources of cost in the business, by identifying which are the most expensive, the company can especially focus on the cost and possibly try to reduce it.

- Fixed cost – head office, branch offices at the Suvanaphol airport, Lamchabang Port, Border Offices and depots

- Operating Cost including communication cost.
- Warehouse operations cost – consider partially fixed and variable during peak season

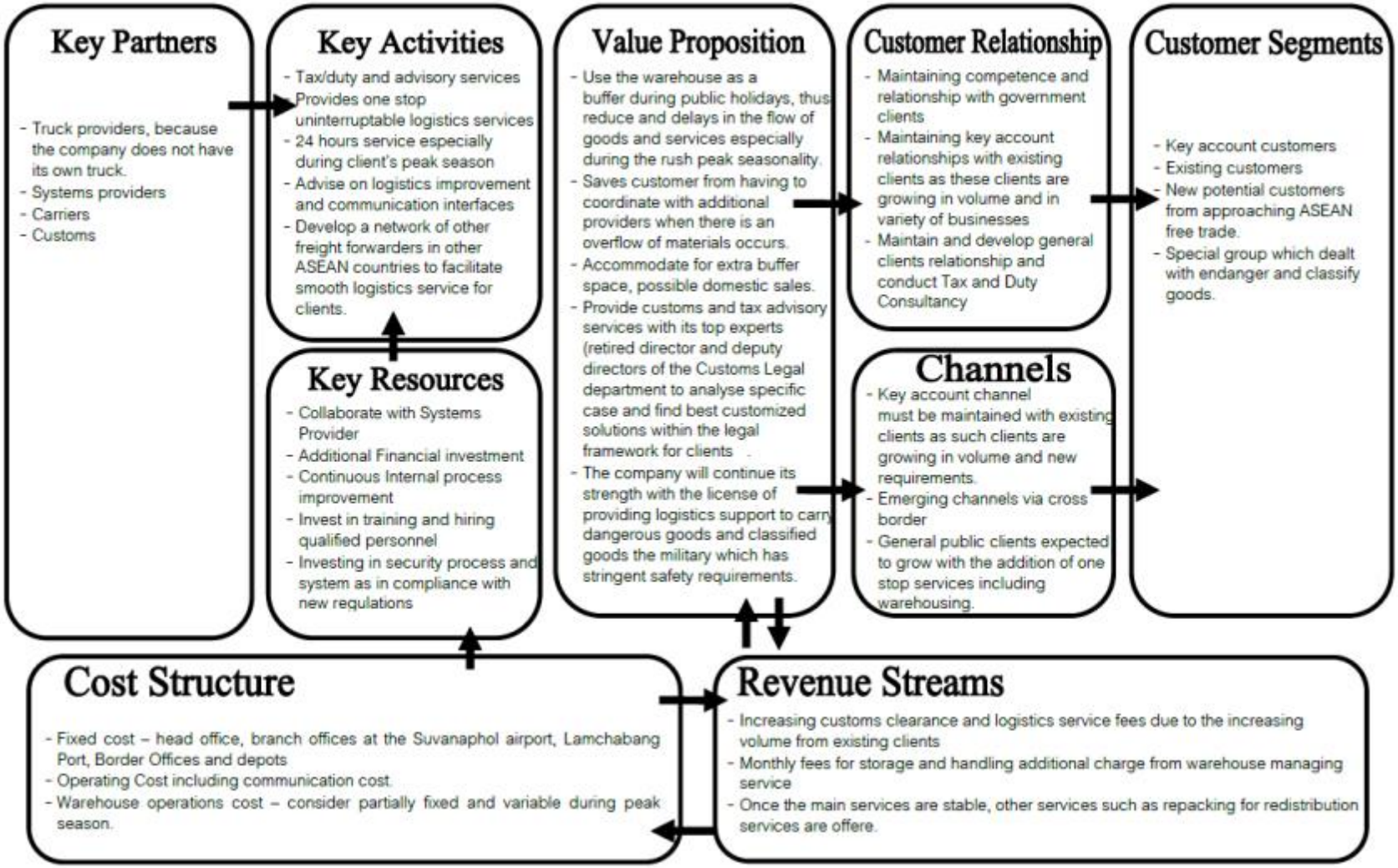


Figure 4-1: Business Model for the case study freight forwarder

CHAPTER V
DATA ANALYSIS

This chapter presents the different alternatives which the freight forwarder sets up a private warehouse or renting a public warehouse. Process of location selection for the public warehouse and what data are require for the process of building a private warehouse. Both alternatives are provided with their own cost structure.

In this industry, the price to which the warehouse owner charged their customer is not commonly shared. However, the most common method is 5-10% of the item that is going to be stored. In this case, because the value of each item varied widely and is very difficult to get the exact price and amount of each SKUs, therefore, the method in making assumption cost is to use the price that is viable enough to do business. To be specific, the acceptable price where both figures of IRR and NPV are positive.

5.1 Building a Private Warehouse

5.1.1 Warehouse Layout Planning

After rent is considered an option, we shall now look at the alternative of building a private warehouse. Building a warehouse with full facilities in it requires a huge amount of investments. Before any decision should be made with such construction project, the investors would want to know the details of the project. The investments include the returns and time horizon of their concerns.

Since the types of products stored in the warehouse are not anything that is biologically harmful, or could rot over time, the warehouse does not need to be insulated and refrigerate in anyway. And since the firm wish to put the available land that their own to use, we can skip the location selection step.

Before the overall layout can be design, the size should be taken into consideration. Because we don't want to build a warehouse that wouldn't be able to hold enough inventory; at the same time it shouldn't be too big that couldn't utilised the space and would be a waste of budget.

The size of the warehouse should vary according to the inventory that the firm plans to store in the warehouse. And because the company have never own a

warehouse, nor have they operate a warehouse, this is going to be something new for them. The amounts of items considered are based on the assumptions. Since the number of container for export and exports have a huge fluctuation annually. This means that if the warehouse this so big that it is able to hold every inventory including the peak season, than there is going to leave the rest of the space unutilised for a very long time, and therefore did not serve its purpose. The freight forwarder can assume that it would be good if they can hold all the import and the additional amount during peak seasons can be stored in public warehouse instead.

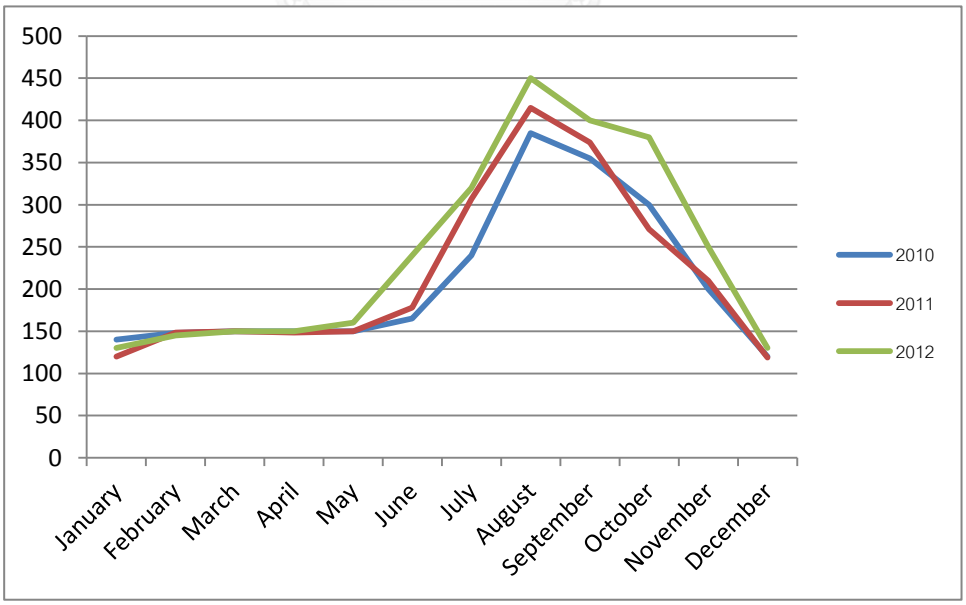


Figure 5-1: Monthly import data from 2010 - 2012

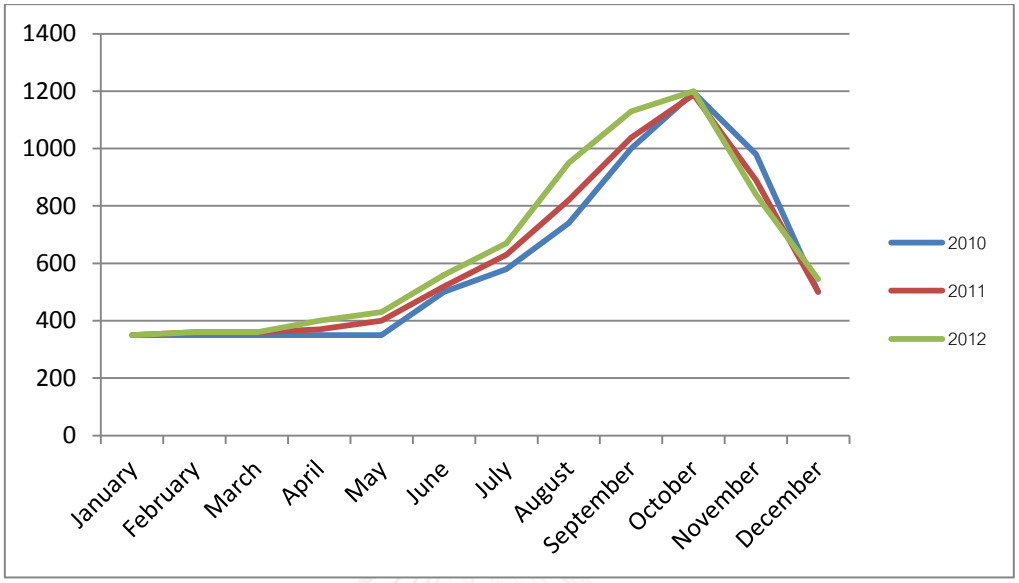


Figure 5-2: Monthly export data from 2010 - 2012

Figure 5.2 shows the peak season for the import is usually in August, which has an average about 648 containers. In export during the month of August are about 900 containers. Together they make up a total of 1,546 containers. The reason we are taking the peak as a base for calculation because we want to make sure that the warehouse is able to hold all the inbounds. Therefore, with 1,546 containers, we can multiply by 25 pallets and we get the total of 38,666 pallets.

Before making further calculation, we have to first understand that the number of containers in the warehouse each month is determined by a variable, he turnover ratio. The ratio is taken from the turn over from average of three year figure, which is 7.2.

- Number of pallets: 38,666
- Inventory turnover: 7.2
- Average inventory in the warehouse = Number of pallets / Inventory turnover

  38,666 / 7.2 = 5,370

After we have the number of pallets that will occupy the warehouse, we can then, calculate for the space required. The policy of stock holding of the new warehouse is to hold it in pallet. Most are assume to be no much bigger than pallet size. There is no repackaging in any way to prevent the missing parts in the package. Each package has its own pallet while storing in the warehouse.

The racking system helps to utilised the warehouse space. The double rack came in a pair, and can store up to 8 pallets, four stacks on top of the other. The size of each double rack is 1.5x3x54 m.

Between rack rows, there should be an intersection so that it would be easier for forklifts to move around and pick up the pallets. To make it easy to organise, the pair of pallets are place back to back with each other, and an intersection between each 10 pair. As demonstrate in the picture below. With the amount of pallets divided by 4, we

can come up with the result of 41.7 rows. The figure is rounded to 40 rows for easy calculation:

- Number of double racks = number of pallets / (number of stacks x 2 bays)

  5,370 pallets / (4 stacks x 2 bays) = 671

- Rack sets = Number of double racks / Number of pair in one set (assume 10)

  671 rack sets / 10 pair = 67

- Length of each rack set = Number of pair in one set (assume 10) x Length of each bay

  10 pair x 3 m = 30 m

- Row length = (Length of rack set x Number of sets) + (Aisle width x Number of aisle)

  (30 m x 3) + (3 m x 3) = 111 m

- Length of bay's side, back to back: 2.4 (1.2 each)

- Total column length = (Length of bay's side x Number of rack sets in row) + (Aisle width x Number of aisle)

  (2.4 m x 10) + (3m x 10)= 54 m

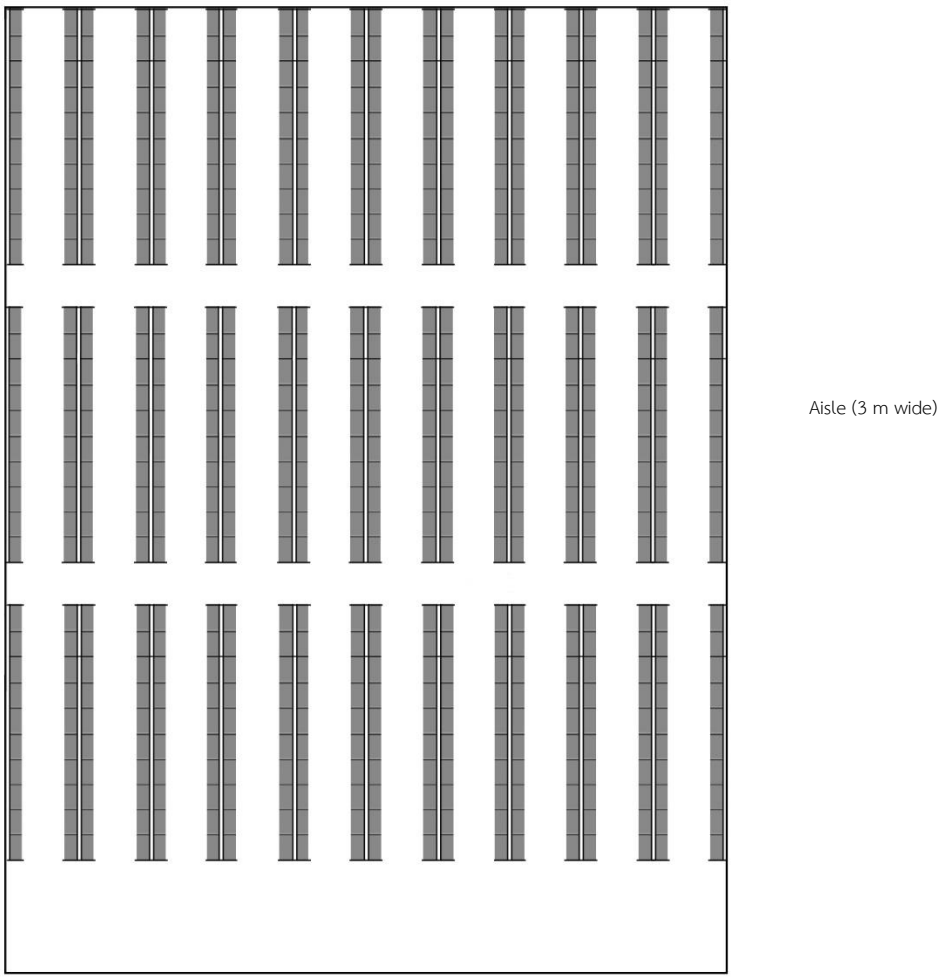


Figure 5-3: Possible layout of the storage area of the warehouse

When calculating the total area requirement, there aisle and intersection should be taking into account. The width of the aisle and intersection has the same width, which is 3 m. So in column length, we add the length of the pallet set with the intersection.

- Total Storage area = vertical length x horizontal length

  111 m x 54 m = 5,981 sqm

There are more aspects of warehouse that needs to be taken into account. This includes the office area, the staging area, the parking lot, the apron truck area, etc. The staging is where the goods are place before they are loaded into the truck so the space should be enough sit the pallets at the same time large enough for the forklifts to run. There are no specifications as to how wide the staging area should be, but according to the modern warehouse recommendations, the recommended width of the staging area should be 7 m. If we decided to located the staging area along the column of the racks the area of the staging is going to be

- Staging area = Warehouse width x staging width

  7 m x 54 m = 546 sqm.

The truck apron is the area the truck where truck docks to the warehouse for loading and unloading. The truck apron area is located next to the staging area. In which there is standard apron length required, depending on the length of the trailer. The truck apron area equals the length of the trailer times two. This gives the trailer enough space to make a turn. In this case, a 60 meters long trailer means it need a total apron length of 120 meters. The total area of the truck apron is by multiply the length of the apron by the width of the warehouse.

- Minimum apron area = (Truck length x 2) x Width of the warehouse

  (21.6 x 2 m) x 54 m = 2,333 sqm

The parking area has its own specific standards for calculations. That is 2.6 m x 5.5 m per standard car and a length of 6 m for drive way.

- Standard car: 2.6 m x 5.5 m / Standard drive way: 6 m
- Number of cars that can park on the side of the building = warehouse length / standard car width

  111 m / 2.6 m = 52 cars
- Width of parking area = Length of the car + width of drive way

  5.5 m + 6 m drive way = 11.5 m
- Total area of the parking area = Width of parking area x length of the warehouse

  11.5 m x 117 m = 1,354 sqm

The space for the office does not require so much space, so the total space of the 20 x 15 m = 300 m^2 should be enough for several working desks, living area and small kitchen. The overall detailed of spaces required can be shown on the table below.

Table 5-1: Different area of the warehouse and total space required

Detailed	Space required
Warehouse Storing area	5,981 sqm
Staging area	378 sqm
Truck apron	2,333 sqm
Office	300 sqm
Car park	1,354 sqm
Total	**10,346 c sqm**

5.1.2 Analysis of Expenditure

5.1.2.1 Cash Outflow

Cash outflows refers the money that the organization paid as a result of its business activities, this includes operating expenses, investing, purchasing of raw materials or tools, wages, rent, tax, load, etc.

The first stage is investing, after we know the required space of our warehouse can calculate the cost of building. Before an infrastructure can be build, the ground

must be flattened and pressed properly to avoid collapsing. Then, the pressed ground needs to be concreted to prepare the area for the building. The cost for building a building is contracted in square meters. The office area can be contacted for difference price. The table below represents costs of building a warehouse.

Table 5-2: Total costs spending on warehouse building and equipments

Details	Cost in Baht / year
Land filling and concrete pour	1,300,000
Construction of warehouse	14,409,763
Construction of office	1,800,000
Equipment	4,584,050
Total	**22,093,812**

The figured shown in the table are calculated based on the acquired from the earlier part. The details of the equipments for the warehouse can be found in the appendix.

Note that the full, capacity of the warehouse can hold up to 10,425 pallets (417 containers) only. The objective is to be able to hold all the import goods for the month of August, which is the peak month of the season. The access containers have to be transfer to other public warehouses if needed.

Next is the purchasing of equipments, as explained in the earlier section, the warehouse required a material handling equipment to operate. Since this warehouse is a startup phrase and the company wants to save as much cost as possible, a complex engineer system are not required; therefore the installation of this system are not taken into account as of now. The list of equipments to be purchase, along with other details such as the cost of each units and the useful life is available in Table in the appendix.

The following part includes all the variable costs and overheads which are displayed in the table below. Because we do not know exactly how much are spend on overheads, we have to base on assumption. In which the overhead cost consist of electricity, water and administrative is account for 15% of the total spending of the facility. The assumption costs for the employees consist of the 20 people of working in the warehouse, 5 people the office, and a manager. Likewise, the maintenance fee is

assumed 15% of the cost of equipment and tools, this part includes the maintenance of the warehouse as well. Note that all the costs are calculated annually.

Table 5-3: Total variable annual cost

Details of Overhead Cost	Baht / Year
Electricity, Water, Administrative	1,620,976
Employee	1,800,000
Maintenance fee	458,405
Total	**2,079,381**

This cost hasn't included the income tax yet, because it requires that we know the figure of the profit and thus varies from year to year. According to the Revenue Department of Thailand, the corporate rate for income tax is 15% if the net profit does not exceeds 1 million baht and 20% if the net profit exceeds 1 million baht. The full details of the annual tax pay are cover in the cash inflow section.

5.1.2.2 Demand Pattern

Demand pattern varies from industries to industries and are uncontrollable. It is especially useful in demand forecast which is crucial for production plan. The more predictable the demand patterns the better. But since the role of a warehouse is only to use the available space to store goods, the impact is not as significant. However, it does matters headcount because a non-automate warehouse depends highly on workers and thus the human resources should plan the number of employee for each months accordingly.

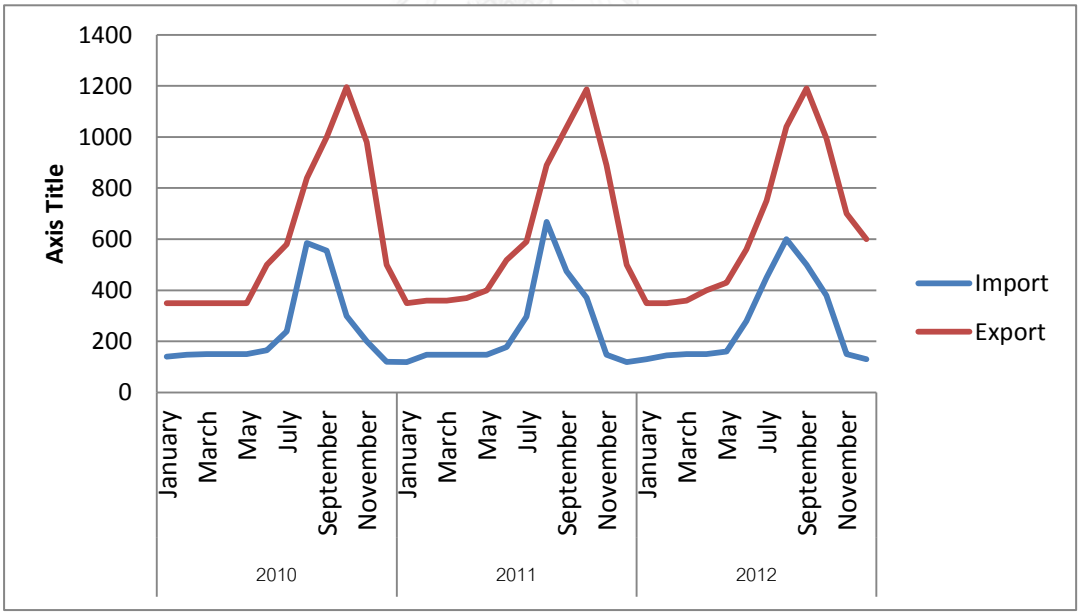


Figure 5-4: Monty import and export figures from 2010 - 2012

The demand pattern of the freight forwarder is fortunately seasonal which is easily predicted. The only problem is that in each year there is a peak demand which is highly concentrated in September and ends in November. This may be the result of Christmas and New Year.

5.1.2.3 Other Services

As mentioned earlier, this private warehouse of the freight forwarder does not plan make into a full embedment of many engineered systems. However, aside of storing and buffering the goods, the warehouse can do more value added activities with the help of IT. The warehouse could use the label application of RFID or barcode to ensure the accuracy of data.

The use of barcode has been highly efficient for manufacturers, retailers, and distributor. It is cost effective and can provide up-to-minute information. Barcodes are use the track parts information, production information, ship information and warehouse information. By labeling the goods with barcodes, the operator can prevent the errors of misplacement of goods and therefore creates an ease of communication between the company and its customers, since Company A, as the manufacturer, is also using barcode.

5.1.2.4 Cash Inflow

Cash inflows are the payment receives from customers for the good or services provided by the company. Shareholder investments, bank loan and interests on savings are also a type of cash inflows.

The payment receives from customers is calculated by the number of unit request for service, which in this case a unit charge per pallet. The average annual number of container in and out of the warehouse is 8,000 containers, which is equivalent to about 200,000 pallets a year. By dividing each variable cost by the annual number of pallets we can get an approximation of the costs for each segment of the variable costs.

Table 5-4: Average variable costs per pallet

Details of Overhead Cost	Average Costs (Baht / pallet)
Electricity, Water, Administrative	8.1
Employee	9
Maintenance fee	2.3
Total	**19.4**

As it has been shown on the table, the variable cost per pallet is 19 Baht per pallet. If the annual number of pallet into and out of the warehouse is fewer, the variable cost per pallet is higher; likewise, if the numbers of pallets are higher, the variable cost is lowered as well. In order for the warehouse to make profit, the annual number of pallet inbounds must not be fewer than 20,000 pallets under the constraint of charging the customers 50 baht/pallet; this is where the IRR = 0%.

After observing the charge per pallet of other warehouse around the area of Laem Chabang we can see that the price charges between the different warehouses are very little. Because we want to make it reasonable for the business partner, Company A, it is reasonable that the freight forwarder starts charging at the standard price at minimum; in this case 60 baht/pallet, because if we charge fewer, the IRR will be smaller than the MARR. Then we can come up with the price charged rate, now we can use the figure to finds out the net income for each month. The net income is calculated by subtracting all the expenses from the income. The formula is as shown below.

Income before tax = Number of pallets x (Unit price – Fix cost)

With three known variables, which are, the number of pallets equals 200,000 pallets. Thus the annual income before tax is 12,000,000 baht. However, this is not the

profit yet since we need to take the tax into account. According to Thai government, the business with income over one million baht are charged with 20% tax. This left us with the profit of 9,600,000 baht/year.

We can finds out if the price charged worked out by using the tools mention earlier in this section; starting with the IRR, than the NVP and the Break Even.

To fully understand the table above, the explanations are provided.

- Cash in-flow: Revenue or the cash received before deducting expense.
- Cash out-flow: Expenses or cash the company has to pay for doing business.
- Investment: The initial amount of money invested for doing the project.
- O&M cost: Or Operation and Management cost.
- Fix cost: The fix amount of money that has to be paid every month regardless of sales or production.
- Income tax: Tax that has to be paid. Accounted to 20% of the profit.
- NPV: Net Present Value

5.2 Renting a public warehouse

5.2.1 Analysis of warehouse location

The data analysis that are planned to be done involved a decision making on the feasible decision whether to rent a public warehouse that has an appropriate site to construct a warehouse. Five existing warehouses around Laem Chabang area are selected to make comparisons. The warehouse will be built on the existing land belongs to the freight forwarder's owner.

For the decision making phrase. Giving warehouses a score is difficult, because there is no threshold to where a quality can be judged. The human judgments are not discrete, however to make this fair, three candidates with an experience in warehousing are be the person who gives the scores. The scoring is given where 0 indicates the least and 10 indicates the best. Each warehouse has variables and the candidates are asked to score each variable for the five warehouses. Then the scores are calculated to find out which public warehouse is most suitable for the freight forwarder's usage.

Another alternative for warehouse choices is to build a private warehouse for the company. Therefore, before any decision is to be made, we need to find out the necessary information to make the comparison. The data includes, the area of the

warehouse, the cost of building, equipments necessary, cost of equipments, cost of operations, overheads, cash out flows and inflows, etc.

5.2.2 Site selection

Before getting into the costs of owning a warehouse it is reasonable to see the various existing warehouses. In this case, the select warehouses are limited to those existed around the area that the freight forwarder plans to build their private warehouse, which is close to the Laem Chabang district. The warehouses varied in location, size and costs. Some of the selected warehouses sites are as follows.

Five different warehouses in Chonburi have been chosen. There are several more available warehouses; however, the ones selected are ones with similar available area of more than 10,000 square meters. From the selected sites, the details listed are Land areas in square meters, rental fees per square meters. The land area represents the usable area within the warehouse that is available for storage. The conditions of the warehouse are judge base on the age of each building and the accessibility of the read is based on how convenient the facility is accessible via trucks.

Table 5-5: Existed warehouses in Chonburi area

Candidate	Rental fees (baht/month)	Conditions (years)	Land Area (sqm)	Distance to port	Accessibility of Roads	Flexibility	Credibility	Picture
Sriracha 1	140	20	11,000	7 km	Fair	Fair	Good	
Sriracha 2	140	8	28,000	20 km	Fair	Good	Fair	

Sriracha 3	130-150	13	30,000	15 km	Good	Fair	Good	
Sriracha 4	150	5	100,000	12 km	Fair	Good	Good	
Laem Chabang	140	15	30,000	8 km	Good	Good	Good	

However, there are some attribute that cannot be recorded numerically. Those attribute includes flexibility, accessibility to roads, credibility. Where the flexibility refers to how much the interior of the warehouse is can be reorganise. The quality column represents the useable resources within the building, credibility of the owner of the warehouse of the particular site, and lastly, building conditions refers to how old the building was.

5.2.3 Site Scoring

There is no significant way in which a person can determine if a location or the condition of the building is good, fair, or bad. The judgment from a person may vary from one another so it is not fair to ask an opinion from just one person. It is more reasonable to ask more people for opinion and weight the opinion and weight it to come up with a reasonable conclusion. The method for weight the opinion is Delphi method, where the opinions are scored base of the opinion of the individuals. For this task, we ask three people who have work experience in warehousing to give their score.

Three individuals give scores to each warehouse using pictures taken from each site. After the scorings have been collected, the result can be seen in the following table

Table 5-6: Average score of three individuals

Site	Rental fees (baht)	Building Condition	Accessibility of Roads	Distance to port	Flexi-bility	Credibility
Sriracha 1	8.7	7.3	7.0	8.3	8.3	9.0
Sriracha 2	9.3	6.3	8.0	5.7	7.7	6.3
Sriracha 3	8.3	7.3	8.7	6.7	7.3	8.3
Sriracha 4	8.7	7.7	6.0	8.0	8.7	8.0
Laem Chabang	9.0	7.7	7.7	8.7	7.3	7.3

Each attribute in the table, rental fees, building condition, accessibility of road, distance to port, flexibilities and credibility, has different importance, and therefore is weight differently. For example the condition of the building should be considered before the flexibilities. The weight is given base of the level of priorities that should be taken into consideration. The weight ranges from 1-6 accordingly, given 6 as the attribute with the most priority and 1 with the least.

Table 5-7: Weight given to each attribute

Site	Rental fees	Building Condition	Distance to port	Accessibility of Roads	Flexibility	Credibility	Total
Site name	0.05	0.1	0.2	0.3	0.3	0.05	1

Using the weight and the score given by the individuals, the final score can be seen in the following table.

Table 5-8: Total score of three individuals after weight

Site	Rental fees (baht)	Building Condition	Accessi-bility of Roads	Distance to port	Flexi-bility	Credi-bility	Total
Sriracha 1	0.4	0.7	1.4	2.5	2.5	0.5	8.0
Sriracha 2	0.5	0.6	1.6	1.7	2.3	0.3	7.0
Sriracha 3	0.4	0.7	1.7	2.0	2.2	0.4	7.5
Sriracha 4	0.4	0.8	1.2	2.4	2.6	0.4	7.8
Laem Chabang	0.5	0.8	1.5	2.6	2.2	0.4	7.9

Land area aside, as the result of the score shows that site Sriracha 1 is the best, with an average total score of 168.3. Although, the score suggest that the first warehouse should be best, our require warehouse area is 14,494 sqm, while Sriracha 1 only has a total area of 11,000 sqm which would not be enough space to accommodate the goods. Therefore the chosen candidate goes to second place, Sriracha 3, with the total of 164.3.

CHAPTER VI
COMPUTATION RESULT AND SENSITIVITY ANALYSIS

In this chapter, the cash inflow and the cash outflow projected in the previous chapter are integrated to determine the project in terms of financial though several cases. Each case is designed to simulate difference situations as well as serve as a sensitivity analysis of the project. The assumed scenarios are as follows:

- Base case
- Warehouse expansion: When demand has increase enough that the company might consider expanding.
- Fix cost increase: by 5% in the first year, 15% in the second year, 30% in the third, and 50% in the fourth year.
- Wages increase: If minimal wage increase.
- Depression: If demand reduce by half

6.1 Minimal Accepted Rate of Return

Value of money depends on time period. Therefore, it is important to establish a “fair” discounted rate, called minimal accepter rate of return (MARR). This discounted can be viewed as the return of the risk-free alternative investment that the freight

forwarder can access in the capital market. As an important parameter of this project, MARR is used to determine Net Present Value (NPV) and Payback Period as illustrated in the following cases.

The invested made into this project are derive from two sources, the owner's capital and bank loan with Minimum Overdraft Rate (MOR) of 7.4% (KTB). The MARR of the capital invested into this project is compared to the MARR received if the money is deposited in the bank, or use to generate elsewhere, in this case, the company's owner expects an interest rate of 6%.

- MARR = (Ratio of investment borrow from the bank x Bank interest rate) + (Ratio of capital x Interest of government bond)

  = (0.5 x 7.4) + (0.5 x 6.0)

  = 6.7%

6.2 Base Case

The first case is the exact situation that is projected in the previous chapter, referred to as Base Case. The case serves as a main quantitative model for the final decision by the executive and as a baseline for the sensitivity analysis in the next section. For convenience, the required information is gathered in the following section.

- This project is assumed to operate for 20 years.

- The investment is estimated to be 41,979,836 Baht/year.
- The income is a constant figure of 10,863,000.00 Baht / year.
- Equipment that has a limit useful life and is considers an investment. (See table 6-2 for details)
- MARR = 6.7% (Section 6.1)
- Fix cost is 1,650,000 Baht/year and Variable cost is 2,005,370 Baht/year
- Assuming service charge per pallet is 150 Baht/pallet
- The minimal demand is 60,500 pallets/year because that is where IRR = 0%.

Table 6-1: Basic Data of proposed project with the expected NPV and IRR of the freight forwarder when MARR = 6.7%

Year	Cash in	Cash out	Investment	Variable cost	Fix cost	Income tax	NPV
0	-	33,505,085	33,505,085	-	-	-	- 33,505,085
1	12,000,000	8,073,869	-	2,258,405	4,269,330	1,546,134	3,926,131
2	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
3	12,000,000	8,243,753	212,355	2,258,405	4,269,330	1,503,663	3,756,247
4	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
5	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
6	12,000,000	8,243,753	212,355	2,258,405	4,269,330	1,503,663	3,756,247
7	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
8	12,000,000	11,236,765	3,953,620	2,258,405	4,269,330	755,410	763,235
9	12,000,000	8,286,169	265,375	2,258,405	4,269,330	1,493,059	3,713,831
10	12,000,000	8,602,397	660,660	2,258,405	4,269,330	1,414,002	3,397,603
11	12,000,000	8,213,965	175,120	2,258,405	4,269,330	1,511,110	3,786,035
12	12,000,000	8,243,753	212,355	2,258,405	4,269,330	1,503,663	3,756,247
13	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
14	12,000,000	8,200,589	158,400	2,258,405	4,269,330	1,514,454	3,799,411
15	12,000,000	8,382,793	386,155	2,258,405	4,269,330	1,468,903	3,617,207
16	12,000,000	11,236,765	3,953,620	2,258,405	4,269,330	755,410	763,235
17	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
18	12,000,000	8,370,473	370,755	2,258,405	4,269,330	1,471,983	3,629,527
19	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
20	12,000,000	8,475,149	501,600	2,258,405	4,269,330	1,445,814	3,524,851

NPV	8,644,032
IRR	8.36%

As the result has shown in the table, the result of NPV analysis of the project is 8,644,032 Baht, and its IRR is 8.36% where MARR equals 6.7%. Looking at the IRR result, this tells us that this project is worth investing.

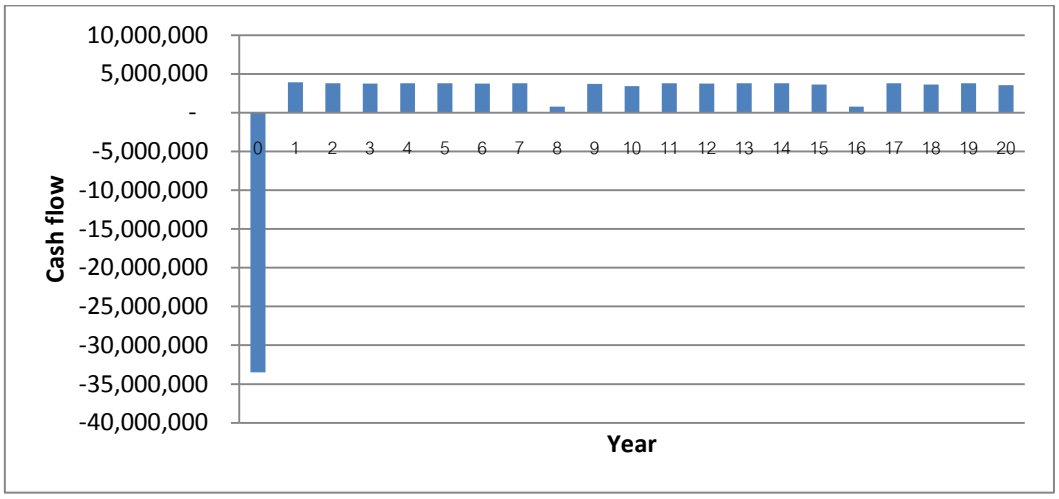


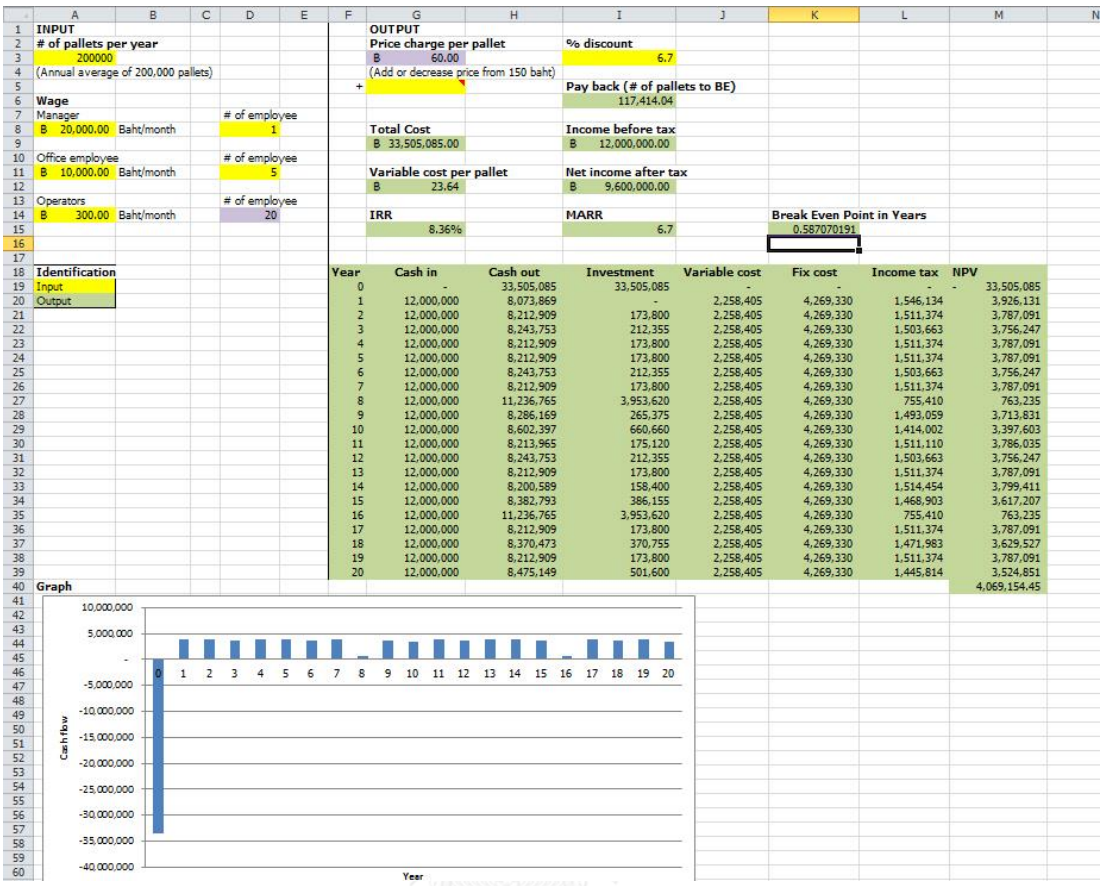
Figure 6-1: The cash flow of the proposed project

The chart above is the cash flow of the proposed project starting from year 0 to year 20th. This project is expected to be able to break-even in year 5, or more specifically, when it should make total sales of 7,044,842 sales to break even.

6.3 Excel Spreadsheet

The excel spread sheet used for all the computation is separated into two main parts; the inputs and outputs. For the ease of identifying each type of values that are displayed; the yellow is the boxes, where users are allow to change the values and see the results. The green boxes are the outputs. There are purple boxes too, those are the self-adjusted values and the value stills change depending on other inputs, however, the user may still change them if they wish to.

The following picture is an excel interface of Phrase I data. The basic input is located on the left side. It includes number of pallets, number of employees and their wedges. On the left side are mostly Outputs. It includes the price charges, discount rage, break even, total cost, variable cost, income before and after tax, IRR, MARR, a table of cash flow and its graph.



INPUT

# of pallets per year		
200000		
(Annual average of 200,000 pallets)		
Wage		
Manager		# of employee
B 20,000.00	Baht/month	1
Office employee		# of employee
B 10,000.00	Baht/month	5
Operators		# of employee
B 300.00	Baht/month	20

Identification
Input
Output

OUTPUT

Price charge per pallet		% discount	
B 60.00		6.7	
(Add or decrease price from 150 baht)			
+		Pay back (# of pallets to BE)	
		117,414.04	
Total Cost		Income before tax	
B 33,505,085.00		B 12,000,000.00	
Variable cost per pallet		Net income after tax	
B 23.64		B 9,600,000.00	
IRR		MARR	Break Even Point in Years
8.36%		6.7	0.587070191

Year	Cash in	Cash out	Investment	Variable cost	Fix cost	Income tax	NPV
0	-	33,505,085	33,505,085	-	-	-	- 33,505,085
1	12,000,000	8,073,869	-	2,258,405	4,269,330	1,546,134	3,926,131
2	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
3	12,000,000	8,243,753	212,355	2,258,405	4,269,330	1,503,663	3,756,247
4	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
5	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
6	12,000,000	8,243,753	212,355	2,258,405	4,269,330	1,503,663	3,756,247
7	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
8	12,000,000	11,236,765	3,953,620	2,258,405	4,269,330	755,410	763,235
9	12,000,000	8,286,169	265,375	2,258,405	4,269,330	1,493,059	3,713,831
10	12,000,000	8,602,397	660,660	2,258,405	4,269,330	1,414,002	3,397,603
11	12,000,000	8,213,965	175,120	2,258,405	4,269,330	1,511,110	3,786,035
12	12,000,000	8,243,753	212,355	2,258,405	4,269,330	1,503,663	3,756,247
13	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
14	12,000,000	8,200,589	158,400	2,258,405	4,269,330	1,514,454	3,799,411
15	12,000,000	8,382,793	386,155	2,258,405	4,269,330	1,468,903	3,617,207
16	12,000,000	11,236,765	3,953,620	2,258,405	4,269,330	755,410	763,235
17	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
18	12,000,000	8,370,473	370,755	2,258,405	4,269,330	1,471,983	3,629,527
19	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1,511,374	3,787,091
20	12,000,000	8,475,149	501,600	2,258,405	4,269,330	1,445,814	3,524,851
							4,069,154.45

Graph

Figure 6-2: Excel interface in Phrase I

6.4 Discussion of Expansion

There is a possibility that the further investment may take place in order to expand the project. The situation is when the company decides to increase their facilities to provide more services. The project of expanding the warehouse is called Extended Phrase, while the current warehouse project is called Initial Phrase.

Since the current warehouse has not been able to hold all of the peak demand in the first place, the probability of both continuing Initial Phrase, or do the addition of Extended Phrase are equally likely to happen. So the probability distribution of both decisions are p = 0.5 for Initial Phrase, and p = 0.5 for Initial and Extended Phrase.

The question is when is a good time to start Extended Phrase? There are no significant answers to the question; however, the reasonable time would be after year 10 because the total time horizon of the project is 20 years. How much Extended Phrase is requires depends on how much more space the company may want to expand its warehouse. To make the assumption easier for calculation, we assume that the Extended Phrase is the same size as the Initial Phrase.

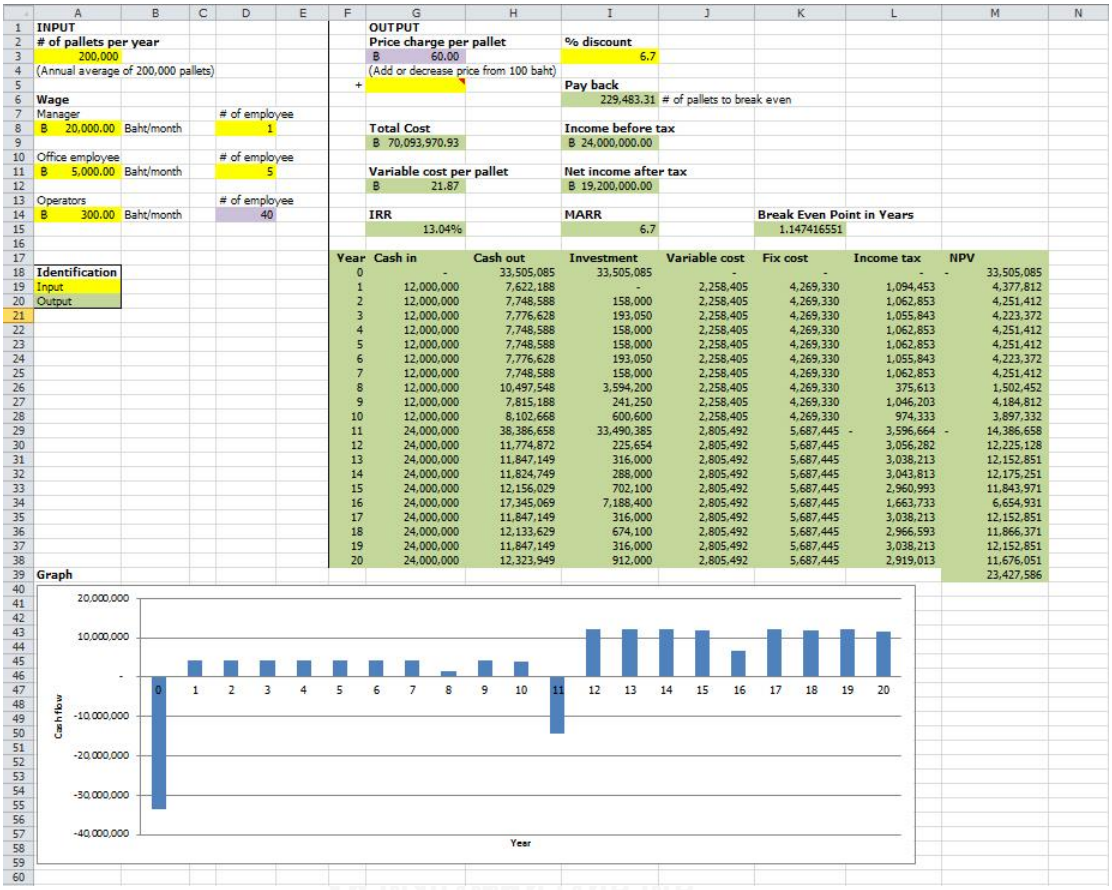
Table 6-2: Initial + Extended Phrase when MARR = 6.7%, charging at 60 baht

Year	Cash in	Cash out	Investment	Variable cost	Fix cost	Income tax	NPV
0	-	- 33,505,085	33,505,085	-	-	-	- 33,505,085
1	12,000,000	- 7,622,188	-	2,258,405	4,269,330	1,094,453	4,377,812
2	12,000,000	- 7,748,588	158,000	2,258,405	4,269,330	1,062,853	4,251,412
3	12,000,000	- 7,776,628	193,050	2,258,405	4,269,330	1,055,843	4,223,372
4	12,000,000	- 7,748,588	158,000	2,258,405	4,269,330	1,062,853	4,251,412
5	12,000,000	- 7,748,588	158,000	2,258,405	4,269,330	1,062,853	4,251,412
6	12,000,000	- 7,776,628	193,050	2,258,405	4,269,330	1,055,843	4,223,372
7	12,000,000	- 7,748,588	158,000	2,258,405	4,269,330	1,062,853	4,251,412
8	12,000,000	- 10,497,548	3,594,200	2,258,405	4,269,330	375,613	1,502,452
9	12,000,000	- 7,815,188	241,250	2,258,405	4,269,330	1,046,203	4,184,812
10	12,000,000	- 8,102,668	600,600	2,258,405	4,269,330	974,333	3,897,332
11	24,000,000	- 38,386,658	33,490,385	2,805,492	5,687,445	- 3,596,664	- 14,386,658
12	24,000,000	- 11,774,872	225,654	2,805,492	5,687,445	3,056,282	12,225,128
13	24,000,000	- 11,847,149	316,000	2,805,492	5,687,445	3,038,213	12,152,851
14	24,000,000	- 11,824,749	288,000	2,805,492	5,687,445	3,043,813	12,175,251
15	24,000,000	- 12,156,029	702,100	2,805,492	5,687,445	2,960,993	11,843,971
16	24,000,000	- 17,345,069	7,188,400	2,805,492	5,687,445	1,663,733	6,654,931
17	24,000,000	- 11,847,149	316,000	2,805,492	5,687,445	3,038,213	12,152,851
18	24,000,000	- 12,133,629	674,100	2,805,492	5,687,445	2,966,593	11,866,371
19	24,000,000	- 11,847,149	316,000	2,805,492	5,687,445	3,038,213	12,152,851
20	24,000,000	- 12,323,949	912,000	2,805,492	5,687,445	2,919,013	11,676,051

NPV	23,427,586
IRR	13.70%

The table above shows us the cash flow of executing an Extended Phrase project in year 11. The investment in Extended Phrase is 35,621,985 baht. Given that the amount of pallet flows per year has double in volume from 200,000 pallets / year to 400,000 pallets / year. This result in the increased in both the cash in, and cash out of the table. Regardless of the large amount of investment spent on the extension phrase,

charging the customer with 60 baht/pallet, still gives a higher NPV and IRR than having Phrase I alone.



INPUT

# of pallets per year		
200,000		
(Annual average of 200,000 pallets)		

Wage

Manager		# of employee
B 20,000.00	Baht/month	1
Office employee		# of employee
B 5,000.00	Baht/month	5
Operators		# of employee
B 300.00	Baht/month	40

Identification
Input
Output

OUTPUT

Price charge per pallet	% discount
B 60.00	6.7
(Add or decrease price from 100 baht)	
+	Pay back
	229,483.31 # of pallets to break even
Total Cost	Income before tax
B 70,093,970.93	B 24,000,000.00
Variable cost per pallet	Net income after tax
B 21.87	B 19,200,000.00
IRR	MARR / Break Even Point in Years
13.04%	6.7 / 1.147416551

Year	Cash in	Cash out	Investment	Variable cost	Fix cost	Income tax	NPV
0	-	33,505,085	33,505,085	-	-	-	- 33,505,085
1	12,000,000	7,622,188	-	2,258,405	4,269,330	1,094,453	4,377,812
2	12,000,000	7,748,588	158,000	2,258,405	4,269,330	1,062,853	4,251,412
3	12,000,000	7,776,628	193,050	2,258,405	4,269,330	1,055,843	4,223,372
4	12,000,000	7,748,588	158,000	2,258,405	4,269,330	1,062,853	4,251,412
5	12,000,000	7,748,588	158,000	2,258,405	4,269,330	1,062,853	4,251,412
6	12,000,000	7,776,628	193,050	2,258,405	4,269,330	1,055,843	4,223,372
7	12,000,000	7,748,588	158,000	2,258,405	4,269,330	1,062,853	4,251,412
8	12,000,000	10,497,548	3,594,200	2,258,405	4,269,330	375,613	1,502,452
9	12,000,000	7,815,188	241,250	2,258,405	4,269,330	1,046,203	4,184,812
10	12,000,000	8,102,668	600,600	2,258,405	4,269,330	974,333	3,897,332
11	24,000,000	38,386,658	33,490,385	2,805,492	5,687,445	- 3,596,664	- 14,386,658
12	24,000,000	11,774,872	225,654	2,805,492	5,687,445	3,056,282	12,225,128
13	24,000,000	11,847,149	316,000	2,805,492	5,687,445	3,038,213	12,152,851
14	24,000,000	11,824,749	288,000	2,805,492	5,687,445	3,043,813	12,175,251
15	24,000,000	12,156,029	702,100	2,805,492	5,687,445	2,960,993	11,843,971
16	24,000,000	17,345,069	7,188,400	2,805,492	5,687,445	1,663,733	6,654,931
17	24,000,000	11,847,149	316,000	2,805,492	5,687,445	3,038,213	12,152,851
18	24,000,000	12,133,629	674,100	2,805,492	5,687,445	2,966,593	11,866,371
19	24,000,000	11,847,149	316,000	2,805,492	5,687,445	3,038,213	12,152,851
20	24,000,000	12,323,949	912,000	2,805,492	5,687,445	2,919,013	11,676,051
							23,427,586

Graph

Figure 6-3: Excel interface if Phrase Initial + Extended

6.5 Sensitivity Analysis Scenario: What if fix cost increase

The first assumption is it raise the fix cost by 5% in the first year, 15% in the second year, 30% in the third and 50% in the fourth year, the result can be show below. This assumption is to see how much change took place with the result of the IRR if fix cost is rising.

Table 6-3: The proposed project after the fix cost changes in the first four years.

Year	Cash in	Cash out	Investment	O&M , variable cost	Fix cost	Income tax	NPV
0	-	33,505,085	33,505,085	-	-	-	- 33,505,085
1	12,000,000	8,244,642	-	2,258,405	4,482,797	1503440.7	3,755,358
2	12,000,000	8,725,229	173,800	2,258,405	4,909,730	1383294.1	3,274,771
3	12,000,000	9,268,392	212,355	2,258,405	5,550,129	1247503.2	2,731,608
4	12,000,000	9,920,641	173,800	2,258,405	6,403,995	1084441	2,079,359
5	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1511374	3,787,091
6	12,000,000	8,243,753	212,355	2,258,405	4,269,330	1503663	3,756,247
7	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1511374	3,787,091
8	12,000,000	11,236,765	3,953,620	2,258,405	4,269,330	755410	763,235
9	12,000,000	8,286,169	265,375	2,258,405	4,269,330	1493059	3,713,831
10	12,000,000	8,602,397	660,660	2,258,405	4,269,330	1414002	3,397,603
11	12,000,000	8,213,965	175,120	2,258,405	4,269,330	1511110	3,786,035
12	12,000,000	8,243,753	212,355	2,258,405	4,269,330	1503663	3,756,247
13	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1511374	3,787,091
14	12,000,000	8,200,589	158,400	2,258,405	4,269,330	1514454	3,799,411
15	12,000,000	8,382,793	386,155	2,258,405	4,269,330	1468903	3,617,207
16	12,000,000	11,236,765	3,953,620	2,258,405	4,269,330	755410	763,235
17	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1511374	3,787,091
18	12,000,000	8,370,473	370,755	2,258,405	4,269,330	1471983	3,629,527
19	12,000,000	8,212,909	173,800	2,258,405	4,269,330	1511374	3,787,091
20	12,000,000	8,475,149	501,600	2,258,405	4,269,330	1445814	3,524,851

NPV	5,887,719
IRR	**7%**

As can be seen in the table, the figures of the fix cost in the first four years have increased. The result to that is the NPV equals to 5,887,719 Baht at the end of year 20th, and the IRR equals to 7%. As expected, both the NPV and IRR has decreased, but in an acceptable range, since the IRR is still higher than the Marginal acceptable rate of return, which is 6.7%.

6.5 Sensitivity Analysis Scenario: What if Wage Increase

The initial assumption of the total number workers consists of the 20 people of working in the warehouse, 5 people the office, and a manager. The wedge is, by law, at minimal 300 Baht per day for operation workers. Now, assuming that, if the company were to raise the wedges from 300 Baht to 400 Baht, the new result is shown in the table below.

Table 6-4: The proposed project wedge rise from 300 to 400 Baht

Year	Cash in	Cash out	Investment	O&M , variable cost	Fix cost	Income tax	NPV
0	-	33,505,085	33,505,085	-	-	-	-33,505,085
1	12,000,000	8,329,869	-	2,258,405	4,589,330	1,482,134	3,670,131
2	12,000,000	8,468,909	173,800	2,258,405	4,589,330	1,447,374	3,531,091
3	12,000,000	8,499,753	212,355	2,258,405	4,589,330	1,439,663	3,500,247
4	12,000,000	8,468,909	173,800	2,258,405	4,589,330	1,447,374	3,531,091
5	12,000,000	8,468,909	173,800	2,258,405	4,589,330	1,447,374	3,531,091
6	12,000,000	8,499,753	212,355	2,258,405	4,589,330	1,439,663	3,500,247
7	12,000,000	8,468,909	173,800	2,258,405	4,589,330	1,447,374	3,531,091
8	12,000,000	11,492,765	3,953,620	2,258,405	4,589,330	691,410	507,235
9	12,000,000	8,542,169	265,375	2,258,405	4,589,330	1,429,059	3,457,831
10	12,000,000	8,858,397	660,660	2,258,405	4,589,330	1,350,002	3,141,603
11	12,000,000	8,469,965	175,120	2,258,405	4,589,330	1,447,110	3,530,035
12	12,000,000	8,499,753	212,355	2,258,405	4,589,330	1,439,663	3,500,247
13	12,000,000	8,468,909	173,800	2,258,405	4,589,330	1,447,374	3,531,091
14	12,000,000	8,456,589	158,400	2,258,405	4,589,330	1,450,454	3,543,411
15	12,000,000	8,638,793	386,155	2,258,405	4,589,330	1,404,903	3,361,207
16	12,000,000	11,492,765	3,953,620	2,258,405	4,589,330	691,410	507,235
17	12,000,000	8,468,909	173,800	2,258,405	4,589,330	1,447,374	3,531,091
18	12,000,000	8,626,473	370,755	2,258,405	4,589,330	1,407,983	3,373,527
19	12,000,000	8,468,909	173,800	2,258,405	4,589,330	1,447,374	3,531,091
20	12,000,000	8,731,149	501,600	2,258,405	4,589,330	1,381,814	3,268,851

NPV	4,249,672
IRR	7.31%

After raising the wedges from a minimum of 300 baht to 400 baht, the fix cost has increase to 4,249,672 Baht / year. This result in the NPV of 351,651 Baht and IRR equals 7.31%. This tells us that there wouldn't be a problem to the project if this scenario happens.

6.6 Sensitivity Analysis Scenario: Depression

This is a section is where we assume that there are depression due to the poor economic that the country is possibly going to face in the future. The assumption is what if the annual number of pallets is decreased by 50%, therefore an initial amount of 200,000 units are reduced to 100,000 units per year.

Table 6-5: Facing depression where volume is decrease by 50%

Year	Cash in	Cash out	Investment	O&M , variable cost	Fix cost	Income tax	NPV
0		- 33,505,085	33,505,085			-	- 33,505,085
1	6,000,000	- 6,873,869	-	2,258,405	4,269,330	- 53,866	- 873,869
2	6,000,000	- 7,012,909	173,800	2,258,405	4,269,330	- 88,626	- 1,012,909
3	6,000,000	- 7,043,753	212,355	2,258,405	4,269,330	- 96,337	- 1,043,753
4	6,000,000	- 7,012,909	173,800	2,258,405	4,269,330	- 88,626	- 1,012,909
5	6,000,000	- 7,012,909	173,800	2,258,405	4,269,330	- 88,626	- 1,012,909
6	6,000,000	- 7,043,753	212,355	2,258,405	4,269,330	- 96,337	- 1,043,753
7	6,000,000	- 7,012,90	173,800	2,258,405	4,269,330	- 88,626	- 1,012,909
8	6,000,000	- 10,036,765	3,953,620	2,258,405	4,269,330	- 844,590	- 4,036,765
9	6,000,000	- 7,086,169	265,375	2,258,405	4,269,330	- 106,941	- 1,086,169
10	6,000,000	- 7,402,397	660,660	2,258,405	4,269,330	- 185,998	- 1,402,397
11	6,000,000	- 7,013,965	175,120	2,258,405	4,269,330	- 88,890	- 1,013,965
12	6,000,000	- 7,043,753	212,355	2,258,405	4,269,330	- 96,337	- 1,043,753
13	6,000,000	- 7,012,909	173,800	2,258,405	4,269,330	- 88,626	- 1,012,909
14	6,000,000	- 7,000,589	158,400	2,258,405	4,269,330	- 85,546	- 1,000,589
15	6,000,000	- 7,182,793	386,155	2,258,405	4,269,330	- 131,097	- 1,182,793
16	6,000,000	- 10,036,765	3,953,620	2,258,405	4,269,330	- 844,590	- 4,036,765
17	6,000,000	- 7,012,909	173,800	2,258,405	4,269,330	- 88,626	- 1,012,909
18	6,000,000	- 7,170,473	370,755	2,258,405	4,269,330	- 128,017	- 1,170,473
19	6,000,000	- 7,012,909	173,800	2,258,405	4,269,330	- 88,626	- 1,012,909
20	6,000,000	- 7,275,149	501,600	2,258,405	4,269,330	- 154,186	- 1,275,149

NPV	- 4,720,765
IRR	- %

In this case, the number demand is reduced by half which is only 100,000 units, making the IRR incomputable. As stated in section 6.2, unless at least 200,000 pallets/year the IRR have a negative figure, unless it charges at 90 baht/pellet with the current demand for the company to get a positive IRR, and at least 105 baht/pallet to have an IRR of 6.97%, a higher figure than MARR. With this situation, the company will

have to have some agreement on either the minimum cost it could allow or a minimum amount inbound and outbound.

6.7 Sensitivity Analysis Scenario: Rent a Public Warehouse

The Forwarder is interested to compare the costs between the alternative of building its own warehouse and renting a public warehouse. We are going to use the valuables of the public warehouse candidate with the highest score and see its cost expenditure. The major different in the two decisions are the investment costs and the fix costs, since renting needs no investment cost on the building.

Initially, the total cost of building a warehouse is estimated to be 41,979,835.63 Baht. However, when the warehouse is rent, all the costs of building a warehouse is eliminated, and therefore is only left with the equipment cost which is 4,453,700 Baht. The cost of renting a warehouse is now added to the fix cost as described on the table below.

Table 6-6: Investment for the build and rent of a warehouse, overheads and wages not included

Details	Build (Baht)	Rent (Baht)
Land filling and concrete pour	1,300,000	-
Construction of warehouse	14,409,763	-
Construction of office	1,800,000	-
Equipment	4,584,050	4,584,050
Total	**22,577,350**	**4,584,050**

The cost of rent is calculated by multiplying the warehouse area of 6,359 sqm times 140 Baht/month and times 12 months. This value is calculated space requirement for building a warehouse, and 140 Baht/sqm/month is an average cost for renting warehouse in Leam Chabang area. Employee wedges consist of 20 people of working in the warehouse, 5 people the office, and a manager. Overhead cost includes usage of water, electricity and maintenance is assumed to be 10% of the cost of equipment and tools, the result is Total Fix cost of 14,952,870 Baht/year. With this information, the NPV and IRR of this alternative can be calculated.

- Rent: 6,539 sqm x 140 Baht x 12 months = 10,683,540 Baht/year
- Employee: (20 operators x 300 Baht/day x 8 hours/day x 20 man-day/month) + (5 office workers x 10,000 baht/month x 12 months)+(1 manager x 20,000 baht/month x 12 months) = 1,800,000 Baht/year

Table 6-7: Fix cost of warehouse where rent is included

Details of Overhead Cost	Costs in Baht / year
Rent	10,683,540
Employee	1,800,000
Overhead	2,258,405
Total	17,211,275

Use the information in table 6-5 we can compute the cash flow of this alternative. Thought with this alternative helps cut a huge cost of investment; however, by adding the rent cost to the existing fix cost, the total fix cost increase tremendously, therefore it is impossible to sustain a positive NPV and IRR unless the customer is charged with 100 Baht/month.

The result tells us that even though renting a warehouse may appears to be a tempting option because of the small investment and because the existed infrastructure making it available for use right away. However, it does not look like a promising result in the long run.

Table 6-8: The proposed project of renting a warehouse, charge customer at 60 baht/pallet

Year	Cash in	Cash out	Investment	O&M , variable cost	Fix cost	Income tax	NPV
0	-	-16806445.5	16806445.5				-16806445.5
1	12,000,000	- 16,576,235	-	2,258,405	14,317,830	-463566	- 4,576,235
2	12,000,000	- 16,750,035	173,800	2,258,405	14,317,830	-498326	- 4,750,035
3	12,000,000	- 16,788,590	212,355	2,258,405	14,317,830	-506037	- 4,788,590
4	12,000,000	- 16,750,035	173,800	2,258,405	14,317,830	-498326	- 4,750,035
5	12,000,000	- 16,750,035	173,800	2,258,405	14,317,830	-498326	- 4,750,035
6	12,000,000	- 16,788,590	212,355	2,258,405	14,317,830	-506037	- 4,788,590
7	12,000,000	- 16,750,035	173,800	2,258,405	14,317,830	-498326	- 4,750,035
8	12,000,000	- 20,529,855	3,953,620	2,258,405	14,317,830	-1254290	- 8,529,855
9	12,000,000	- 16,841,610	265,375	2,258,405	14,317,830	-516641	- 4,841,610
10	12,000,000	- 17,236,895	660,660	2,258,405	14,317,830	-595698	- 5,236,895
11	12,000,000	- 16,751,355	175,120	2,258,405	14,317,830	-498590	- 4,751,355
12	12,000,000	- 16,788,590	212,355	2,258,405	14,317,830	-506037	- 4,788,590
13	12,000,000	- 16,750,035	173,800	2,258,405	14,317,830	-498326	- 4,750,035
14	12,000,000	- 16,734,635	158,400	2,258,405	14,317,830	-495246	- 4,734,635
15	12,000,000	- 16,962,390	386,155	2,258,405	14,317,830	-540797	- 4,962,390
16	12,000,000	- 20,529,855	3,953,620	2,258,405	14,317,830	-1254290	- 8,529,855
17	12,000,000	- 16,750,035	173,800	2,258,405	14,317,830	-498326	- 4,750,035
18	12,000,000	- 16,946,990	370,755	2,258,405	14,317,830	-537717	- 4,946,990
19	12,000,000	- 16,750,035	173,800	2,258,405	14,317,830	-498326	- 4,750,035
20	12,000,000	- 17,077,835	501,600	2,258,405	14,317,830	-563886	- 5,077,835

NPV	- 66,859,492.36
IRR	- %

Table 6-9: The proposed project of renting a warehouse, charge customer at 100 baht/pallet

Year	Cash in	Cash out	Investment	O&M , variable cost	Fix cost	Income tax	NPV
0	-	17441485.5	17441485.5				-17441485.5
1	20,000,000	17,211,275	-	2,258,405	14,952,870	1009426	2,788,725
2	20,000,000	17,385,075	173,800	2,258,405	14,952,870	974666	2,614,925
3	20,000,000	17,423,630	212,355	2,258,405	14,952,870	966955	2,576,370
4	20,000,000	17,385,075	173,800	2,258,405	14,952,870	974666	2,614,925
5	20,000,000	17,385,075	173,800	2,258,405	14,952,870	974666	2,614,925
6	20,000,000	17,423,630	212,355	2,258,405	14,952,870	966955	2,576,370
7	20,000,000	17,385,075	173,800	2,258,405	14,952,870	974666	2,614,925
8	20,000,000	21,164,895	3,953,620	2,258,405	14,952,870	218702	- 1,164,895
9	20,000,000	17,476,650	265,375	2,258,405	14,952,870	956351	2,523,350
10	20,000,000	17,871,935	660,660	2,258,405	14,952,870	877294	2,128,065
11	20,000,000	17,386,395	175,120	2,258,405	14,952,870	974402	2,613,605
12	20,000,000	17,423,630	212,355	2,258,405	14,952,870	966955	2,576,370
13	20,000,000	17,385,075	173,800	2,258,405	14,952,870	974666	2,614,925
14	20,000,000	17,369,675	158,400	2,258,405	14,952,870	977746	2,630,325
15	20,000,000	17,597,430	386,155	2,258,405	14,952,870	932195	2,402,570
16	20,000,000	21,164,895	3,953,620	2,258,405	14,952,870	218702	- 1,164,895
17	20,000,000	17,385,075	173,800	2,258,405	14,952,870	974666	2,614,925
18	20,000,000	17,582,030	370,755	2,258,405	14,952,870	935275	2,417,970
19	20,000,000	17,385,075	173,800	2,258,405	14,952,870	974666	2,614,925
20	20,000,000	17,712,875	501,600	2,258,405	14,952,870	909106	2,287,125

NPV	5,520,206
IRR	0.12%

6.8 Set up prices

The base price for renting a plain regular warehouse with nothing inside is an average of 150 baht/pellet. However, the new warehouse of the freight forwarder is equipped with rack, workers and put away services. The following is a list of prices that the company can charge its customers and the return it gives based on a fix number of pallet of 200,000 pallets / year. The price range is assumed 40 – 150 Baht/pallet.

Table 6-10: IRR and NPV result according to price charge in Initial Phrase

Price charge (Baht)	IRR	NPV
40	-15.38%	- 28,457,458.58
50	-0.92%	- 12,194,152.06
60	8.36%	8,644,031.84
70	14.34%	20,332,460.97
80	19.76%	36,595,767.48
90	24.90%	52,859,073.99
100	29.91%	69,122,380.51
110	34.84%	85,385,687.02
120	39.72%	101,648,993.53
130	44.57%	117,912,300.05
140	49.41%	134,175,606.56
150	54.23%	150,438,913.07

How much cost to charge depends on the company owner's perceptions and at what price is agreeable between the company and its customer; More input are adjustable and can be done in the excel sheet.

Because the Initial and Extended Phrase was set up, it would be convenient to let the company own knows the IRR of this phrase too. Like the previous table, the price ranges from 40 - 150 baht/pallet, with the assumption of receiving 400,000 pallets/year, starting year 11.

Table 6-11: IRR and NPV result according to price charge in Initial and Extended Phrase

Price charge (Baht)	IRR	NPV
40	7.16%	1,093,158
50	10.69%	12,260,372
60	13.94%	33,224,891
70	14.84%	34,594,800
80	16.29%	45,762,014
90	17.52%	56,929,228
100	18.59%	68,096,441
110	19.54%	79,263,655
120	20.39%	90,430,869
130	21.16%	101,598,083
140	21.87%	112,765,297
150	22.53%	123,932,511

To make the comparison easier to interpret, the data from table 6.10 - 6.11 is demonstrate in graph form as shown in the following figure.

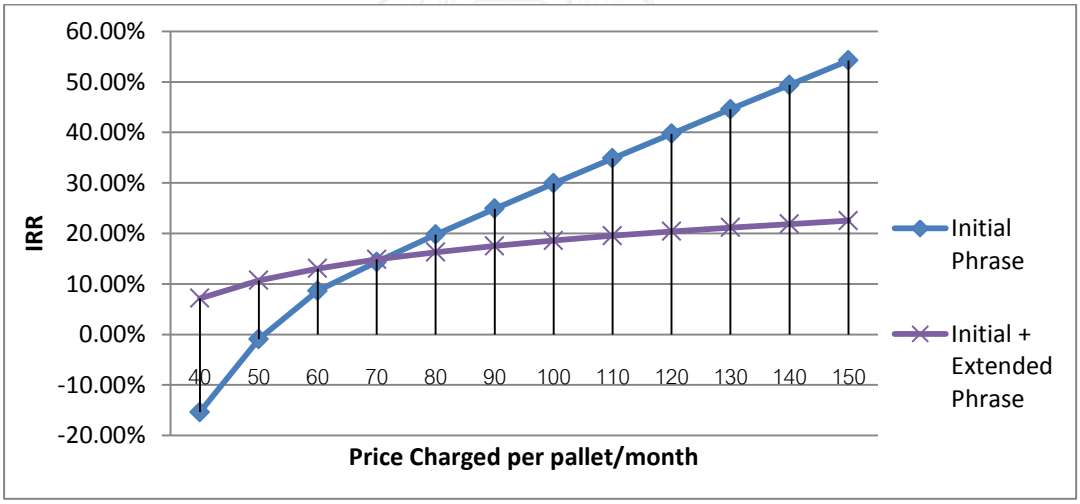


Figure 6-4: IRR trend of Initial Phrase and Initial and Extended Phrase respect to price charged per pallet

After the computation, it can be observed that the IRR of Initial and Initial + Extended Phrase that the trend is gradually moving away from the Initial Phrase as

higher price is charge. Due to the high volume of the Initial + Extended phrase the trend has less swings.

To summarise, the following table shows us the IRR NPV and Pay Back Period of each proposed project. However, since it is impossible for the rent option to charge customer lesser than 100 Baht/pallet, other options have to show the result of effect of charging at 100 Baht/pallet as well.

Table 6-12: IRR and NPV result according to price charge in Initial and Extended Phrase

Price Charged (Baht)	Phrase I IRR	Phrase I + II IRR	Rent IRR
40	-15.38%	7.16%	-
50	-0.92%	10.69%	-
60	8.63%	13.04%	-
70	14.34%	14.84%	-
80	19.76%	16.29%	-
90	24.90%	17.52%	-5.73%
100	29.91%	18.59%	11.76%
110	34.84%	19.54%	25.15%
120	39.72%	20.39%	37.33%
130	44.57%	21.16%	49.18%
140	49.41%	21.87%	60.87%
150	54.23%	22.53%	72.49%

It is not possible to compare the result of three projects properly to use the cost per pallet of 60 Baht/pallet, because the IRR and NPV of rent will not be applicable therefore, compare the project with the cost of pallet of 100 baht. The result is shown in the following table which include IRR, NPV and Payback period of each project.

Table 6-13: IRR and NPV and payback period of each project charging at 100 baht/pallet

Project	IRR	NPV (Baht)	Payback Period (years)
Build Initial Phrase	29.91%	69,122,380	0.58
Build Initial + Extended Phrase	32.61%	110,815,240	1.15
Rent	0.12	5,520,206	17.67

CHAPTER VII
CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

The case study freight forwarder is a 3PL that has provided excellent performance. Its goal has been trying it's best to keep their customers happy. It has maintained very good long term relationship with its customers. Customer A, its biggest customers, plans to move more logistics services to the freight forwarder. However, to do so, the freight forwarder is requires it to have a warehouse to support such activities.

The question arises that leads us to decide whether the company should build a new warehouse or not. Since there are also other alternative such as renting the public warehouses instead. For the company, the most important thing is customer retention, so having a warehouse is a must. The information required to carry out the project is gather through literature reviews, several papers, and involved asking the opinions of professionals in the warehousing field to ensure reliabilities of the solution.

All the common considerations of warehouse cost structures are gathered through researched, the assumption of warehouse fix costs and variable costs for each months are mapped out. With the secondary data from the case study freight forwarder, we can estimate the rough income for each year. These data can provide the

calculations for economic tools such as NPV and IRR, which is the key in that helps determine the feasibility of each project.

A business model help guide the company towards the goal, which is highly beneficial to the freight forwarder. Since they do not have experience with managing their own private warehouse before, a business model is essential to help the company defines the strategist to deal with the business activities, so that it is always focusing on what is most important, such as customer value, and income stream.

7.2 Recommendations

For companies that highly dependent on their customer's growth, it is important to ensure that every request from the customer is answered accordingly, in this case a warehouse should be provided. As comparison between build its own private warehouse to rent a public warehouse, based on the IRR, NPV, and payback period, build one is a better option. A large building such as a warehouse requires lots of investments, however these days; there may be cheaper technologies to help build it with lower cost. With promising customer in hand, it guarantees a profit to the company. Moreover, the useful life of the building lasted for a long time and could be sold off if requires. The option of expanding is also given with even higher returns; the decision should be consider when the current capacity could not accommodate higher demand. With the country coming closer to open up for AEC, the area around the ports is ensure

to be increased in value as well as trade activities, therefore building a private warehouse sounds like a promising option.

As there is no fix business model, it is possible that it can be improved later in to the one that better fits the growing business. What the company has to keep in mind is, every time there is a change in a business model or any policies, in is important that every member of the company is aware of the change and understands what is going on.

APPENDIXS

Table 8-1: Description of warehouse design and operating problems (Gu et al., 2007)

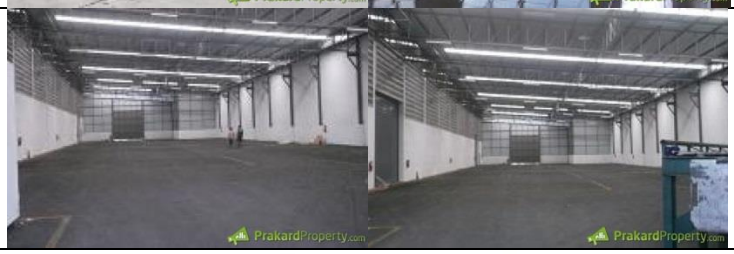
Design and operation problems		Decisions
Warehouse	Over all structure	Material flow Department identification Relative location of departments
	Sizing and dimensioning	Size of the warehouse Size and dimension of departments
	Department layout	Pallet block-stacking pattern (for pallet storage) Aisle orientation Number, length, and width of aisles Door locations
	Equipment selection	Level of automation Storage equipment selection Material handling equipment selection (order picking, sorting)
	Operation strategy	Storage equipment selection (e.g. random vs. dedicated) Order picking method selection
	Receiving and Shipping	Truck-dock assignment Order-truck assignment

Warehouse operation			Truck dispatch schedule
	Storage	SKU-department assignment	Assignment of items to different warehouse departments Space allocation
		Zoning	Assignment of SKUs to zones Assignment of pickers to zones
		Storage location assignment	Storage location assignment Specification of storage classes (for class-based storage)
	Order picking	Batching	Batch size Order-batch assignment
		Routing and sequencing	Routing and sequencing of order picking tours Dwell point selection (for AS/RS)
		Sorting	Order-lane assignment

Table 8-2: Selected individuals who have work experience related to warehousing.

Name	Company Name	Position	Warehousing Experience
Mr. Punyapon Tepparasit	MVP Consultant	CEO	5 years
Ms. Patitta Sawaengpak	CPF Logistics Co., Ltd.	Inventory Manager	7 years
Ms. Suwapat Phanthunakin	Sian Food Products Public Co., Ltd.	Warehouse Manager	10 years

Table 8-3: Available warehouse sites around Leam Chabang with pictures.

Site	Land Area in sq/meters	Picture
Sriracha 1	11,000	
Sriracha 2	28,000	
Sriracha 3	30,000	
Sriracha 4	100,000	

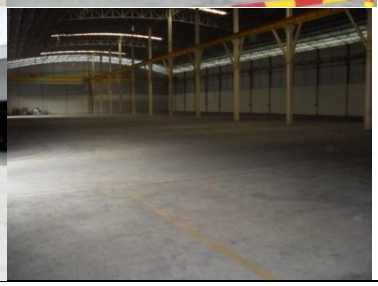
		 
Laem Chabang	30,000	   

Table 8-4: Existing public warehouse information

Site	Land Area (sqm)	Rental fees (baht)	Building Condition	Accessi-bility of Roads	Distance to port	Flexi-bility	Credita-bility
Sriracha 1	11,000	130-150	New	Fair	7 km	Fair	Good
Sriracha 2	28,000	140	Fair	Fair	20 km	Good	Fair
Sriracha 3	30,000	130-150	Fair	Good	15 km	Fair	Good
Sriracha 4	100,000	150	Fair	Fair	12 km	Good	Good
Laem Chabang	30,000	140	New	Good	8 km	Good	Good

Table 8-5: Scoring and Indication

Scoring	Indication
0 to 3	Old
4 to 7	Fair
8 to 10	Good

Table 8-6: Scorn given by Mr. Punyapon Tepparasit

Site	Rental fees (baht)	Building Condition	Accessibility of Roads	Distance to port	Flexi-bility	Credi-bility
Sriracha 1	9	8	7	8	9	9
Sriracha 2	9	7	8	6	8	6
Sriracha 3	9	7	8	6	8	8
Sriracha 4	9	7	6	8	8	7
Laem Chabang	9	8	7	9	7	7

Table 8-7: Score given by Ms. Patitta Sawaengpak

Site	Rental fees (baht)	Building Condition	Accessibility of Roads	Distance to port	Flexi-bility	Credi-bility
Sriracha 1	9	7	7	9	8	10
Sriracha 2	10	6	8	6	7	7
Sriracha 3	8	7	9	8	7	9
Sriracha 4	9	7	6	8	9	9
Laem Chabang	10	7	8	8	8	8

Table 8-8: Ms. Suwapat Phanthunakin

Site	Rental fees (baht)	Building Condition	Accessibility of Roads	Distance to port	Flexi-bility	Credi-bility
Sriracha 1	8	7	7	8	8	8
Sriracha 2	9	6	8	5	8	6
Sriracha 3	8	8	9	6	7	8
Sriracha 4	8	9	6	8	9	8
Laem Chabang	8	8	8	9	7	7

Table 8-9: Weight of the each attribute

Site	Rental fees (baht)	Building Condition	Accessibility of Roads	Distance to port	Flexi-bility	Credi-bility	Sum
Site name	0.05	0.1	0.2	0.3	0.3	0.05	1

Scores after calculation

Table 8-10: Scorn given by Mr. Punyapon Tepparasit, after weighted

Site	Rental fees (baht)	Building Condition	Accessi-bility of Roads	Distance to port	Flexi-bility	Credi-bility	Average
Sriracha 1	0.45	0.8	1.4	2.4	2.7	0.5	0.39
Sriracha, 2	0.45	0.7	1.6	1.8	2.4	0.3	0.35
Sriracha 3	0.45	0.7	1.6	1.8	2.4	0.4	0.35
Sriracha 4	0.45	0.7	1.2	2.4	2.4	0.4	0.36
Laem Chabang	0.45	0.8	1.4	2.7	2.1	0.4	0.37

Table 8-11: Score given by Ms. Patitta Sawaengpak, after weighted

Site	Rental fees (baht)	Building Condition	Accessi-bility of Roads	Distance to port	Flexi-bility	Credi-bility	Average
Sriracha 1	0.5	0.7	1.4	2.7	2.4	0.5	0.39
Sriracha 2	0.5	0.6	1.6	1.8	2.1	0.4	0.33
Sriracha 3	0.4	0.7	1.8	2.4	2.1	0.5	0.37
Sriracha 4	0.5	0.7	1.2	2.4	2.7	0.5	0.38
Laem Chabang	0.5	0.7	1.6	2.4	2.4	0.4	0.38

Table 8-12: Score given by Ms. Suwapat Phanthunakin, after weighted

Site	Rental fees (baht)	Building Condition	Accessi-bility of Roads	Distance to port	Flexi-bility	Credi-bility	Average
Sriracha 1	0.4	0.7	1.4	2.4	2.4	0.4	0.37
Sriracha 2	0.45	0.6	1.6	1.5	2.4	0.3	0.33
Sriracha 3	0.4	0.8	1.8	1.8	2.1	0.4	0.35
Sriracha 4	0.4	0.9	1.2	2.4	2.7	0.4	0.38
Laem abang	0.4	0.8	1.6	2.7	2.1	0.35	0.38

Table 8-13: Result after averaging the score

Site	Sum of Score
Sriracha 1	32.29
Sriracha 2	28.86
Sriracha 3	31.57
Sriracha 4	30.81
Laem Chabang	30.90

Table7-14: Costs of warehouse equipments

Item	Cost per unit	Size	Info	Capacity	Useful life	Unit use	Cost (Baht)	Rent	
Wood palle8	290-360 / rent 2.5 a day	1200 x 1000 x 150 mm		1.2-2.5 tons	2 years	600	144,000	2.5	/day
Double Deep Rack	2,300	3600x 2500 x 9800 mm (2x4 pallets)		500-700kg /pallet	10 years	180	414,000	-	
Forklift	700,000		Max Lift 6500 mm	2-3.5 tons	8 years	5	3,500,000	19000	/month
Hand forklift	5,700		Max Lift 195 mm	2.5 tons	8 years	10	57,000	4000	/month
Closed circuit cameras	33,000		additional 800/cam		10 years	12	42,600	-	
Indoor sprinkler and tank	50/piece + 36/squsare ft pipe + 30,000 Tank		Max 15 feet apart		20 years	154	120,860	-	
Lighting	70/piece				4 months	200	14,000	-	
Computers	13,000				3 years	8	104,000	-	
Desk	2,400	120 x 60 x 75 cm			3 years	10	24,000	-	

Chair	1,150	57 x 54 x 83 cm			3 years	15	17,250	-	
Color laser printer	44,890	600 x 600 cm			3 years	1	44,890	-	
Barcode scanner system	3000- 4000 /unit				3 years	5	15,000	-	
Toilet	1,672				10 years	12	20,064	-	
Men urinal	405				11 years	7	2,835	-	
Sink	295				12 years	12	3,540	-	
Fire house cabinet	12,000				8 years	5	60,000	-	
Total							**458,4039**	**372,140**	

REFERENCES

Arain, M., et al. (2010). "What is a pilot or feasibility study? A review of current practice and editorial policy." BMC Medical Research Methodology(10): 1-7.

Ashayeri, J. and L. Gelders (1985). "Warehouse design optimization." European Journal of Operational Research. **21**(3): 285-294.

Baker P. and M. Canessa (2009). "Warehouse design: a structured approach." European Journal of Operational Research.(193): 425-436.

Frazelle, E. (2002). World-Class Warehousing And Material Handling,. New York, United States, McGraw-Hill.

Goetschalckx, M. (2002). "Strategic Network Planning." Supply Chain Management and Advance Planning: Concepts, Models, Software, and Case Studies: 105-121.

Osterwalder, A. and Y. Pigneur (2009). The Business Model Generation. Amsterdam, NL, Patrick van der Pijl.

Rouwenhorst, B., et al. (1999). "Warehouse design and control: Framework and literature review. ." European Journal of Operational Research.(122): 515-529.

Rowley, J. (2000). The Principles of Warehouse Design, Institute of Logistics & Transport.

Tompkins, A., J. and A. White, J. (2010). Facilities Planning, John Wiley & Sons, Inc.

Arain, M., et al. (2010). "What is a pilot or feasibility study? A review of current practice and editorial policy." BMC Medical Research Methodology(10): 1-7.

Archiwaranguprok, S. (2013). "Supply Chain Manager Competencies as Antecedents of Supply Chain Integration and their effects on Operational Performance: A Study of Thailand Automotive Industry." Doctor of Philosophy in Logistic Management, Chulalongkorn University.

Ashayeri, J. and L. Gelders (1985). "Warehouse design optimization." European Journal of Operational Research. **21**(3): 285-294.

Baker P. and M. Canessa (2009). "Warehouse design: a structured approach." European Journal of Operational Research.(193): 425-436.

Banchuenvijit, W. (2009), "The Short-Run Relation between the Thai Stock Market And Some Other Stock Markets." International Journal of Business and Economics. **1**, 1-202.

Blomqvist, T. (2010). "A warehouse design framework for order processing and materials handling improvement - Case Etra Oy." Master of Economics Thesis, Aalto University School of Economics.

Bodner, D. A., Govindaraj, T., Karathur, K. N., Zerangue, N. F., and McGinnis, L. F. (2005). "A Process Model and Support Tools for Warehouse Design." School of Industrial and Systems Engineering Thesis, Georgia Institute of Technology.

D'Souza, D. F. and Wills A. C.. (1999), The Catalysis Approach, Massachusetts, USA: Addison Wesley Longman, Inc.

Frazelle, E. (2002). World-Class Warehousing And Material Handling,. New York, United States, McGraw-Hill.

Gould, S., O'Sullivan M., Tilley C., Topazio N. (2013), "Business Model Background Paper". Integrated reporting , 1-19.

Goetschalckx, M. (2002). "Strategic Network Planning." Supply Chain Management and Advance Planning: Concepts, Models, Software, and Case Studies: 105-121.

Kaiser, U. (2008), "Developing an Effective Business Model." A primer in Entrepreneurship, 1, 2-32.

Kostrzewski M., (2012), "The Procedure of Warehouses Designing as an Integral Part of The Warehouses Designing Method and The Designing Software." International Journal of Mathematical Models and Methods In Applied Sciences. **6**, 535-543.

Kubzansky, M. (2012), "The Importance of Business Models.", Old Problems, New Solutions: Harnessing Technology and Innovation in the Fight Against Global Poverty, 41-48.

Larsson, V. and Olsson, F. (2010). "Warehouse Design When Establishing a New Factory in Russia." Master of Science Thesis, Chalmers University Of Technology.

Manzini, R., Accorsi, R., Pattitoni, L., Regattieri, A. (2011), "A Supporting Decisions Platform for the Design and Optimization of a Storage Industrial System.", Efficient Decision Support Systems - Practice and Challenges in Multidisciplinary Domains. **6**, 437-458.

Mapfre RE. (2008), Warehouse Safety Guide, Spain: Imagen Gráfica de Ávila, S.L.

Mehrotra, V. (2003). "An Economic Cost Benefit Analysis of International and External Warehouses in Food Retail Industry." Master of Engineering in Logistics Thesis, Massachusetts Institution of Technology.

Osterwalder, A. and Y. Pigneur (2009). The Business Model Generation. Amsterdam, NL, Patrick van der Pijl.

Queirolo, F., Schenone, M., Nan, P. (2002), "Warehouse Layout Design: Minimizing Travel Time With A Genetic And Simulative Approach - Methodology And Case Study." Proceedings 14th European Simulation Symposium,1-5.

Rouwenhorst, B., et al. (1999). "Warehouse design and control: Framework and literature review. ." European Journal of Operational Research.(122): 515-529.

Rowley, J. (2000). The Principles of Warehouse Design, Institute of Logistics & Transport.

Serote, L. (2010). "Facility design: Achieving overall efficiency in the warehouse environment." Bachelors of Industrial Engineering Thesis, University of Pretoria.

Spear, C. (2011). "Warehouse Design for POLY GAIT". Industrial Engineering Bachelor of Science Thesis, California Polytechnic State University.

Speh, T. W. (2009). "Understanding Warehouse Costs and Risks.", Warehouse Forum. 24 (7), 1-6.

Tompkins, A., J. and A. White, J. (2010). Facilities Planning, John Wiley & Sons, Inc.

Weisz, H. P. (2002). “You Are Probably Paying Too Much For Your Third Party Warehousing.”, HW Associates Management Consultants. 1-5.

VITA

Ms. Chanokpim Chanudomporn receives a Bachelor degree from Sirindhorn International Institute of Technology, Thammasat University in Engineering Management. She started her work at SCM International Training Center For Professional Qualifications (SCM-ITC) and have been working at the Institute ever since. Afterwards, in 2011 she began her study in a dual master's degree program at Regional Centre for Manufacturing Systems Engineering, a collaborate program between Warwick University, United Kingdom and Chulalongkorn University.