

A MANAGEMENT INVENTORY SYSTEM FOR JAZTRONICS CO., LTD.

by

Mr. Janevit Jantanasmit

A Final Report of the Six-Credit Course CE 6998 - CE 6999 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
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Project Title

A Management Inventory System for Jaztronics Co., Ltd.

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Academic Year

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The Graduate School of Assumption University has approved this final report of the six-credit course, CE 6998 – CE 6999 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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ABSTRACT

This project focuses on the system analysis, system design, and system development of an inventory management system for Jaztronics Co., Ltd. to assist the company in improving the efficiency and the effectiveness of its business by replacing the paper-based system with the computerized system.

An analysis of the existing system, including existing business functions and existing processes, was conducted to identify the current problem and the areas for the improvement. The user requirements were also collected and analyzed for the designing of the proposed system. The design stage of the proposed system covers the dataflow diagram design, the process design, the database design, the user interface design, and the report design. Hardware and software specifications were also listed to perform cost and benefit analysis. The system implementation phase covers coding and testing application program, in which Microsoft Visual Basic 6 was used in coding. The system was evaluated in the system evaluation stage to test if it is capable of working and meeting the objectives. The results of the system evaluation suggest that the system performs accurately and satisfactorily according to the design specifications and objectives.

The recommendation to the project gives the idea and suggestion for achieving the best system performance for providing great contributions to the company's inventory management system and helping the company have more effective and efficient operation.

ACKNOWLEDGEMENTS

The project report has been completed with the contributions from several people. I would like to acknowledge their efforts and thank them all.

Firstly, I would like to express my sincere gratitude to my advisor, Dr. Chamnong Jungthirapanich for his valuable guidance advice, suggestion, comment, and encouragement throughout the whole project.

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I. INTRODUCTION

1.1 Background of the Project

JazTronics (Thailand) Co., Ltd. was establish in 1992. The JazTronics Group is Japan's multi business company to specialize in dealing electronics parts. Under the slogans "Detailed service from the ground up" and "Minimizing overall costs to the user", the JazTronics Group provides a broad range of services spanning from import/export to procurement, distribution, warehousing, and just-in-time delivery. Beginning with the establishment of a subsidiary in Singapore in 1988, the Group has continued to expand into Thailand, Hong Kong, China, Philippines and Taiwan. Today the Group's parts procurement network encompasses more than 400 Japanese and local suppliers. This international network enables the provision of valuable services to our steadily growing customer base.

For our business, we can say that an inventory system is the important part for running business. An inventory represents the largest investment in assets for the company. In addition, customer have become accustomed to high levels of product availability. Therefore, inventory investment can represent more than half of the company's total assets.

JazTronics Company is now facing with many inventory problems such as difficulty to get the product information, periodic lack of sufficient storage, inefficiency to control and track and inventory system and soon. Because the existing system can't provide inventory follow by Thai regulation, Account department has to maintain manually with them self by entry all invoice to DBase III "Base on DOS program" to convert data from supplier currency "USD/YEN" to Thai baht in each item. In this step sometime operator enter wrong data because of misunderstanding of character such as

0000001014 as 0000001014 or sometime invoice that is received from supplier is not so clear that is cause of data redundancy. This problem occurr the same as tax invoice, Sometime tax invoice has more than 4000 items in each invoice that means they have to spend more than 1 hour in each invoice and when error occurr it is very difficult to solve problems.

After JazTronics company had studied its inventory problems, we found that the cause of the problems came from its manual system which makes its inventory lack the efficiency, accuracy, become difficult to manage, contain redundancy of document and data and waste a lot of paper. So we decide that it is time to adopt computerize system to solve all problems. For this project, I will develop Inventory System for JazTronics (Thailand) Co., Ltd. by using a computer system.

1.2 Objectives

Nowadays, JazTronics (Thailand) Co., Ltd. is competing with other competitors in same market share. We must enhance the performance of this business process to retain the competition. The following objective below:

- (1) To reduce the processing time and paper cost by increasing the efficiency and effectiveness of the workflow.
- (2) To make database more accurate, flexible and more reliable.
- (3) To avoid operation occurring.
- (4) To improve company's performance by using computer based information system.

1.3 Scope

This project covers a design and development of the proposed inventory management system for JazTronics Company, which covers the following functions:

- (1) Inventory Control
- (2) Costing Simulation
- (3) Report generating



II. THE EXISTING SYSTEM

2.1 Background of the Organization

The inventory system is very important for trading firms. They must control the level of the inventory, which must be suitable to the marketing demand. The person who has the responsibility in this department must have the experience to plan and forecast the stock level and stock type to support sales department. Keeping the stock as much as possible is not the way to solve the problem because they will lose opportunity cost to manage funds to the others. However, most trading firms have a lot of stock types and models, then it will be hard work to control the quantity and types of the stock.

JazTronics (Thailand) Co.,Ltd. has been in the PCB Assembly since 1992. They are a Thai company, which has 100 employees. The technology of manufacturing is through whole JT technology, Flexible circuit board assembly, In-circuit/ Function testing and Electromechanical assembly. The company's goal is to increase market shares and produce good quality products to satisfy customers. The company has established a good relationship with various customers and suppliers. The company brings new and high technology into the system in order to complete with competitors.

JazTronics (Thailand) Co., Ltd. consists of 4 departments. Each department will have their sections. Figure 2.1 shows the organization chart of the company.

(1) Sales &marketing department.

This department has the activities with the sale and marketing plan. However, they need the sales information to support their actions and analysis in order to forecast plan, and support the sale teams.

(2) System Section.

This department consists of support, technical, and information technology section. The technical section repairs and maintains the machines that are purchased. The support section takes care of the customers and will solve the problems when the customer has the problems with the company's product. The support section will work and cooperate with the technical section. All departments are supported through information technology section.

(3) Administration department

This department has 2 sections. The first section is accounting section, which is responsible for accounting jobs. The accounting section will cooperate with financial section. The purchasing section is another section of this department and they must respond and find the stocks information to support sale & marketing department. The purchasing section will send the purchase orders to the suppliers when reaching the reorder point.

(4) Inventory department.

Inventory department will be responsible with goods and other stocks of the organization. The staffs in this department must deal with other departments such as sales & marketing department, accounting department, and purchasing department. They must provide the inform a tion of product, stock information, and documents to the other departments. Therefore this department must face a lot of inventory problems, quantity, and documentation.

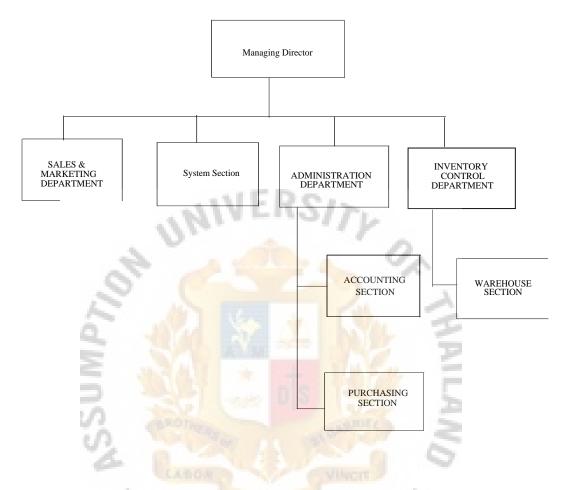


Figure 2.1. Organization Chart of Jaz Tronics (Thailand) Co., Ltd.

2.2 Existing System

The inventory management system is the core of the company, which interrelated to other departments such as accounting, marketing and purchasing department. All processes are currently manual and on the spreadsheet basis. Each department own and develop their data on a Microsoft excel format

Thus, the existing system produces much paperwork, and requires many staffs to operate. The results are redundant processes, inefficient operation, inflexibility, non-scalability, and so on.

As shown in Figures 2.2 and 2.3 the current business processes of JazTronics (Thailand) Co.,Ltd is described as follows:

- (1) Inventory staff will take care in two parts of document. First is customer invoice, this document will be receiver after customer order accept. Another document is GRN or good receive note, this document will be receive after supplier send the product to warehouse completed.
- (2) After the inventory staff receive customer invoice they will send the customer invoice, which will be copied and forwarded to account department in order to check and verify.
- (3) If customer invoice are accepted, account staff will record it to transaction database that waiting for costing simulation.
- (4) Inventory staff are also receive GRN and send it to account staff. Account staff will be convert currentcy exchange from YEN or USD to Thai bath. Accounts staff will be add expense cost, which came from clearing charge or OT, to each GRN invoice.
- (5) Account staff will verify the GRN and then put all transaction to database that waiting for costing simulation.

- (6) Accout will process costing simulation by FIFO
- (7) At the end of each month. The inventory transactions are informed to the inventory department and inventory reports are also generated for the manager.



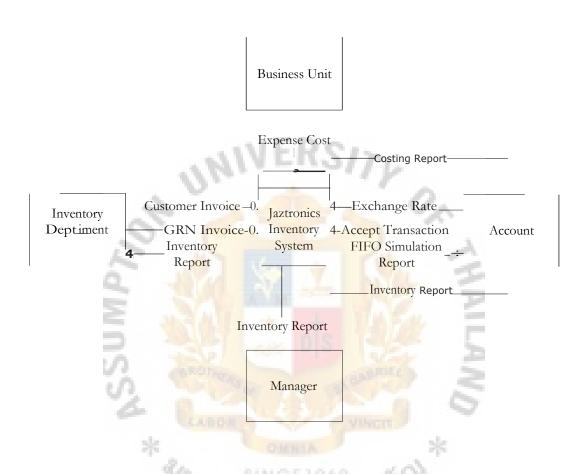


Figure 2.2. Context Level Existing System Data Flow Diagram.

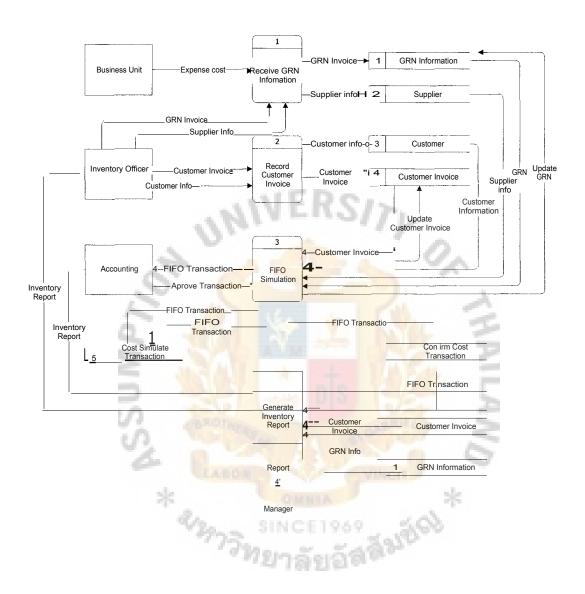


Figure 2.3. Existing System Data Flow Diagram.

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2.3 Current Problems and Area for Improvements

The current problems and areas for improvement of the existing system can be summarized as follows:

- (1) The stored data is redundant in multiple files from many other departments.

 The daily transactions that are transferred to another department must be rewritten and recorded in the document files. Therefore, every transaction occurring in a day spends a lot of time and causes of staff to face the routine jobs. Moreover the inventory's information is inflexible to change in the future such as price, type of product, quantity and so on.
- (2) Lack of data integrity: The system must have capture data. So processing of the system has to deal and contact many departments in the organization. Some time the data will be changed, and the staff must inform other departments, which have been effected in this situation. However, the information that must be transferred to other departments usually is missing in the manual process. Change of documents will occur many times thus sales department may have problems that does not match the invoice document which is issued by account department.
- (3) A lot of documents: The existing system is a manual system and it is generated by using many paper works. This problem is the result of the redundant jobs. The organization will spend the cost of office supplies and space for these duplicate documents. Moreover to be recorded in the paper can't be kept for a long time for reference in the future and data is not secure from accident and other person who is unauthorized.

- (4) The inventory control system does not have a good standard of coding and barcode system. Some products in the warehouse are not assigned the codes that cause problems when the products have a large volume to check and sell.
- order planning of inventory such as re-order point is not defined that causes the staff can not decide which level product to reorder. The result is product in stock may be in shortage or surplus.
- (6) There are a lot of errors in the system. At the end of year, the accounting department will face a lot of problems about sale, amount, vat, cost, balance sheet, income statement and so on. Therefore she must spend a lot of time to clear and find out the correct way to close the yearly account. For this problem the system will spend a lot of time and high cost of account auditing.
- (7) The report problems will occur because of a great number of daily transactions, which lead to report problems such as late monthly and annual stock report, inaccurate and unreliable of reports, not up-to-date for the manager to make a decision immediately.

III. THE PROPOSED SYSTEM

3.1 User Requirements Analysis

The requirement analysis defines the business requirements for a new system without consideration of technology. The requirement analysis phase answers the question, "what do the users need and want from a new system?" (Bentley & Jeffrey, 1998) The requirement analysis phase that includes defines requirements, analyze functional requirements, trace and complete requirements, prioritize requirements, and update the project plan.

The proposed computerized system will facilitate the day-to-day operation and set up information base for management instead of manual system. The proposed system will serve all user requirements, utilize existing resources and increase effectiveness in sales and purchasing/store department. Moreover the proposed system can avoid an increase in administrative staffs.

The user requirements are obtained from the user themselves and also the existing system evaluation. Actually, the existing system can serve the user requirement to some extent. But users still need further development for more system functions as well as improvement within the existing system operation scope (Bentley & Jeffrey 1998). The main development and improvement includes query capability volume report and sales report, database storage, security, etc. The user requirements are concluded as follows:

(a) Input Requirements

- (1) Only authorized users can access the data.
- (2) The system should alert the user when the duplicate data are entered or the data are in wrong format.
- (3) The user should take less time to enter the required information.

- (4) The system should verify that the correct data type is entered into the database.
- (5) The system should provide appropriate default value for each data field for easy data input.

(b) Process Requirements

- (1) The system should calculate the total amount of each purchase order, invoice, and, receipt.
- (2) The system should provide data sharing between sales & marketing, accounting, and purchasing department.
- (3) The system should be able to add, update, and delete the information in the database.
- (4) The user should be able to search for the required information.
- (5) The system should process the purchase order and add the quantity to the stock when the items are received.

(c) Output Requirements

- (1) The system should generate date and time to be recorded for transaction automatically.
- (2) The store controller must be able to view the current stock level of each product from the computer screen at any time.
- (3) Take less time to obtain the required information such as customer details, supplier details, inventory details, etc.
- (4) The interface has to be well organized and be user-friendlier.
- (5) The system should be able to show historical data about the quantity ordered and received on each day.

(6) The system should generate accurate monthly and annual reports as well as other reports such as the name and transaction of company's regular customers, etc.

(d) Location

The proposed system allows different users in different departments to share necessary data concurrently through Local Area Network within the head office.

3.1.1 Data Modeling

A model is a representation of reality (Bentley & Jeffrey 1998). Model can be built for proposed systems as a way to document business requirements or technical designs. The model composes of 2 types as follows:

- (1) Logical Models show what a system is or does. They depict the system independent of any technical implementation.
- (2) Physical Models show not only what a system is or does, but also how the system is physically and technically implemented. They are implementation dependent because they reflect technology choices and the limitations of those technology choices.

Data Modeling is a technique for organizing and documenting a system's data. The data modeling is sometime called database modeling (Bentley & Jeffrey 1998). The entity relationship diagram (ERD) is the data modeling technique that used to depicts data of inventory information system in term of entities and relationships described by the data. There are three levels of entity relationship diagram: context data model, keybased data model and fully attributed data model.

The context data model represents only the entity and relationship between each entity (Date 1996). There are ten entities discovered in the system: Supplier Invoice,

Supplier, Supplier Invoice, Supplier Invoice Description, Item, Stock, Customer Invoice, Customer, Customer Invoice Description, and Exchange Rate. Each entity has the relationship, when combined with the entity name in form of simple business sentences.

The key- based data model, the primary and foreign keys are added to each entity (Date 1996). The primary key is the candidate key that will most commonly be used to uniquely identify a single entity instance such as Supplier has a single attribute primary key (Supplier ID). The foreign key is a primary key of one entity that is contributed to (duplicate in) another entity to identify instances of a relationship.

The fully attributed data model includes all remaining descriptive attributes and sub setting criteria (Date 1996). The complete entity relationship diagram of the proposed system is shown in Appendix A.

3.1.2 Process Modeling

Process Modeling is a technique for organizing and documenting the structure and flow of data through a system's processes and/or the logic, policies, and procedures to be implemented by a system's process (Bentley & Jeffrey 1998). The data flow diagram (DFD) shows the relation between process and data, and in data dictionaries, that formally describes the systems data and it is used.

Data flow analysis examines the use of data to carry out specific business processes within the scope of a systems investigation. Data flow diagrams show the use of data in the system pictorially. They show all the essential components in the system and how they fit together. It can be difficult to fully understand a business process through a verbal description alone; data flow diagrams help by illustrating the essential components of a process and the way they interact.

To construct the process model, the context diagram is constructed to establish initial project scope of inventory and sales information system. Figure 3.1 illustrates the context diagram of the proposed system. The whole system includes six external entities, which are Customer, Accounting Department, Management, Supplier, Purchasing Department, and Warehouse.

Next, the functional decomposition diagram also called hierarchy chart, shows the top-down function decomposition and structure of a system. A decomposition diagram is essentially a planning tool for more detailed process models, namely, and data flow diagram. The functional decomposition diagram of Proposed System is shown in Figure 3.2.

After finishing the context diagram and functional decomposition diagram, a data flow diagram can be drawn to depict the flow of data to and from within the system.

The major functions of the proposed system can be summarized as follows:

Process 1. Generate GRN Information

The purpose is to enter Good Receive Note or GRN and verify GRN before recording it to confirm GRN database. The GRN information will be used to check the amount to goods that supplier send to warehouse. After customer credit and customer orders are accepted, the sales officer will send order acceptance to warehouse.

Process 2. Record Customer Invoice

When the customer information is accepted, the inventory officer will prepare customer invoices and calculate sub total, value added tax, and net total of original tax invoice. The products and original tax invoice will be sent to customer. After products and invoice are sent, the inventory officer will update customer invoice into database.

Process 3. FIFO Simulation

The account staff loads GRN information and customer invoice from database and process FIFO transaction. After FIFO simulation completed, FIFO transaction will be recorded in cost simulate transaction database and will send to account staff to approve transaction. If transaction is passed then FIFO transaction will move to record to confirm cost transaction database.

Process 4. Generate Report

After the FIFO transaction is approved, the staff at account department will generate report for costing simulation and also provide information to inventory department to generate inventory report. Moreover, admin staff will generate monthly report to manager.

Figure 3.3 illustrates data flow diagram of proposed system. The lower levels of data flow diagram are shown in Appendix B.

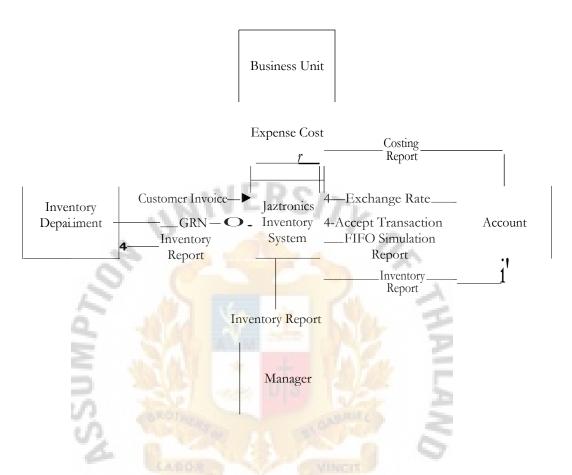


Figure 3.1. Context Level Proposed System Data Flow Diagram.

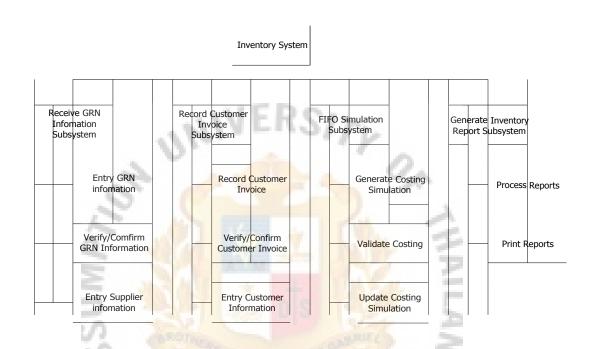


Figure 3.2. Functional Decomposition Diagram of Proposed System.

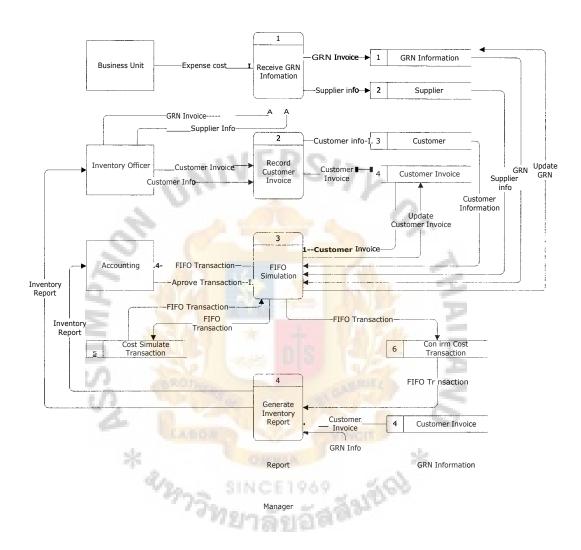


Figure 3.3. Proposed System Data Flow Diagram.

3.2 Decision Analysis

The business requirement analysis has usually numerous alternative ways to design a new information system to fulfill user requirements. Some questions may occur before designing the new system.

- (1) How much of the system should be computerized?
- (2) Should we purchase software or build it ourselves?
- (3) Should we design the system for an internal network, or should we design a web-based solution?
- (4) What emerging information technologies might be useful for this application?

The questions are answered in the decision analysis phase, so that this phase is to identify candidate solutions, analyze candidate solutions for feasibility, and recommend a candidate system as the target solution to be designed.

After identifying candidate solutions, each candidate is evaluated by technical feasibility, operational feasibility, and economic feasibility.

Candidate Solutions

Brainstorming possible solution is an approach for identifying candidate solutions. Brainstorming is an effective technique for identifying possible solutions. Brainstorming should encompass solutions that represent buy, build, and a combination of buy and build option. Table 3.1 illustrates the candidate system matrix of proposed systems, which is a useful tool for effectively capturing, organizing, and comparing the characteristics for different candidate solutions. There are three candidate solutions that can be defined for the proposed system as follows:

(1) Candidate 1: Resources Sharing LAN-File Server

Visual Basic 6.0 is the tool that allows user to develop Windows (Graphic User Interface-GUI) application. The applications have a familiar appearance to the users. The file server is used in this candidate to store database, and client PCs executes all database instructions. Against other desktop packages Access has one huge advantage, it is likely that users are running windows as operating system and using Microsoft Office as application base. Access can be used by almost anyone of any level. Beginners can get to grips with it very easily using the wizards and the easy to understand interface. But Access does not provide good performance when run across a network and when it is used by more than handful of people at once.

(2) Candidate 2: Two Tier Client/Server Computing - Web Database

Candidate 2 represent two tier client/server computing with web database. Web-base database (WBD) server facilitates virtual communities for discussion, present linked resources in relational databases, deliver instant feedback, and customized instructional sequences. The advancement of Internet and database technologies enable web servers to present dynamic information. The client PCs are not installed software but it requires only a web browser to run the develop application and some application programs.

(3) Candidate 3: Two Tier Client/Server Computing — Database Server

This candidate is used to follow the concept of two tier client/server computing. Candidate 3 represents Visual Basic 6.0 and SQL Server 2000 that can support the multi-user environment and relational database technology. The database server serves as the system database, its function

is manage the resources that clients requesting. Moreover SQL 2000 extremly reliable and fully RDBMS that can maintainace all transactions.



Table 3.1. Candidate System Metrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Portion of system			
computerized			
Brief description of that	Fully supports	Fully supports	Fully supports
portion of the system	all relevant unit	all relevant unit	all relevant unit
that would be	that are	that are	that are
computerized in this	involved	involved	involved
Benefits			
Brief description of the	Application	Better control	Provides high
business benefits that	development is	of redundant or	efficiency,
would be realized for	easy to learn	out-dated	powerful
this candidate.	and develop	information	DBMS and
4.1	with the	through	application that
. 0	existing tool.	single-point	perform more
-		storage and	efficiently
.0' /		access.Improve	122
	_	d productivity	A
, 100 m	1 (20 7	through quicker	T.
40		access to	7.3
Servers and		Take.	
Workstations	n n n		
A description of the	Server:	Server:	Server:
servers and workstation	Pentium III 800	Pentium III 800	Pentium III 800
needed to support this	MHz	MHz	MHz.
candidate.	PC: Pentium II	PC : Pentium II	PC : Pentium II
40.00	733 MHz.	733 MHz.	733 MHz.
Software tools needed	OWHIA	- Séc	
Software tool needed to	Microsoft	Window 2000	Window 2000
design and build the	Visual Basic 6	Window 98 SE	Window 98 SE
candidate (e.g.,database	Microsoft	Internet	Visual Basic 6.0
management system,	Access 97	Information	SQL Server
emulators, operating	Window 2000	Server 5.0	2000
system, languages etc,)	Server	Active Server	
Not generally applicable	Window 98 SE	Page 3.0	
if applications software		MS SQL server	
packages are to be		7.0	
purchased.		MS Visual	

Table 3.1. Candidate System Metrix. (Continued)

Characteristics	Candidate 1	Candidate 2	Candidate 3
Application Software			
A description of the	Database	Custom	Custom
software to be	Package.	Solution	Solution
purchased, built,			
accessed, or some			
combination of this			
Method of data			
processing			
Generally some	Database stored	Oracle uses a	Database stored
combination of : on-line,	on server and	two-tier Client/	and process on
batch, deferred batch,	processes on	Server	server. GUI
remote batch, and	workstation.	Architecture	stored and
realtime.	4	with a power	processed on
12	V 2000	database server	workstation.
Output Devices and		(4)	1
Implication	7 1730	True .	
A description of output	Display	Display	Display
devices that would be	Monitor	Monitor	Monitor
used, special output	HP laser printer	HP laser printer	HP laser printer
requirements (e,g.,	- DS		
network, preprinted	1 1000 -10		20
form,etc.), and output	NO THE REAL PROPERTY.		2
considerations	7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		3
Input Devices and	ION NO		
Implication	OMNIA	**	
A description of input	Keyboard and	Keyboard and	Keyboard and
method to be used, input	Mouse	Mouse	Mouse
devices (e.g.keybord,	ที่มาลังเลี้	Star Sur	
mouse, etc.), special	100 23 65		
input requirements (e.g.,			
new or revised forms			
from which data would			
be input). and input			
considerations(e.g,			
timing of actual inputs)			

Table 3.1. Candidate System Metrix. (Continued)

Characteristics	Candidate 1	Candidate 2	Candidate 3
Storage Devices and			
Implication			
Brief description of	20GB hard disk	MS SQL	MS SQL
what data would be	and tape	Server DBMS	Server DBMS
stored, what data would	backup	with 20 GB	with 20 GB
be accessed from		storage	storage
existing stores, what		capacity.	capacity.
storage media would be			
used, how much storage			
capability would be			
needed, and how data	WIFR	215	



Feasibility Analysis Matrix

Feasibility Analysis can occur as each candidate is identified or after candidates have been identified. Feasibility analysis should not be limited to costs and benefits. The following feasibility criteria are used to evaluate solutions against at least four criteria.

- (1) Operational feasibility: It is a measure of how the solution change the user's work environment, the solution fulfill the user's requirements and the users feel about such a solution from Table 3.1 candidate system matrix. All candidates can support the current business process but candidate1 and candidate 3 are the highest score. Candidate 1 is easy to design, easy to understand interface. Candidate 3 is fully supporting the user requirements with quick implementation. Moreover this candidate supports hypertext links to local or remote document, full color in-line graphics, and universal browser for any file type. Users can use the same interface regardless source of data.
- (2) Technical feasibility: It is the measure of technically practical solution and technical expertise to design and build by staff. Candidate 2 is the lowest score of technical feasibility because database is an extremely complex to understand and using for users. Candidate 1 is the simple way to develop the database, and suitable for a small system with less number of users. But this candidate does not provide good performance when run across a network. Candidate 3 is the highest score of technical feasibility. SQL database is easily used in an office environment where most users are sitting in front of computer anyway.

- (3) Economic feasibility: It is the measure of cost-effective solution. Candidate 2 is an extremely complex and more powerful software solution and requires a lot of user training that causes candidate 2 takes the largest investment. Candidate 3 is the most economic feasibility score that consume the smallest investment with shortest payback period.
- (4) Schedule feasibility: It is a measure the solution can be designed and implemented within an acceptable time period or not. Candidate 2 consumes the most of time to design and implement the proposed system because oracle is very difficult to learn. Candidate 1 takes the least time because Ms Access is not complicated, and difficult to learn and design system. Candidate 3 spends more time than candidate 1 but it is also a quickly implemented solution.

Table 3.2 shows the completed feasibility analysis matrix for each candidate. After completing the candidate system matrix and feasibility analysis matrix. Candidate 3 has the highest total score, and ranks the best solution for the proposed system. This candidate is in-house custom solution. The company will hire 1 system analysts, 1 programmer, 1 network specialist, and 1 database specialist. The solution will be analyzed and designed by our own. Additional information, Return-on-Investment Analysis (ROI) technique compares the lifetime profitability of alternative solutions. The ROI for this project is percentages rate that measure the relationship between the amount the business gets back from an investment and the amount invested. The lifetime ROI for a potential project is calculated as follows.

Lifetime ROI = (Estimated lifetime benefit — Estimated lifetime cost)/Estimated lifetime costs

The cost of development of candidate 3 is 434,000 baht and the payback period is approximately 1 year. The net present value is 1,277,126.66 baht.

So Candidate 3 is the best target that is selected for further design phase. This candidate can support to achieve:

- (1) Drastic reduction in cost of office supplies, printing, and copying.
- (2) Drastic reduction in the amount of file and shelf space required.
- (3) Improved productivity through quicker access to information resources.
- (4) Better control of redundant or out-dated information through single-point storage and access.

Table 3.2. The Completed Feasibility Analysis Matrix.

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3
Operational Feasibility	30%			
Functionality. A		Fully	Fully	Support the
description of to what		supports the	support the	multi-uses
degree the candidate		user	user	Supports full
would benefit the		requirements	requirements	color in-line
organization and how		in term of	with quick	implementati
well the system would		functionality	implementati	on.
work. Political. A		and easy to	on.	
description of how well		design and		
received this solution		implement.		
would he from user	OFF	EDC.		
Score:	TA.	80	90	98
Technical Feasibility	25%		r _	
Technology. An	/	MS Access	ASP is a	MS SQL
assessment of the		is the simple	generally	Server is full
maturity, availability (or		way to	accepted	database
ability to acquire), and	V.	dev <mark>el</mark> op	technology	server whose
desirability of the		data <mark>b</mark> ase. It	in	engines are
computer technology	-	can be	developing	superior in
needed to support this		proved but it	Intranet	terms of
candidate.	140	is suitable	application	speed and
Expertise. An assessment		for a small	with	multi-user
the technical expertise	Yes.	system. It	Microsoft	capabilities.
needed to develop,		does not	Product.	
operate system.	9	provide good	Intranet	
*	100	performance	Explorer is	
Vo.	SIM	when run	available for	
43973		across a	workstations.	
	$\eta_{E\gamma}$	network.	1.00	
Score:		80	85	98

Table 3.2. The Completed Feasibility Analysis Matrix. (Continued)

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3
Economic Feasibility	35%			
Payback period				
		Approximate	Approximate	Approximate
		ly 2.50 Yrs.	ly 3 Yrs.	ly 1 Yr.
N. (D.1a)				
Net present value (Baht)				
		Approximate	Approximate	Approximate
		ly	ly	ly
		294,762.95	400,276.61	1,277,126.66
Detailed calculation:	W	See	See	See
Betaired calculation.		Appendix H	Appendix H	Appendix H
Score:		95	90	100
Schedule Feasibility	20%		7,47	100
~ C. (E				
An assessment of how			1	
long	X	Ap <mark>pr</mark> oximate	Approximate	Approximate
200	704	ly 4 months	ly 8 months	ly 6 months
the solution will take to		+ 17	Far.	
design and implement.		DIS 4	LAGE.	
Score:	1.70	100	65	80
Ranking	100%	88.75	82.5	94

3.3 System Design

System design focuses on the technical or implementation concerns of the system. The design is the solution or translation of requirements into way of meeting them. Thus the purpose of the design phase is to transform the business requirements statement from the requirements analysis phase into design specifications for construction. The detail of each design technique can be explained as follows.

3.3.1 Structure Design.

Structure Design is a technique that breaks up a large program into a hierarchy of modules. The systems design proceeds through the two phases of logical design and physical design. The logical design shows the major features and how they are related to one another. The physical design is an activity following logical design, produces program software, files, and a working system. Design specifications instruct programmers about what the system should do. The programmers in turn the programs that accept input from users, process data, produce the reports, and store data in the files.

The primary tool used in structured design is the Structured Chart. Structure Design requires Data Flow Diagrams because the processes appearing on Data Flow Diagrams will represent modules on a structure chart. One approach that is used to derive a program Structure Chart from program DFD is Transform Analysis that is technique that devices the DFD into those perform input and editing, those that do processing or data transform and those that do output.

Data Flow Diagrams (DFD s) are partitioned into individual transaction module in order to specify the afferent, central transform and efferent. The structure chart is illustrated in Appendix C.

3.3.2 Process Specification

The purpose of a process specification is to define what the system does to transform inputs into outputs. It provides the details of system processes in table format, which is easier to look at all, related inputs, outputs, and relevant process than a diagram. All specified tables, which are the process from the logical data flaw diagram, are shown on Appendix D.

3.3.3 Data Dictionary

Data dictionary provides a list of terms and definition for all data items and data stores within the developed system. The data dictionary for both entity relationship diagram and data flow diagram is shown on Appendix E.

3.3.4 Database Design

In order to get the Database Schema for database design the data model (ERD) or logical data model is converted into implemented database. In data analysis, a normalization technique is used to transform all data in ERD into applicable database. The result of database design is illustrated in Appendix F.

3.3.5 User Interface Design

Input design serves an important goal and get the data into a format suitable for the computer. Two characteristics of types of inputs is used to design input as follows:

- (1) How the data is initially captured, entered, and processed.
- (2) The method and technology used to capture and enter the data.

After reviewing input requirement, the input design that refers to the design of screen design, document form, and document flow. The basic function is to accept data entry, verification, validation, editing. Adding, changing and deleting information. This process is the most difficult part. It consumes time in programming and designing because the validation, checking, retrieving, saving, looping, calculation, and etc must

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be done by input function. When designing input screens for an application that will contain a GUI appearance, the designer must be careful to select the proper control object for each input attribute. The input screens of the proposed system are in Appendix G.

3.3.6 Report Design

The output is applied to any information produced by a system, whether printed, displayed, or spoken. Design output, the analysts select methods for presenting information, and create documents, reports, or other formats that contain information produced by the system. The Output Design of report design is in Appendix H.

3.4 Hardware/Software Requirements

3.4.1 Hardware Requirement

Referring to the existing operation system user PCs stand-alone, which does not connect to any server. To implement the proposed system, it require the new hardware to be Database server is a computer whose primary function is to offer the computing services or manage system resources for client PCs requesting for those services. The users do not generally sit at a server and use it as a workstation. The hardware requirements are shown in Tables 3.3 and 3.4 respectively.

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Table 3.3. Database Server Specification.

Device	Specification
Processor Type and Speed	Intel Pentium III 800 MHz or higher
Cache Memory	512 KB
Primary Memory	SDRAM 512 MB or higher
Hard Drive Copacity	20 GB or higher
CD-ROM Drive (x)	40 x or higher
Floopy Drive	3.5" 1.44 MB
Display Monitor	IBM SVG.14"
UPS	SYNDOME SD 200 1 KVA

Table 3.4. Client Machine Specification.

Device	Specification
Process Type and Speed	Intel Pentium II 733 MHz or higher
Cache Memory	256 KB
Primary Memory	SDRAM 64 MB or higher
Hard Drive Capacity	Ultra ATA/66
Display Monitor	ACER 15"
Floppy Drive	3.5" 1.44 MB
Modem Type	Internal
Modem Speed (KBPS)	56
CD Speed (x)	52x
Keyboard (keys)	Acer Keyboard

3.4.2 Software Requirement

The software specifications for server software and client software are showed in table in Tables 3.5 and 3.6 respectively.

Table 3.5. Server Software Specification.

Software	Specification
Database Server Software	Microsoft SQL Server 2000
Operation System	Microsoft Windows 2000
Application Server	Microsoft Visual Basic 6.0

Table 3.6. Client Software Specification.

Software	Specification
Operation System	Microsoft Windows 98 SE
Application Software	Microsoft office 2000

3.5 Network Configuration

The objectives of network connection are sharing resources such as database, printers, multiple users can access to the system at the same time, controlling or using the system at different places in the organization. The connection between Database server and client machine can be established through the LAN. Intranet is a private network based on TCP/IP protocols. It belongs to an organization and is accessible only by the organization members, employees, or others with authorization. In order to prevent unauthorized access from the outsitde into a company's confidential data, specialized software known as a firewall is often deployed. The proposed system is

designed to use Star Topology that uses Hub to be the center of the connecting workstations is shown on Figure 3.4.



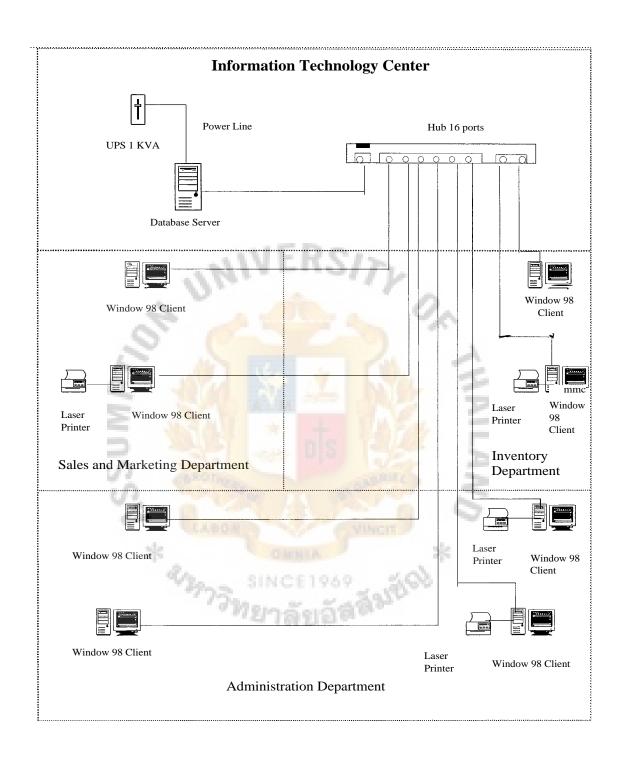


Figure 3.4. Network Configuration of the Proposed System.

3.6 Security and Control

Security and Control features are very important in today's environment for any information system. Proper security and control should be maintained by every company to prevent from any unauthorized access of data. Data is the most important resource of an information system. Any theft or vandalism could cost the company a lot of money and it should be avoided.

The following steps should be followed by the company to prevent any unauthorized access of information:

- (1) Multilevel ID and password is assigned to the DBMS and the application package Procurement system to prevent from any unauthorized access.
- (2) Passwords should be frequently changed.
- (3) Authorized persons should be required to sign the source document.
- (4) Volume backup of data should be made and updated every week
- (5) Training should be provided to every employee concerned for proper use of data.

3.7 System Cost Evaluation and Comparison

Economic feasibility has been defined as a cost-benefit analysis. The details of both cost and benefit of the new system compared with the old system must be defined. Therefore the analyst can weigh the costs and benefits of each alternative. The table and figure of cost information are constructed to provide clean picture of the comparison of both systems costs. Costs fall into two categories. There are cost associated with developing the system, and there are cost associated with operating the system.

System development costs are usually onetime cost that will not recur after the project has been completed such as people-ware cost, training cost, computer usage, etc.

Operating cost tend to recur throughout the lifetime of the system such as office supplies cost, miscellaneous cost, salaries cost, etc.

Moreover, the benefits of the new system are presented in both tangible and intangible terms. Finally, the analysis techniques which break-even analysis between accumulated annual cost and accumulated purposed cost, and payback period of purposed system are showed benefits over the cost after the proposed system is developed to replace the existing system.

(1) Cost of existing system

The existing system is operated manually and incurs both fixed cost and annual operating cost. For fixed costs consist of hardware cost and software cost. The hardware cost includes personal computer, laser printer, and calculator. The software cost includes Microsoft window 98, Microsoft Office 97. The annual operating cost includes salary cost and office supplier & miscellaneous expense.

The office equipment are what sales officers, inventory officer, and management officer use in their operation are four personal computers that used to input the customer data, customer order, product information into MS Excel. The existing system is a form of conventional files at this point, it causes the store data to be redundant in multiple files from many other departments, and the paper cost is very high when compared with the computerized system. The details of the existing system cost are summarized on Tables 3.7 and 3.8.

(2) Cost of the proposed system

The proposed system cost is also classified into fixed cost and annual operating cost. Fixed cost includes hardware cost (1 database server, 3

clients machine, and 1 UPS), software cost (1 Operating System Server Software, 1 Database Server Software, 1 Web Server Software, and 1 Application Server Software), people-ware cost (only the salary cost of specialized persons who are involved in developing the new system), maintenance cost (hardware and software), and implementation cost (training cost and installation cost). The annual operating cost includes salary cost and office supplier and miscellaneous cost.

The proposed system or computerized system requires some investment in computer hardware and software. Therefore, the maintenance cost for new hardware and software is also paid to the vendor. In the first year of proposed system, it has free maintenance charge. Moreover the additional salary cost is paid to the people such as system analysts, programmers, network specialist and database specialist who are involved in the system development process. Before implementing the proposed system implementation cost which are training cost and installation cost are spent according to the project budget.

The new system reduces the number of office and controller in the inventory and sales operation. Only one management officer, one store controller, one sales officer and one inventory officer can operate the system without any workloads. The system analyst facilitated the development of information systems and computer applications bridging the communications gap that exists between non-technical system owner and users and technical system designers and builders. The network administrators, who are responsible for maintaining the network connection

of the developed system. The details of the proposed system cost are summarized on Tables 3.9 and 3.10.



Table 3.7. Cost of Existing System, Baht.

Cost Item	Years				
	1	2	3	4	5
Fixed Cost					
Hardware Cost:					
Personal Computer 4 units @					
19,990	11,994	11,994	11,994	11,994	11,994
Laser Printer 1 units g 15,000	3,000	3,000	3,000	3,000	3,000
Calculator 5 units @ 2,000	10,000	-	-	-	-
Total Hardware Cost	24,994	14,994	14,994	14,994	14,994
Software Cost					
Microsoft Windows 98 SE 1					
unit Al 0,000	2,000	2,000	2,000	2,000	2,000
Microsoft Office 2000 1 unit @	ER	3/1	9000		
15,000	3,000	3,000	3,000	3,000	3,000
Total Software Cost	5,000	5,000	5,000	5,000	5,000
Total Fixed Cost	29,994	19,994	19,994	19,994	19,994
Operating Cost				3.	
Salary:			M.		
Management officer 1 person @	92 1		YAL	7	
10,000	10,000	11,000	12,100	13,310	14,641
Sale officer 2 person @ 15,000	30,000	33,000	36,300	39,930	43,923
Sale coordinator 1 person @	n n	8 8	100		
13,000	13,000	14,300	15,730	17,303	19,033.30
Inventory officer 1 person @		100	and b		
10,000	10,000	11,000	12,100	13,310	14,641
Total monthly salary cost	63,000	69,300	76,230	83,853	92,238
Total Annual Salary Cost	756000	831600	914760	1006236	1106859.6
Office Supplies &	CHERRY		- A		
Miscellancous:	NCET	969	200		
Stationary 20,000 Per Annum	20,000	22,000	24,200	26,620	29,282
Paper 30,000 Per Annum	30,000	33,000	36,300	39,930	43,923
Utility 36,000 Per Annum	36,000	39,600	43,560	47,916	52,207.60
Miscellancous 20,000 Per					
Annum	15,000	16,500	18,150	19,965	21,961.50
Total Annual office Supplies &					
Miscellancous Cost		111,100		134,431	147,874.10
Total Annual Operating Cost		942,700		1,140,667	1,254,734
Total Manual System Cost	886,994	962,694	1,056,964	1,160,661	1,274,728

Table 3.8. Five Years Accumulated Existing System Cost, Baht.

Years	Total Existing Cost	Accumulated Cost
1	886,994	886,994
2	962,694	1,849,688
3	1,056,964	2,906,652
4	1,160,661	4,067,313
5	1,274,728	5,342,041
Total	5,342,041	-



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Table 3.9. Estimated Cost of Proposed System, Baht.

Years					
Cost Items	1	2	3	4	5
Fixed Cost					
Hardware Cost:					
Database Server 1 unit @ 99,600	19,920	19,920	19,920	19,920	19,920
Clients Machine 3 units @ 19,990	17,394	17,394	17,394	17,394	17,394
UPS 1 unit @ 3,000	600	600	600	600	600
Total Hardware Cost	37,914	37,914	37,914	37,914	37,914
Software Cost:	5/7				
Operating System Server Software 1 unit	2,000	2,000	2,000	2,000	2,000
@ 10,000	4	4	Ď.		
Database Server Software lunit @ 25,000	5,000	5,000	5,000	5,000	5,000
Developer Software 1 unit @ 25,000	5,000	5,000	5,000	5,000	5,000
Total Software Cost	12,000	12,000	12,000	12,000	12,000
People-Ware Cost:		TOR.			
System Analysts 6 months @ 15,000	90,000	at.	2	-	-
Programmers 2months @ 12,000	24,000	UV.	5	_	_
2 Network Specialist 1 month @ 10,000	20,000	- 6	Y	_	_
Database Specialist 1 month @ 12,000	12,000	- 3	s -	_	_
Total People-Ware Cost	146,000	10%	_	_	_
ัชทยาลัยอั	980				

Table 3.9. Estimated Cost of Proposed System, Baht. (Continued)

	Years				
Cost Items	1	2	3	4	5
Maintenance Cost:					
Hardware Maintenance Cost	_	8,000	8,000	8,000	8,000
Software Maintenance Cost	-	5,000	5,000	5,000	5,000
Total Maintenance Cost	_	13,000	13,000	13,000	13,000
Implementation Cost:					
Training Cost	20,000	-	-	_	_
Installation Cost	17,500	5/-71	9.5	_	_
Total Implementation Cost	37,500	/	12.	-	-
Total Fixed Cost	233,414	62,914	62,914	62,914	62,914
Operating Cost		7/		A	
People-Ware Cost:	2 1		2	工	
Admin Officel person @10,000	10,000	11,000	12,100	13,310	14,641
Store Controller 1 person @ 12,000	12,000	13,200	14,520	15,972	17,569.20
Sales Officers 1 person @ 15,000	15,000	16,500	18,150	19,965	21,961.50
Inventory Officers 1 person	15,000	16,500	18,150	19,965	21,962
@15,000	13.	Wilson	9	9	
Total Monthly Salary Cost	52,000	57,200	62,920	69,212	76,133.20
Total Annual Salary Cost	624,000	686,400	755,040	830,544	913,598
Office Supplies & Miscellaneous	1000	49.97	D.		
Cost:	1 65 23 5				
Stationary 20,000 per year	20,000	22,000	24,200	26,620	29,282
Paper 8,000 per year	8,000	8,800	9,680	10,648	11,713
Utility 36,000 per year	36,000	39,600	43,560	47,916	52,708
Miscellaneous 20,000 per year	20,000	22,000	24,200	26,620	29,282
Annual Office Supplies and	84,000	92,400	101,640	111,804	122,984
Miscellaneous Cost					
Total Operating Cost	708,000	778,800	856,680	942,348	1,036,583
Total Computerized System Cost	941,414	841,714	919,594	1,005,262	1,099,497

Table 3.10. Five Years Accumulated Computerized Cost, Baht.

Year	Total Computerized Cost Accumulated Cost	
1	941,414	941,414
2	841,714	1,783,128
3	919,594	2,702,722
4	1,005,262	3,707,984
5	1,099,497	4,807,481
Total	4,807,481	-

(3) Comparison of System Cost

After both the existing system cost and proposed system cost are identified, the comparison table is constructed to compare between accumulated manual cost and accumulated proposed cost in order to analyze break-event point, and reveal the cost saving after implementing the proposed system. The figure of the comparison of system cost is summarized on Table 3.11.

(4) Benefit Analysis

The benefit of the new system can be classified into tangible and intangible benefits. The tangible benefits are usually measured in terms of monthly or annual savings or of profit to the firm. The tangible benefits are decreased response time, elimination of job steps, increased sales, reduced expenses, etc. The intangible benefits are benefits believed to be difficult or impossible to quantify. The example of intangible benefits are better service to community, better decision making, etc. The details of these can be summarized as follows:

Tangible Benefits

The tangible benefits of this project are measured in terms of annual cost savings (salary cost, office suppliers cost, miscellaneous), possible long run cost, and operation time improvement. The tangible benefits of the proposed system is show on Table 3.12.

Table 3.11. The Comparison of Accumulated Existing Cost and Proposed Cost, Baht.

Year	Accumulated Existing Cost	Accumulated Proposted Cost	
1	886,994	886,994	
2	962,694	1,849,688	
3	1,056,964	2,906,652	
4	1,160,661	4,067,313	
5	1,274,728	5,342,041	

Table 3.12. Tangible Benefit of Proposed System, Baht.

Benefit	Price	
Salary Cost:		
1 store Controller (12,000 Baht per month)	144,000	
1 sales officers (15,000 Baht per month)	180,000	
1 sales coordination (13,000 Baht per month)	156,000	
Total Salary Cost	480,000	
Office Supplies Cost:		
Stationary (166.66 Baht per month)	2,000	
Paper Cost (1,500 Baht per month)	18,000	
Utility (500 Baht per month)	6,000	
Total office Supplies Cost	26,000	
Miscellaneous Expenses:		
Mailing Expense (666.66 Baht per month)	8,000	
Total Miscellaneous Expenses:	8,000	
Total Cost Saving	514,000	
Elimination of the possible long run cost:		
1 store Controller (12,000 Baht per month)	144,000	
1 sales offices (15,000 Baht per month)	180,000	
1 Inventory offices (10,000 Baht per month)	120,000	
Total Long Run Cost Elimination	444,000	
Operation Time Improvement:		
1 store controller (8,700 Baht per Month)	104,400	
1 sales officer (11,875 Baht per Month)	11,875	
1 inventory offices (7,250 Baht per month)	87,000	
Total Operation Time Improvement	333,900	
Total Tangible Benefit:	1,291,900	

Intangible Benefit

These benefits are difficult to quantify in value. The proposed system provides the intangible benefits, which are summarized as follows:

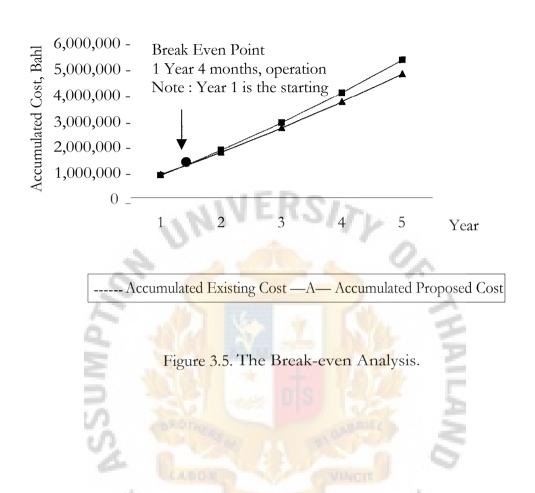
- (a) Providing faster order processing time.
- (b) Better customer relation.
- (c) Better decision-making.
- (d) Improving employee morale.

Break-even Analysis

Break-even analysis shows the point where the accumulative cost of the existing system is equal to the accumulative cost of the proposed system.

Table 3.11 is comparison of the accumulated manual cost and accumulated proposed cost. At the beginning, the cost of the proposed system is higher than the cost of manual system because of the development cost incurred at the first year of the new system implementation. But, for the long term, the proposed system can reduce the annual operating cost especially salary cost and office supplies cost.

The break-even point of the proposed system is depicted on Figure 3.5. The break-even point will occur approximately 1.4 years after the system has been operated. This result is satisfactory for investing and implementing the proposed system because it will incur less operating cost than the existing system in the long run operation.



(6) Payback Analysis

Payback period analysis is a type of "break-even" measure. It tends to provide a measure of the economic life of the investment in terms of its payback period. Payback analysis determines how much time will lapse before accrued benefits overtake accrued and continuing costs. With adjusted costs and benefit at the discount rate of 10% to account for the time value of money concept also applies in this analysis. The discount rate is required to calculate the discount value of all costs and benefits after the first year back to present value at the present year.

The advantages of payback period are simple to compute, provide some information on the risk of the investment, and provide a crude measure of liquidity.

The acceptance of the project occurs only when the project's payback period is less than or equal to the predefined payback period guideline, generally 3 years. If the payback period for the system is greater than four years, the information system should be a bad investment.

Figure 3.6 shows the payback period of the proposed system that has already been calculated to evaluate the candidate solution (see the full details of payback calculation in Table on Appendix H). The result of payback period is 1 year, which is less than the predefined maximum desired payback period (3 years). Thus this project is acceptable to implement with the return on investment to recover the initial investment within 2 years.

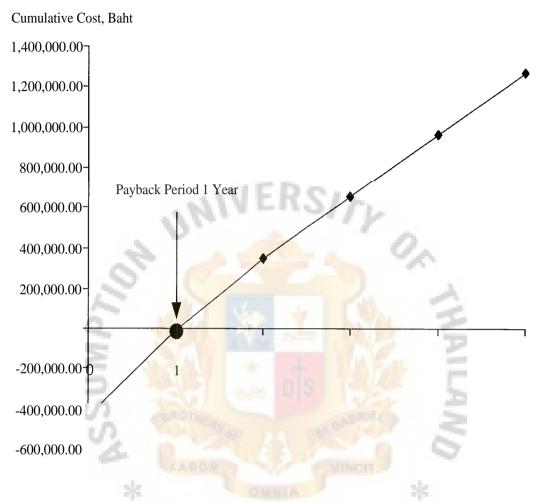


Figure 3.6. Payback Period Analysis of Proposed System.

IV. PROJECT IMPLEMENTATION

4.1 Project Management

A project is considered as a sequence of unique, complex, and connected activities having one goal or purpose that must be completed by a specific time, within budget and according to specification. Hence for any system development project, effective project management is necessary to ensure that the project meets the deadline, is developed within an acceptable budget, and fulfills expectations and specifications.

For this reason, the project management techniques and project modeling techniques are very helpful in implementing the project successfully. A Gantt chart is being used here to effectively present the milestones of this project. It also presents the definition, direction, monitoring, and controlling the development of this information system with a specified time frame.

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Project Plan of Management Inventory System for JazTronics (Thailand) Co., Ltd.

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4.2 Overview of System Implementation

System implementation is the construction of the system and the delivery of that system into production. System implementation consists of two phases, namely: Construction and Delivery.

The purpose of the construction phase is twofold:

- (1) To build and test a functional system that fulfils business and design requirements
- (2) To implement the interfaces between the new system and existing production systems.

After the approval of the technical design statement and prototypes, the construction of the new system begins. During the construction, we construct and test the system components. First activity in the construction phase is to build and test the networks. The second activity is to build and test the database. This task must immediately precede other programming activities because database are the resources shared by the computer programs to be written. After completion of this activity, the installation and testing of the Software package is done. This activity is followed by the writing and testing of the new programs.

4.2.1 Testing

Testing is a very important skill in computer programming. Modules and programs are tested and debugged as they are written. Testing should not be deferred until after the entire program has been written.

Following types of testing are performed:

(1) Stub testing: A test performed on individual modules, whether they be main program, subroutine, subprogram, block, or paragraph.

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- (2) Unit of Program testing: A test whereby all the modules that have been coded and stub tested are tested as an integrated unit. Unit testing uses the test data created during the design phase. All modules are then implemented and that unit equals the program itself.
- (3) System testing: A test that ensures that application programs written in isolation work properly when they are integrated into the new system.
- (4) Peak load testing: A test that determines whether the system can handle the volume activities in the peak period of processing demand.
- (5) Storage testing: A test that determines the storage capacity of the system to store transaction data on a disk or in other files.
- (6) Backup and recovery testing: It tests that all backup and recovery procedures are working properly and with consistency.
- (7) Performance or Response time testing: A test that determines how long it will take the system to process one instruction.
- (8) Human factors testing: It determines how users will react when they use the system, such as input, output, and interface design.

4.2.2 Prepare Conversion Plan

The purpose of this activity is to prepare a detailed conversion plan to provide a smooth transition from the old system to the new system. Following steps are required to complete this activity:

- Collect and review design specifications for the new system to identify database to be installed and user training needs.
- (2) Establish a schedule for installation of databases.
- (3) Identify a training program and schedule for the system users.

(4) Develop a detailed installation strategy to follow for converting from the existing to the new production information system.

The development team agreed upon the Parallel conversion approach for the conversion. Under this approach, both the old and the new systems are operated for some period of time. This is done to ensure that all major problems in the new system have been solved before the old system is discarded. This strategy minimizes the risk of major flaws in the new system causing irreparable harm to the business.

4.2.3 Training

Converting to a new system necessitates that system users be trained and provided with documentation that guides them through using the new system. Training is performed on the group basis because it is a better use of time and it encourages group learning possibilities. Simple and clear user manuals are given to the users. The user manuals contain a detailed explanation of people's jobs for the new system. It also shows how the new system fits into the overall workflow. Training needs of the system users is reviewed by referring to the conversion plan. Schedule training sessions are then established and conducted on the group basis.

4.2.4 System Support

System support is the ongoing maintenance of a system after it has been placed into operation. This includes program maintenance and system improvements. It consists of four ongoing activities, namely:

- (1) System maintenance
- (2) System recovery
- (3) End-user assistance
- (4) System-enhancement and reengineering

System maintenance is actually the corrective action taken when some error or bugs are identified in the system. These bugs may be caused by the miscommunication of the requirements or the design flaws. Some are even caused by the unanticipated situations, which were therefore not tested.

The fundamental objectives of the system maintenance are:

- (1) To make predictable change to existing programs to correct errors that were made during systems design and implementation.
- (2) To preserve those aspects of the programs that were already corrected.

System recovery can be defined as the overcoming from crash. From time to time, system failure is inevitable. It generally results in an aborted or "hung" program and possible loss of data. Hence during system recovery, we fix the system.

System support also asks for the End-user assistance. User always require additional assistance, no matter how well they have been trained. Hence, we should routinely observe the use of the system, conduct user satisfaction surveys and meetings, changing business procedures and clarifications, provide additional training, and logging additional ideas and requests in the repository.

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V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

JazTronics (Thailand) Co., Ltd. is an electronics manufacturing company which produces PCB assembly for both local and overseas customers. As the demand forecast for the electronic parts is continuously growing, this company is expected to grow with it. The company has been continuously utilizing various means to fulfil the demands of the market and stand ahead in its competition.

This project covers the study and analysis of the existing system, system requirement, as well as developing the proposed system to help company manage its inventory more efficiently. The proposed system aims improve processing time and paper cost by increasing the efficiency and effectiveness of the workflow. Moreover the propose system also avoids operation occurring.

In the analysis of the existing system, the necessary company's background, existing company's business function, and concerned business process were carefully analyzed to identify the current problem and the areas for improvement.

After the problem and areas for improvement had been completely identified, the user requirement were collected and studied. The user requirement mostly concerned with reducing time consuming in the process and availability of product and stock information. After we got the user requirement and enough data of the existing system, then we started to design the proposed system according to those data.

The system design phase is very important phase for this project because it extremely effects to the final system and consists of many activities including the dataflow diagram design, the process specification creation, the database design, the data dictionary creation, the user interface design, and the report design. In the design stage, the hardware and software requirements were also analyzed and identified. The

proposed system required the desktop computer with Microsoft Windows 98 as well as necessary peripheral devices. The system security was also discussed in the design stage. Certainly, the cost and benefit analysis was performed to ensure that the proposed system would be more beneficial than the existing system. In the cost analysis, the cost of the existing system and the cost of the proposed system were compared. Indeed, the proposed system could give more benefit to the company.

After the design phase had been completed, the system implementation was performed to convert the final physical system specifications into working and reliable software and hardware, also to provide the document, and training for the user and caretaker of the system.

5.1.1 Intangible Benefits

Despite the various tangible benefits that are already shown and compared with the costs, there are also intangible benefits of this project. Although these benefits are difficult to quantify, a project would be incomplete without identifying these. Here are some of the intangible benefits provided by this project:

- (1) Better decision making
- (2) Improved work performance, efficiency and productivity.
- (3) Improved customer goodwill
- (4) Significant reduction in errors
- (5) Effective time and resource management
- (6) Intra-organization cooperation
- (7) Computer based information system
- (8) Competitive advantage

5.1.2 Degree of Achievements

Table 5.1 shows the degree of achievements of this project. It shows the time spent on each process of the proposed system compared to the existing system.

Table 5.1. The Degree of Achievement of the Proposed System.

Process	Existing System	Proposed System	
Record GRN Information			
Process	4 hours	5 minutes	
Record Customer Invoice	HEDO.		
Process	2 hours 30 minutes	10 minutes	
FIFO Simulation Process	2 hours	5 minutes	
Generate Inventrory Report		A	
Process	30 minutes	5 minutes	
Total	9 hours	25 minutes	

The details of this operation time improvement can be summarized as follows:

(1) Record GRN Information Process:

The existing system spends 4 hours to input all data into Microsoft Excel. With the existing system, the data entry officer has to enter GRN information and verify manually for 4 hours. In contrast, the proposed system provides the graphical user interface to ease the input process, the officer can check the GRN immediately on computer and print out for a total of 5 minutes.

(2) Record Customer Invoice Process

The Existing System Consumes two hour thirty minutes for Record Customer Invoice process. This process will take time to record all customer invoice to Excel file about 2 hours and 30 minutes to verify and confirm customer invoice. The new system should provide the calculation

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function and arrangement product order to facilitate this process in 10 minutes.

(3) FIFO Simulation Process:

This process is also a time consuming task 2 hours to accomplish for the existing system. The account staff makes contrast of the GR_N and customer invoice to find the cost of customer invoice. The proposed system can update the stock immediately at the time of inventory requisition within 5 minutes.

(4) Generate Inventrory Report Process

This process concentrated specification generates purchase requisition of product and sends it to purchasing department. The existing system consumes 30 minutes to search the product information and calculate the quantity of product purchase. The proposed system consumes 5 minutes to search the product information and generate the purchase requisition.

(5) Report Generation Process:

The existing system uses MS Excel to prepare the report and distribute to the other departments. It spends about 30 minutes to prepare each report. The proposed system will automate the process and reduce the processing time so it should consume time of 5 minutes.

5.2 Recommendations

Management Inventory System is essential to the strategic mission and plan of inventory department of Jaztronics Co., Ltd. Unless old legacy system was dramatically improved, it was unlikely that business would be able to realize any of its Strategic vision. It is recommended that the same strategy be applied to other areas of the business, which will further enhance the growth prospects of the company.

Inventory is one of the most expensive and important assets to many companies. Stock controlling is used to design policies that make sure the costs of holding stock are as low as possible. The inventory system should be combined with another system, such as accounting department, and purchasing department. Thus the developed system essentially require all appropriate documentation, as the new information system will require some expandable uses in the future. Thus information technology is an important role in operating a business. The reasons for initiating inventory system are greater processing speed, better accuracy and improved consistency, faster information retrieval, integration of business areas, reduced cost and better security. The proposed system should use laser automation, specifically bar code. Bar coding fills a logistical gap by decreasing error rates, improving location inaccuracies, and increasing inventory-processing rates. Bar-code scanners actually use very small levels of energy. Thus the laser beam is as safe as looking into a light bulb. Bar coding is a simple process of scanning a symbol with a laser light. This laser reading is then converted from light to an analog signal to a digital signal. The analog signal is determined by the lines. These signals are processed in to an ASCII language or binary digit, simulated as a keyboard input, and finally read by the computer as something like a keyboard input. The advantage of implementing bar coding in the proposed system is the relatively low start-up cost, because of bar code systems operate immediately upon installing the

software into the computer. The proposed system of inventory information system is designed in form of two tiers Client/Server Computing — Database Server by use Visual Basic 6.0 and SQL Server 2000 that can support the multi-user environment and relational database technology. The database server serves as the system database, its function is manage the resources that clients requesting. Moreover SQL 2000 extremly reliable and fully RDBMS that can maintainace all transactions.

For future expansion, if the company wants to expand its branches to other locations, other branches can use this program because database can be shared and check product in each branch.





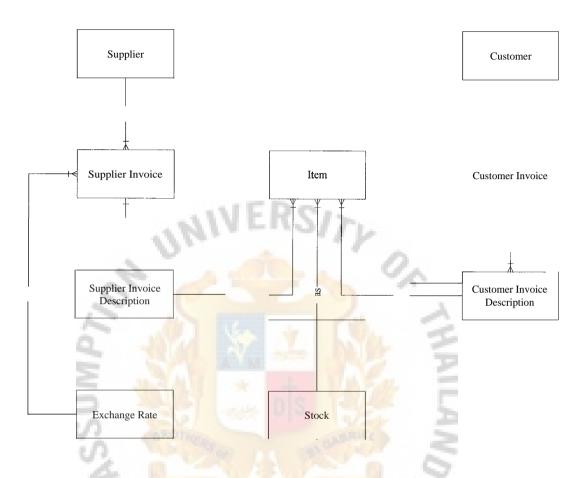


Figure A.1. The Entity Relationship Diagram of Proposed System.

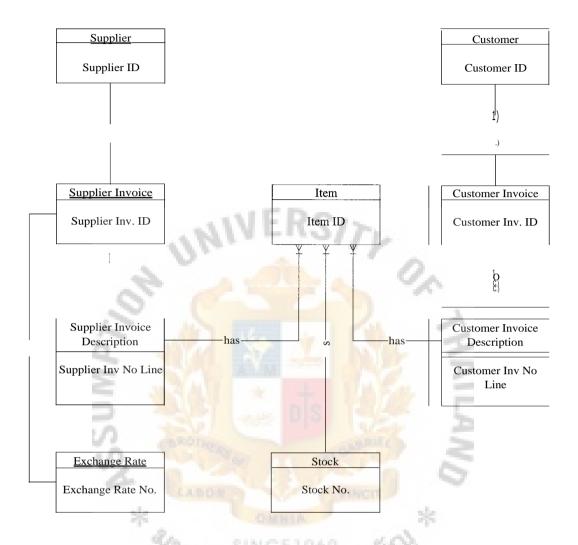


Figure A.2. Key Base Entity Relationship Diagram of Proposed System.

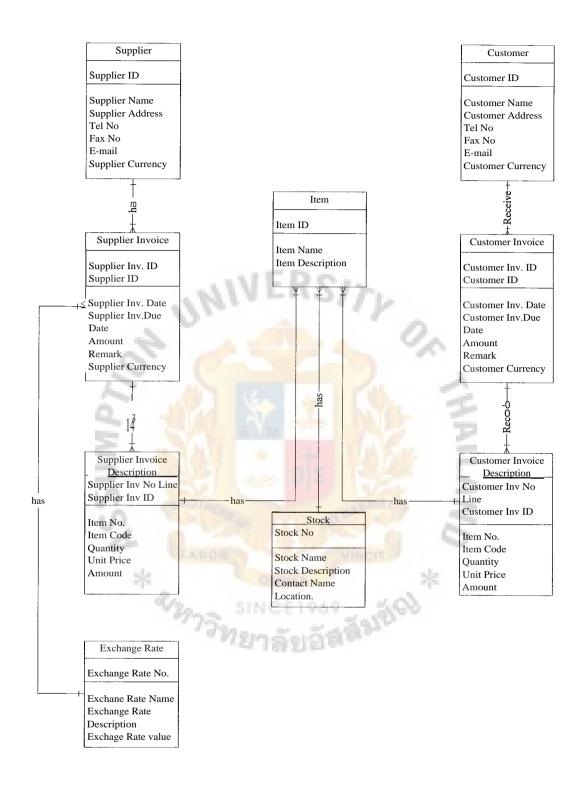


Figure A.3. Fully Attribute Entity Relationship Diagram of Proposed System.



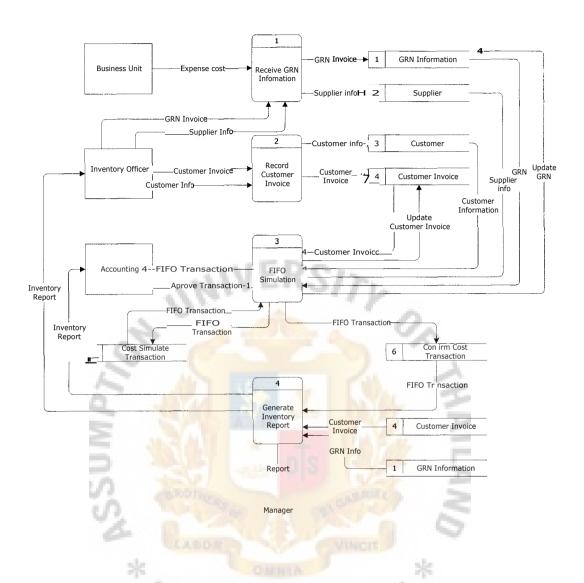


Figure B.1. Data Flow Diagram Level 0.

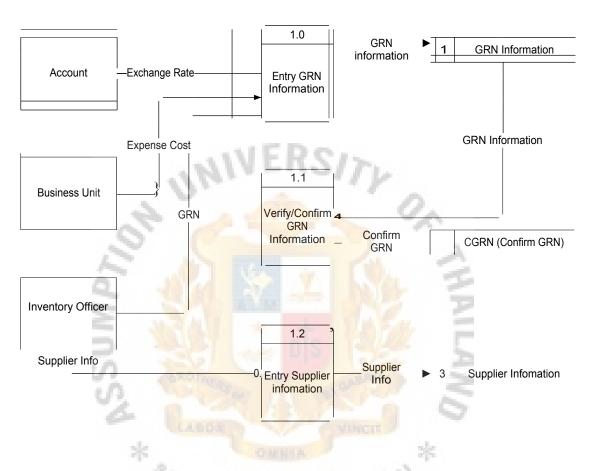


Figure B.2. Data Flow Diagram Level 1 Receive GRN Information.

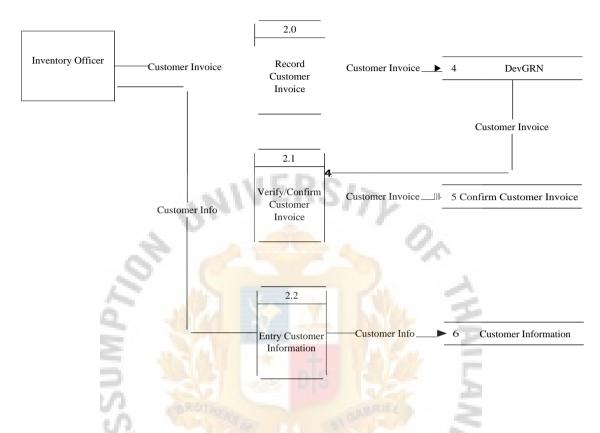


Figure B.3. Data Flow Diagram Level 1 Receive Customer Invoice.

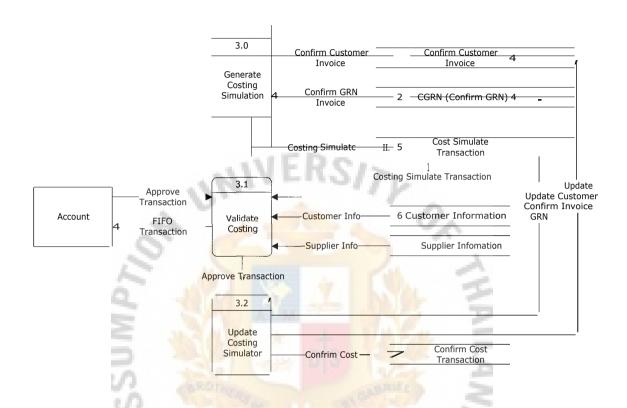


Figure B.4. Data Flow Diagram Level 1 FIFO Simulation.

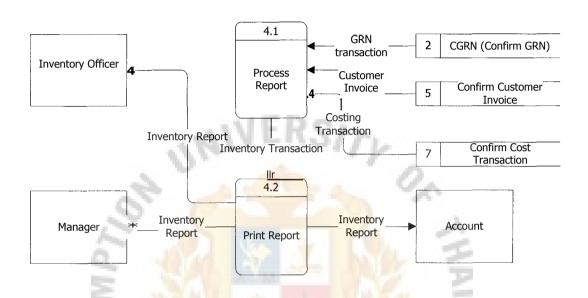


Figure B.5. Data Flow Diagram Level 1 Generate Report Process.



Table C.1. Process Specification of Process 1.0.

Data In	Description						
Process Name	Receive GRN Infomation						
Data In	GRN Invoice					GRN Invoice	
	Supplier Infomation						
Data Out	GRN Invoice						
	Supplier Infomation						
	(1) Entry GRN Infomation						
Process	(2) Verify /Confirm GRN infomation						
-OF	(3) Entry Supplier Information						
7	(1) GRN Information						
Attachement	(2) CGRN (Confirm GRN)						
5	(3) Supplier Infomation						

Table C.2. Process Specification of Process 2.0.

Items	Description			
Process Name	Record Customer Invoice			
Data In	Customer Invoice			
	Customer Information			
Data Out	Customer Invoice			
Data Out	Customer Information			
	(1) Record Customer Invoice			
Process	(2) Verify/Confirm Customer Invoice			
	(2) Entry Customer Information			
	(1) DevGRN			
Attachment	(2) Confirm Customer Invoice			
	(3) Customer Information			

Table C.3. Process Specification of Process 3.0.

Items	Description		
Process Name	FIFO Simulation		
	Customer Invoice		
	Customer Information		
	Supplier Information		
Data In	GRN		
	Approve Transaction		
	FIFO Transaction		
	Update Customer Invoice		
Data Out	Update GRN		
FIFO Transaction			
	(1) Record Customer Invoice		
Process	(2) Verify/Confirm Customer Invoice		
1	(3) Entry Customer Information		
á	(1) DevGRN		
Attachment	(2) Confirm Customer Invoice		
	(3) Customer Information		

Table C.4. Process Specification of Process 4.0.

Items	Description
Process Name	Generate Report
	GRN Transaction
Data In	Customer Invoice
	Costing Transaction
Data Out	Inventory Transaction
Data Out	Inventory Report
Process	(1) Process Report
	(2) Print Report



Table D.1. Data Dictionary of the Entity Relationship Diagram.

Field Name	Definition	
Customer	The person who orders or buys products.	
Customer Id	The identification number of each customer in an	
	ascending order.	
Customer Name	The company name of the customer	
customers.		
Customer address	The address of the customer.	
Customer Tel.	The telephone number of the customer billing	
Customer Fax	The facsimile number of the customer billing	
Customer E-mail	The E-mail address of the customer billing	
Customer Invoice	The Invoice of the customer who buy the product.	
Customer- Invoice-	The identification of each invoice for customer.	
Customer-Invoice-Date	The date of invoice is generated.	
Customer-	The due date of customer's payment.	
Invoice-due- date		
Delivery order	A document issued by warehouse to specify detail	
	of products and detail of the receivers.	
Delivery order-No.	The identification number of each delivery order	
Q 40	in an ascending order.	
Delivery Order-Date	The date of delivery order is generated.	
Delivery Order-Qty	The quantity of product that deliveries to	
Delivery - Type	The type of delivery product to customer.	
Has	The relationship between supplier and product.	
Product	It is an inventory product that is available for	
A 0	customers.	
Product-ID	The identification code of each product.	
Product - Description	The identification each product's description	
Product-Price-Per-Unit	The price of each product.	
Product Qty	The quantity of the product in the warehouse.	
Supplier	A business partners who provide the same product	
	for both resale and service to the customers.	
Supplier-ID	The identification number of each supplier in an	
	ascending service.	
Supplier-Name	The company name of the supplier.	
Supplier-Address	The identification address of each supplier.	
Supplier-Tel	The telephone number of each supplier.	
Supplier-Fax	The facsimile number of each supplier.	
Supplier- E-mail	The E-mail address of each supplier	
Supplier- Invoice	The invoice that supplier bill product to the	
	company or the customer.	
Supplier-Invoice-No	The identification number of each supplier	
Supplier-Invoice -Date	The date of supplier- invoice is generated.	

Table D.1. Data Dictionary of the Entity Relationship Diagram. (Continued)

Field Name	Definition	
Supplier-Invoice- Due-	The due date of company's payment.	
Date		
Remark	Additional information informed to the customer	
	on each order.	
Vat 7%	The 7% of VAT is included in the product price.	



Table D.2. Data Dictionary of Data Flow Diagram.

Name	Type	Description
Accounting	External Entities	Responsibility cost, benefit,
Department		income, and expense of
1		company.
Customer	External Entities	The person or company who
		order or buy product.
Customer database	External	Store customer's data.
Check customer	Process	Checking customer data and
information		product order.
Customer	Data Flow	Customer's data acceptation.
information	2 110	Customer's data acceptation.
Customer payment	Process	Checking customer invoice at
process	LI	due date.
Check customer data	Process	Checking customer credit.
Check customer	Process	Checking customer 's order
order	1100055	with product database.
Customer data	Data Flow	Customer's name, ID,
Customer data	Data Flow	address, and credit.
Customer	Data Flow	Customer's data and
information	Data Flow	customer's product order.
Customer order	Data Flow	Customer' product order.
	Data Flow	All information about
Customer payment information	Data Flow	
Customer	Data Flow	customer's payment. Customer's data and
1.7.7	Data Flow	
information	Donate	customer's order acceptation.
Calculate customer	Process	Calculating invoice such as
invoice	D	VAT, product price, etc.
Count number of	Process	Counting the number of
product in stock	Man aller	product in warehouse.
Calculate product at	Process	Calculating quantity product
reorder point	P	in stock.
Create Product Code	Process	Generating product's code.
Create Product Price	Process	Generating product's price
		(sale price).
Calculate customer	Process	Calculating customer's
receipts		receipt such as VAT,
		product, price, etc.
Delivery Order	External	Storing delivery order
Database	database	information.
Delivery Information	Data Flow	Description about product's
		delivery.
Delivery Product	Process	Delivering product to the
		customer.

Table D.2. Data Dictionary of Data Flow Diagram. (Continued)

Name	Typo	Description	
Demand Payment of	Type Process	Description Demand payment of	
'	F10CESS		
A Debt Generate Product At	Process	customer at invoice due	
	Flocess	Calculating product quantity	
Reorder Point	Dungana	at reorder point.	
Generate Purchasing	Process	Producing purchase	
Requisition	D.	requisition of product at	
Generate Purchasing	Process	Produce purchase order form	
Order Form		to supplier.	
Invoice Database	External Storing		
	invoice		
Database Invoice	Data Flow	Description about invoice	
	Miari	such as customer, address,	
	D	product, date, etc.	
Load Product	Process	Loading product information	
Information		fr <mark>om pr</mark> oduct database.	
Management	External entity	Sale and marketing	
		d <mark>epartme</mark> nt, Inventory	
Match Purchase	Process	Checking product receive	
order information	THE ROLL OF	with purchase order	
Product order	External database		
database	NAT	information.	
Product Receiving	Process	Receiving product from	
7.0	The state of the s	supplier.	
Process	Process	Receiving product from	
6.00	CARON	supplier.	
Product keeping	Data Flow	Keeping product received	
	OMBIA	into warehouse.	
Purchase order	Data Flow	Description about purchase	
information	777200000	order.	
Payment Slips	Data Flow	The terms of payment that	
T dyment sups	2 400 1 10 11	are cash or credit.	
Payment Information	Data Flow	Description about payment	
1 ayment imormation	Data 1 10 W	such as total price.	
Prepare customer	Process	Preparing invoice of	
invoice	1100000	customer at due date.	
Product In Stock	Data Flow	The number of product in	
Information	Data 1 10 W	stock.	
Product at reorder	Data Flow	The product type has quantity	
	Data FIOW	at reorder point.	
point Product Receive	Data Flow	Description product receives	
riouuci keceive	Data FIUW		
Dec du et Ca da	Doto Flow	from supplier. The product ID	
Product Code	Data Flow	The product ID.	

Table D.2. Data Dictionary of Data Flow Diagram. (Continued)

Name	Туре	Description		
Product update Data Flow		Products updates and send to		
information		store in product database.		
Prepare invoice at	Process	Prepares customer invoice at		
due date		due date		
Report Database	External	Storing report information.		
Receive Customer	Process	Storing customer information		
information		such as order, customer's		
		name, address, etc.		
Receive Purchase	Process	Receiving Purchase product		
Order		order such as product, type,		
	STATE	and quantity.		
Receipt Database	External	Storing receipt information.		
Receipt Information Data Flow		Document send to customer		
2		after receives payment slip.		
Report Database	External	Storing report information.		
Report Information	Data Flow	Sale report, Inventory report.		
Report Result	Data Flow	Result of sale report,		
0		in <mark>ventory re</mark> port.		
Supplier	External Entity	The staff of the supplier		
	3/41 + 1	whom purchasing officer can		
Supplier Database	External	Storing supplier information		
Supplier	Data Flow	Description about supplier		
Information	The same of the sa	such as name, address, etc.		
Update Product	Process	Update product quantity,		
Information	LABOR	price, and code.		
*		*		
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Table E.1. The Design of Customer Table.

Name	Туре	Length	Кеу Туре	Foreign Key	Check
Customer ID	Text	20	Primary Key	Customer Invoice table	
Customer Name	Text	30	Attribute	-	
Customer Address	Text	50	Attribute	-	-
Telephone Number	Number	9	Attribute	-	9 digits
Fax Number	Number	9	Attribute	-	9 digits
E-mail	Text	10	Attribute	-	
Customer Currency	Text	5	Attribute	() ;	-

Table E.2. The Design of Customer Invoice Table.

Name	Туре	Length	Key Type	Foreign Key	Check
Customer	Text	20	Primary Key	-	
Invoice ID.	块		MIA	2/5	
Customer Invoice	Number	8INC	Attribute	909-	
Date		ชทายาร	ela de		
Customer	Number	8	Attribute	-	
Invoice Due Date					
Amount	Number	12	Attribute	-	
Remark	Text	200	Attribute	-	
Customer ID	Text	20	Foreign Key	Customer Table	
Customer	Text	5	Attribute	-	
Currency					

Table E.3. The Design of Customer Invoice Description Table.

Name	Туре	Length	Key Type	Foreign Key	Check
Customer Invoice ID.	Text	20	Foreign Key	Customer Invoice Table	-
Item No.	Number	8	Attribute	-	-
Item Code	Text	50	Foreign Key	Item Table	-
Quantity	Number	8	Attribute	-	-
Unit Price	Number	12	Attribute	-	-
Amount	Number	12	Attribute	·	-

Table E.4. The Design of Supplier Table.

Name	Type	Length	Key Type	Foreign Key	Check
Supplier ID	Text	20	Primary Key	Supplier Invoice table	
Supplier Name	Text	30	Attribute	0 - 0	-
Supplier	Text	50	Attribute	WOLL S	-
Address	*		OMBIA	3/4	
Telephone	Number	9	Attribute	40h -	9 digits
Number	- 49	73	~ ~ ~ 3	3757	
Fax Number	Number	9	Attribute	_	9 digits
E-mail	Text	10	Attribute	-	-
Supplier	Text	5	Attribute	-	-
Currency					

Table E.5. The Design of Supplier Invoice Table.

Name	Type	Length	Key Type	Foreign Key	Check
Supplier	Text	20	Primary Key	-	
Invoice ID.					
Supplier Invoice	Number	8	Attribute	-	
Date					
Supplier Invoice Number		8	Attribute	-	-
Due Date					
Amount	Number	12	Attribute	-	-
Remark	Text	200	Attribute	-	
Supplier ID	Text	20	Foreign Key	Customer Table	-
Supplier	Text	5	Attribute		_
Currency	- 17	100			
Exchange Rate	Number	12	Attribute	10	



Table E.6. The Design of Supplier Invoice Description Table.

Name	Type	Length	Key Type	Foreign Key	Check
Supplier Invoice ID.	Text	20	Foreign Key	Supplier Invoice Table	-
Item No.	Number	8	Attribute	-	-
Item Code	Text	50	Foreign Key	Item Table	-
Quantity	Number	8	Attribute	-	-
Unit Price	Number	12	Attribute	-	-
Amount	Number	12	Attribute	-	-
Unit Price in Baht	Number	12	Attribute	-	-
Amont in Baht	Number	12	Attribute	-	-
Expense per Unit	Number	12	Attribute	-	-
Expense	Number	12	Attribute	20 -	-
Net unit price	Number	12	Attribute	YA -	-
Net Amount in Baht	Number	12	Attribute	Ê	_
Ref. Po.No.	Text	20	Attribute	-	-

Table E.7. The Design of Item Table.

Name	Type	Length	Key Type	Foreign Key	Check
Item Code	Text	50	Primary Key	gen -	-
Item Name	Text	50	Attribute	-	-
Item Description	Text	50	Attribute	-	-



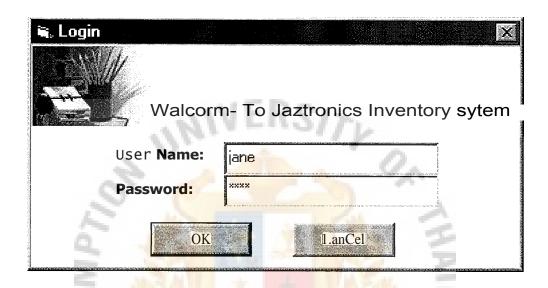


Figure F.1. Logon Screen.

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		io		2,408.641		7,526.441	8,601.65								
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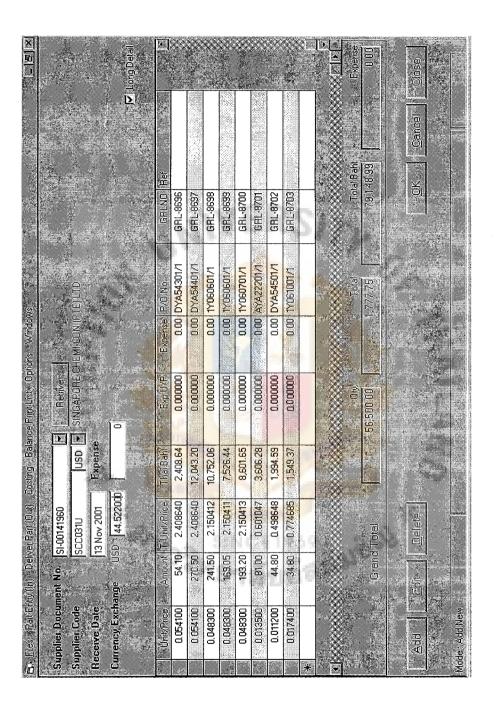
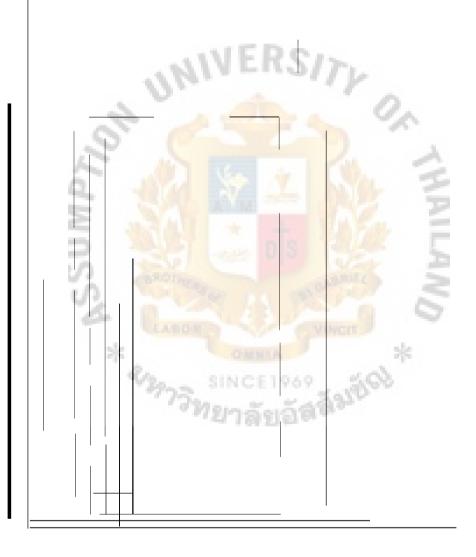


Figure F.2. GRN Entry. (Continued)



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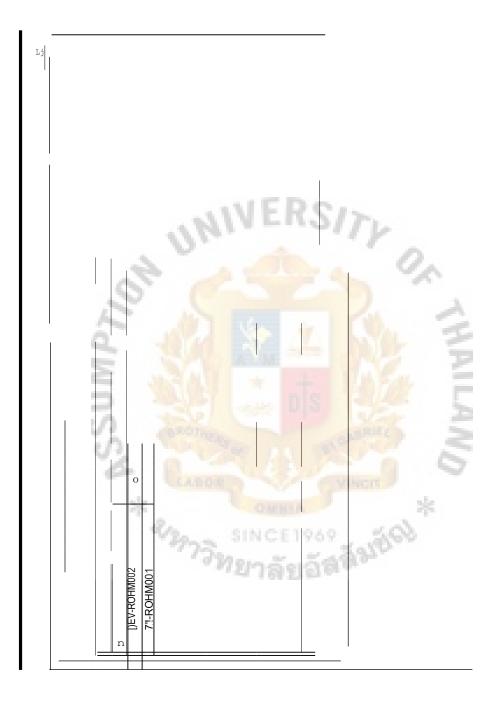
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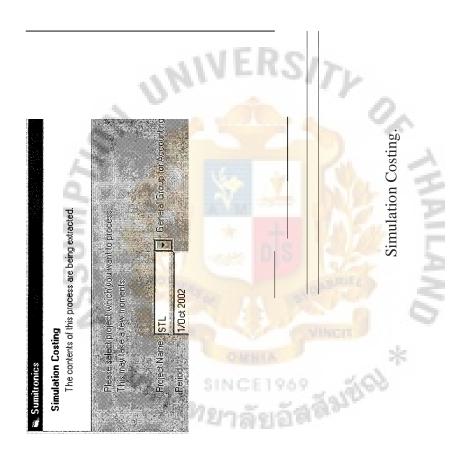
Customer Invoice.

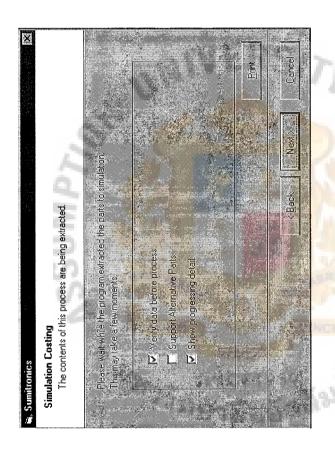


Print Customer Invoice Check List.



Confirm Customer Invoice.





Simulation Costing. (Continued)



Simulation Costing Process Screen.

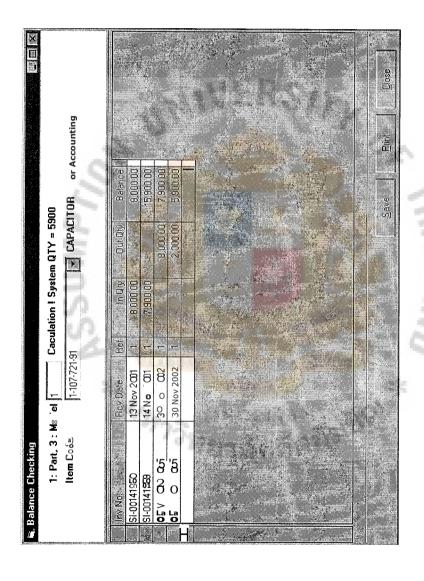
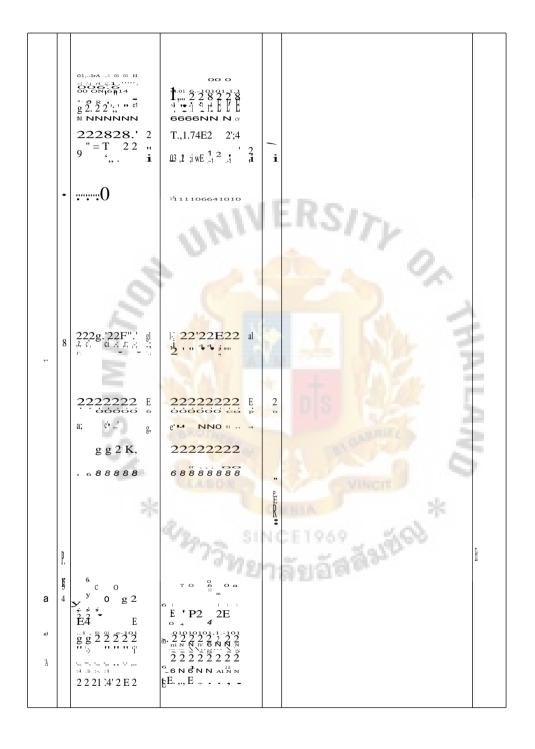


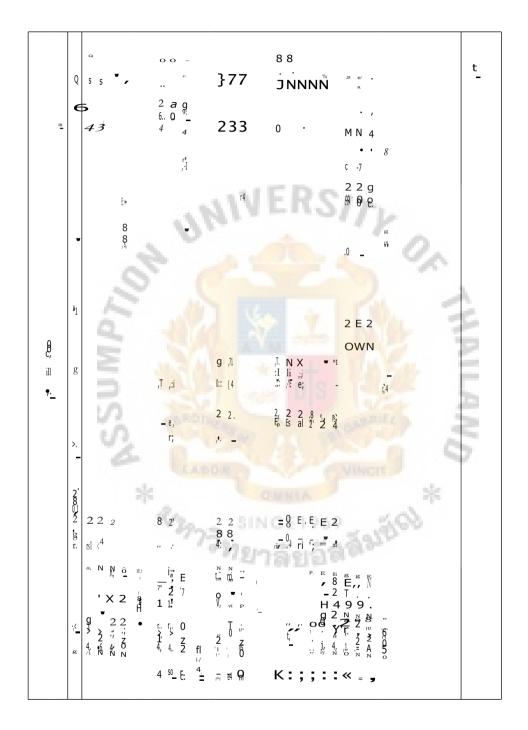
Figure F.10. Stock Ledger Screen.



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	NO.	UNIT/PRICE	BAL OF	AMOUNT		4/0	NET ANT	NET AMT FLA RRF PONO.
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		0.082000	175,000.00	14,350.00		0.082000	14,350.00	2 PO-YEM-0000589-01
		0.046000	15,000.00	690.00		0.046000	690.00	2 PO-YEM-0000589-01
18/Sep/2002 06s64995F77		0.046000	5, 000.00	230.00		0.046000	230.00	2 PO-YEM-0000569-01
18/sep/2002 06864995F78		0.046000	5, 000.00	230.00		0.046000	230.00	2 PO-YEM-0000589-01
18/sep/2002 06s64995F83		0.046900	5, 000.00	230.00		0.046000	230.00	2 PO-YEM-0000589-03
18/Sep/2002 06864995E95		0:046000	5, 000.00	230.00		0.045000	230.00	2 PO-YEM-0000589-03
18/sep/2002 0,5864996E01	2	0.046000	15, 000, 00	690.00		0.046000	690,00	2 PO-YEM-0000589-01
18/Sep/2002 05S64996F26	k	0.046000	5,000.00	230.00		0.046000	230.00	2 PO-YEM-0000589-01
18/sep/2002 06s64996F39		0.046000	40, 000.00	1,840.00		0.046000	1,840.00	2 PO-YEM-0000589-03
18/Sep/2002 06s70072F29		0.082000	15,000.00	1,230.00		0.082000	1,230.00	2 PO-YEM-0000589-01
06870072F41		0.082000	40,000.00	3,280.00	4	0.082000	3,280.00	2 PO-YEM-0000589-01
i2 18/sep/2002 06s70072F53		0.082000	5,000.00	410.00		0.082000	4.10.00	2 PO-YEM-0000589-01
13 18/Sep/2002 06s70072F60		0.082000	35,000.00	2,870.00		0.082000	2,870.00	2 PO-YEM-0000589-01
14 18/sep/2002 06970072877	7	0.082000	2,200.00	180.40		0.082000	180.40	2 PO-YEM-0000589-01
18/ Sep/2002 48162967FU6		0.630000	36, 800.08	22,680.00		0.630000	22, 680, 00	2 PO-YEM-0000589-01
18/Sep/2002 48T83835F03		2.482000	10, 000.00	24,820.00		2.482000	24,820.00	Z PO-YEM-0000589-03
18/Sep/2002 48T84366F05		3,786,000	5,000.00	18,900.00		3,7800,00	18,900.00	Z PO-YEM-0000589-01
		0.163000	12,000.00	1,956.00		0.163000	1,956.00	2 PO-YEM-0000589-01
		0.141000	16,000.00	2,256.00		0.141000	2,256.00	2 PO-YEM-0000589-01
M	SUBTOTAL		446,200.00	97,302.40			97,302.40	
INV NO. : SI-00141959								
		0.016300	5, 900.00	96.17		0.779615	4,599.73	Z AYA22101/1
14/Nov/2001 1-107-883-91		0.022500	4, 000.00	90.00		1.076158	4,304.63	2 1Y050801/1
14/Nov/2001 1-107-652-91		0.048300	3, 500.00	169.05		2.310151	8,085,53	2 1Y060601/1
14/Nov/2001 1-107-652-91	9 .	0.048300	4,000.00	193.20		2.310150	9,240.60	2 1X0,60701/1
14/Nov/2001 1-124-230-91		0.013500	6,000,00	81.00		0.645693	3,874.16	2 AYA22201/1
14/Nov/2001 1-107-903-91		0.011200	4,000.00	44,80		0.535688	2,142.75	2 DYA54501/1
14/Nov/2001 1-107-893-91		0.017400	2,000.00	34.80		0.832230	1,664.46	Z 1Y061001/1
	SUBTUTAL		29,400.00	709.02			33,911.86	
INV NO. : SI-00141960								
13/Nov/2001 1-107-721-91	Š	0.016300	0.00	0, 00		0.725709	0.00	2 AYA22101/1
13/Nov/2001 1-107-883-91	ť	0,022500	4, 600.00	90.00		1.001745	4,006.98	2 1YU60801/1
13/Nov/2001 1-107-883-91	Ś	0.022500	1, 000.00	22.50		T.001750	1,001,75	2. 1Y060901/1
13/Nov/2001 1-107-940-91	3	0.016300	2,000.00	32.60		0.725710	1, 451, 42	2 pYAS4601/1
13/Nov/2001 1-107-940-91		0.016300	2, 000.00	32.60		0.725710	1,451.42	2 DYAS4701/1
13/Nov/2001 1-128-563-91		0.042300	0,00	0.00		1.883280	0.00	2 1xn61201/1
13/Nov/2001 1-128-563-91	*	0.042300	0,00	0.00		1.883280	8	2 17061101/1
13/Nov/2001 1-128-563-91		0.042300	2,500.00	105.75	١,	1.883280	4,708.20	2 1x061201/1
13/Nov/2001 1-107-638-91		0.054100	1,000.00	54.10		2.408640	2,409.64	2 DYA54301/1
C: \ TINDOUS\ Daskesp\ ACCOUNT\ Reperes\ 1NCONTNO_BAL_CHCCKL. Epo	441							Page 1 of 2



Costing Simulation Group by Invoice Report.



Costing Simulation Group by Item Code.



Table H.1. Estimated Cost of Candidate 1, Baht.

Cost Items	Price
Development Cost	
Personnel:	
1 System Analyst (4 months @ 15,000 Baht/ month)	60,000
2 Programmers (3 months @ 11,500 Baht/ month)	69,000
2 Network Specialists (2 months @ 10,000 Baht/ month)	40,000
Total Personnel Cost	169,000
Hardware:	ŕ
1 Server	90,000
1 UPS (1KVA)	9,000
3 Clients (3 @ 19,990)	79,960
Total Hardware Cost Software:	141,000
Database Software	70.000
Application Software	70,000
Total Software Cost	27,000
Implementation Cost:	97,000
Training Cost	20,000
Installation Cost	30,000
Total Implementation Cost	25,000 55,000
Total Development Cost	462,000
Project Annual Operating Cost	402,000
User:	
1 General Manager (20,000 Baht per month)	240,000
2 Store Controllers (12,000 Baht per month)	288,000
2 Sales Officers (15,000 Baht per month)	360,000
2 Inventory Officers (10,000 Baht per month)	240,000
Office Supplies & Miscellaneous Cost:	ŕ
Stationary (1,500 Baht per month)	18,000
Paper (5,000 Baht per month)	60,000
	36,000
Utility Cost (3,000 Baht per month) Miscellaneous Cost (2,000 Baht per month)	24,000
Maintenance Cost:	, ,
Hardware Maintenance Cost (8,000 Baht/ 5 years)	8,000
Software Maintenance Cost (5,000 Baht/ 5 years)	5,000
Total Annual Operating Cost	1,279,000
Total Computerized System Cost	1,741,000

Table 1-1.2. Estimated Cost of Candidate 2, Baht.

Cost Items	Price
Development Cost	
Personnel:	
2 System Analysts (4 months @ 15,000 Baht / month)	120,000
2 Programmers (3 months @11,500 Baht / month)	69,000
4 Database Specialists (3 months @ 12,500 Baht / month)	150,000
4 Network Specialists (2 month @ 10,000 Baht / month)	80,000
Total Personnel Cost	419,000
Hardware:	.15,000
1 Database Server	90,000
3 Clients (3 @ 19,990)	79,960
1 UPS	9,000
Total Hardware Cost	141,000
Software:	141,000
1 Web Server Software	20,000
1 Application Server Software	20,000
Total Software Cost	100,000
Implementation Cost:	100,000
Training Cost	70,000
Installation Cost	35,500
Total Implementation Cost	105,500
Total Development Cost	765,500
Project Annual Operating Cost	703,300
User:	
1 General Manager (20,000 Baht / month)	240,000
1 Store Controller (12,000 Baht /month)	144,000
1 Sales Officer (15,000 Baht / month)	180,000
1 Inventory Officer (10,000 Baht /month)	120,000
System Support:	,
1 System Analyst (15,000 Baht / month)	180,000
1 Database Administrator (20,000 Baht / month)	240,000
Office Supplies & Miscellaneous Cost:	
Stationary (1,500 Baht per month)	18,000
Paper (1,000 baht per month)	12,000
Utility (2,500 Baht / month)	30,000
Miscellaneous Expense (1,000 Baht per month)	12,000
Maintenance Cost:	
Hardware Maintenance Cost (8,000 Baht / 5 years)	8,000
Software Maintenance Cost (5,000 Baht / 5 years)	5,000
Total Annual Operating Cost:	1,189,000
Total Computerized System Cost	1,954,500

Table H.3. Estimated Cost of Candidate 3, Baht.

Cost Items	Price
Development Cost	
Personnel:	
1 System Analyst (6 month @15,000 Baht / month)	90,000
1 Programmer (2 months @ 11,500 Baht / month)	23,000
2 Network Specialists (1 month @ 10,000 Baht / month)	20,000
1 Database Specialist (1 month @ 12,500 Baht/ month)	12,500
Total Personal Cost	145,500
Hardware:	
1 Database Server	90,000
3 Clients (3@ 19,990)	79,960
1UPS	9,000
Total Hardware Cost	141,000
Software:	
1 Operating System Server Software	20,000
1 Database Server Software	50,000
1 Application Software	30,000
Total Software Cost	110,000
Implementation:	
Training Cost	20,000
Installation Cost	17,500
Total Implementation Cost	37,500
Total Development Cost	434,000
Project Annual Operating Cost	
User:	
1 Management Officer (10,000 Baht / month)	120,000
1 Store Controller (12,000 Baht / month)	144,000
1 Sales Officer (15,000 Baht /month)	180,000
1 Inventory Officer (10,000 Baht ./ month)	120,000
System Support:	
1 System Analyst (15,000 Baht / month)	180,000
2 Network Administrators (10,000 Baht / month)	240,000
Office Suppliers & Miscellaneous Cost :	
Stationary (1,500 Baht per month)	18,000
Paper (1,000 Baht per month)	12,000
Utility (2,500 Baht per month)	30,000
Miscellaneous Expense (1,000 Baht per month)	12,000
Maintenance Cost:	
Hardware Maintenance Cost (8,000 Baht per 5 years)	8,000
Software Maintenance Cost (5,000 Baht /5 years)	5,000
Total Annual Operating Cost	1,069,000
Total Computerized System Cost	1,503,000

Table H.4. Payback Period for Candidate 1, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-462,000					
Annual Operating Cost		-1,279,000	-1,406,900	-1,547,590	-1,702,349	-1,872,583.90
Discount Factors for 10 %	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted Cost (adjust to present value)	-462,000	-1,162,611	-1,162,099.40	-1,162,240.09	-1,162,704.37	-1,162,874.60
Cumulative time - adjusted cost over life time	-462,000	-1,624,611	-2,786,710.40	-3,948,950.49	-5,111,654.86	-6,274,529.46
Benefit derived from operation of the new system	0	1,540,000	1,605,000	1,705,500	1,876,050	2,063,655
Discount Factors for 10%	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted benefits (adjusted to present value)	0	1,399,860	1,325,730	1,280,830.50	1,281,342.15	1,281,529.76
Cumulative time - adjusted benefits over lift time	0	1,399,860	2,725,590	4,006,420.50	5,287,762.65	6,569,292.41
Cumulative lifetime- adjusted cost + benefit	-462,000	-224,751	-61,120.40	57,470.01	176,107.79	294,762.95

Table H.S. Payback Period for Candidate 2, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	765,500				-	
Annual Operating Cost		-1,189,000	-1,307,900	-1,438,690	-1,582,559	-1,740,8149
Discount Factors For 10 %	1.000	0.909	0.826	0.751	0.683	0.621
Time Adjusted Costs (adjusted to present value)	-765,500	-1,080,801	-1,080,325.40	-1,080,456.19	-1,080,887.80	-1,081,045.49
Cumulative - adjured cost over lift time	-765,500	-1,846,301	-2,926,626.4	-4,007,082,59	-5,087,970.39	-6,169,015.80
Benefit derived from operation of the new system	0	1,540,000	1,605,000	1,705,500	1,876,050	2,063,655
Discount Factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621
Time adjusted benefits (adjusted to present value)	0	1,399,860	1,325,730	1,280,830.50	1,281,342.15	1,281,529.76
Cumulative time - adjusted benefit over life time	0	1,399,860	2,725,590	4,006,420.50	5,287,762.65	6,569,292.41
Cumulative lifetime - adjusted cost + benefit	-765,500	-446441	-201,036.40	-662.09	199,792.26	400,276.61

Table 11.6. Payback Period for Candidate 3, Baht

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-434,000					
Annual Operating Cost		-1,069,000	-1,175,900	-1,293,490	-1,422,839	-1,565,122.90
Discount Factor for 10%	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted Costs (adjusted to present value)	-434,000	-971,721	-971,293.40	-971,410.99	-971,79994	-971,941.32
Cumulative time-adjusted cost over life time	-434,000	-1,405,721	-2,377,014.40	-3,348,425.39	-4,320,224.43	-5,292,165.75
Benefit derived from operation of the new system	0	1,540,000	1,605,000	1,705,500	1,876,050	2,063,655
Discount Factor for 10%	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted benefits (adjusted to present value)	0	1,399,860	1,325,730	1,280,830.50	1,281,342.15	1,281,529.76
Cumulative time - adjusted benefits over lift time	0	1,399,860	2,725,590	4,006,420,50	5,287,762.65	6,569,292.41
Cumulative lifetime time- adjusted cost + benefit	-434,000	-5,861	348,575.60	657,995.11	967,538.11	1,277,126.66

Cumulative Cost, Baht

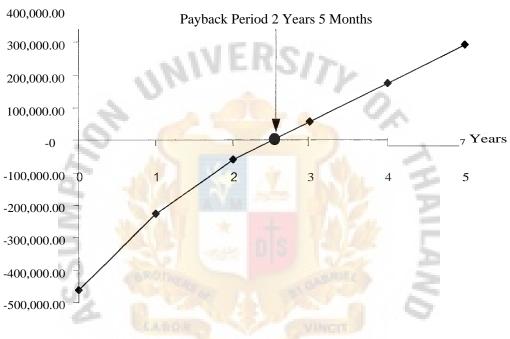


Figure H.1. Payback Period for Candidate 1.

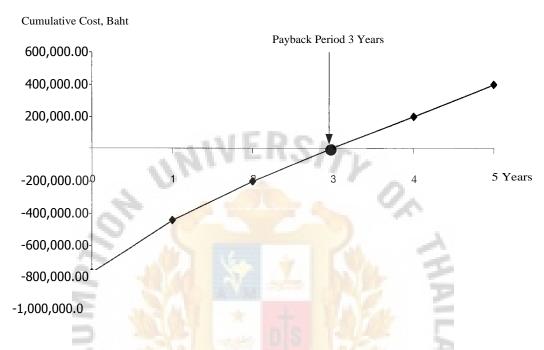


Figure H.2. Payback Period for Candidate 2.

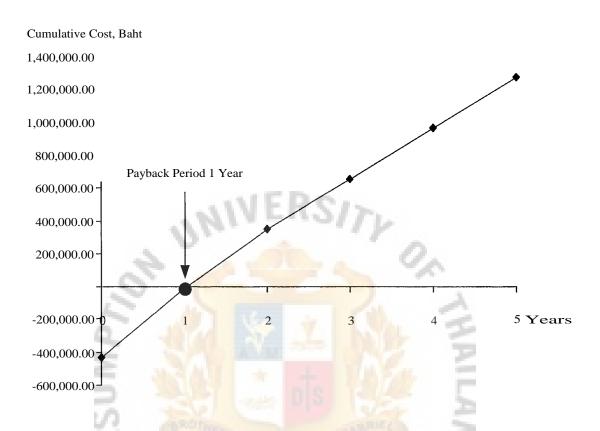


Figure H.3. Payback Period for Candidate 3.

Table H.7. Net Present Value for Candidate 1, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year4	year 5
Development Cost	-462,000					
Annual Operating Cost		-1,279,000	-1,406,900	-1,547,590	-1,702,349	-1,872,583.90
Discount Factor for 10%	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted Costs (adjusted to present value)	-462,000	-1,162,611	-1,162,099.40	-1,162,240.09	-1,162,704.37	-1,162,874.60
Cumulative time - adjusted cost over life time						-6,274,529.46
Benefit derived from operation of the new system	0	1,540,000	1,605,000	1,705,500	1,876,050	2,063,655
Discount Factor for 10%	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted Benefits (adjusted to present value)	0	1,399,860	1,325,730	1,280,830.50	1,281,342.15	1,281,529.76
Cumulative time - adjusted benefit over life time	0	1,399,860	2,725,590	4,006,420.50	5,287,762.65	6,569,292.41
Cumulative lifetime time-adjusted cost + benefit						294,762.95

Table H.B. Net Present Value for Candidate 2, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost:	-765,500				1	
Annual Operating Cost:		-1,189,000	-1,307,900	-1,438,690	-1,582,559	-1,740,814
Discount factor for 10%	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted Costs (Adjusted to present)	-765,500	-1,080,801	-1,080,325.40	-1,080,456.19	-1,080,887.80	-1,081,045.49
Cumulative time - adjusted cost over life time:		+				-6,169,015.80
Benefit derived from operating of the new system:	0	1,540,000	1,605,000	1,705,500	1,876,050	2,063,655
Discount factor for 10%	. 1	0.909	0.826	0.751	0.683	0.621
Time Adjusted benefits (adjusted to present value)	0	1,399,860	1,325,730	1,280,830.50	1,281,342.15	1,281,529.76
Cumulative time - adjusted benefit over life time	0	1,399,860	2,725,590	4,006,420.50	5,287,762.65	6,569,292.41
Cumulative lifetime time-adjusted cost + benefit	1		1, 3		0	400,276.61

Table H.9. Net Present Value for Candidate 3, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-434,000					
Annual Operating Cost		-1,069,000	-1,175,900	-1,293,490	-1,422,839	-1,565,122.90
Discount Factors for 10%	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted Costs (Adjusted to present value)	-434,000	-971,721	-971,293.40	-971,410.99	-971,799.04	-971,941.32
Cumulative time- adjusted cost over life time						-5,292,165.75
Benefit derived from operation of the new system	0	1,540,000	1,605,000	1,705,500	1,876,050	2,063,655
Discount Factors for 10%	1	0.909	0.826	0.751	0.683	0.621
Time Adjusted benefits (adjusted to present value)	0	1,399,860	1,325,730	1,280,830.50	1,281,342.15	1,281,529.76
Cumulative time- adjusted benefit	0	1,399,860	2,725,590	4,006,420.50	5,287,762.65	6,569,292.41
Cumulative lifetime time-adjusted cost + benefit		·				1,277,126.66

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