



Inventory Information System for
Zenith Products International Co., Ltd.

by

Ms. Sansanee Dulyakupt

A Final Report of the Six-Credit Course
CS 6998 - CS 6999 System Development Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer Information Systems
Assumption University

November 2003

**Inventory Information System for
Zenith Products International Co., Ltd.**

by
Ms. Sansanee Dulyakupt

A Final Report of the Six-Credit Course
CS 6998 – CS 6999 System Development Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer Information Systems
Assumption University

November 2003

Project Title	Inventory Information System for Zenith Products International Co., Ltd.
Name	Ms. Sansanee Dulyakupt
Project Advisor	Air Marshal Dr. Chulit Meesajjee
Academic Year	November 2003

The Graduate School of Assumption University has approved this final report of the six-credit course, CS 6988 – CS 6999 System Development Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.

Approval Committee:



A handwritten signature in black ink, reading "AM Chulit Meesajjee".

(Air Marshal Dr. Chulit Meesajjee)
Dean and Advisor



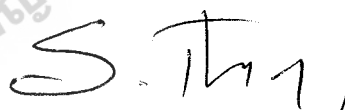
A handwritten signature in black ink, appearing to be "S. Charmonman".

(Prof. Dr. Srisakdi Charmonman)
Chairman



A handwritten signature in black ink, reading "V. Avatchanakorn".

(Asst. Prof. Dr. Vichit Avatchanakorn)
Member



A handwritten signature in black ink, reading "S. Thayarnyong".

(Assoc. Prof. Somchai Thayarnyong)
CHE Representative

November 2003

ABSTRACT

This project is written to be submitted for CS 6998 – CS 6999 System Development Project of MS (CIS) program, Assumption University. The project covers the system analysis, system design and implementation of Inventory Information System for Zenith Products International Co., Ltd. to solve the problems occurring in the existing system.

The existing system is based on a manual system. Before the development of the Inventory Information System is done, the current problems of the existing system and area for improvement have been clearly defined. The objective of the proposed system is to define the user requirements. Many alternative systems are of interest, but the final candidate solution will be selected based on the payback method, the break-even methodology, and feasibility study.

In the new computerized system, Automobile Insurance Information System has replaced the existing system, and the problems occurring in the existing system have been solved including the decrease of high maintenance costs. The new system facilitates all user requirements in entering and finding details as well as providing reports as often as they need. Moreover, it can improve efficiency for planning, decision-making and also provide better response time to both operation and business process, making the company get more efficient information and profits.

ACKNOWLEDGEMENTS

The effort of many people has made into the creation of this project possible. The writer would like to express her sincere thanks to all of them for their kind cooperation and advice. The comments of their reviews were extremely helpful in the completion of this project.

She desires to express her most sincere appreciation and thanks to Air Marshal Dr. Chulit Meesajjee, her project advisor, for his continuing advice, support and correction throughout this system development project.

Finally, her very special thanks go to her parents, family members, and friends for the time they spent with her in the preparation, for their constant encouragement, and for their inspiration to help her complete this project.

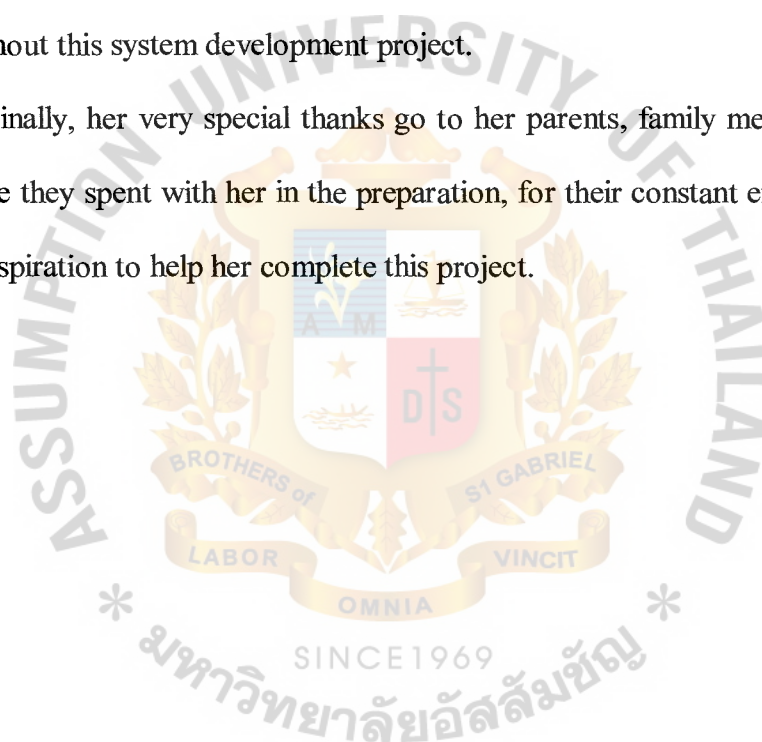


TABLE OF CONTENTS

<u>Chapter</u>	<u>Page</u>
ABSTRACT	i
ACKNOWLEDGEMENTS	ii
LIST OF FIGURES	v
LIST OF TABLES	viii
I. INTRODUCTION	1
1.1 Background of the Project	1
1.2 Objectives of the Project	1
1.3 Scope of the Project	2
1.4 Deliverables of the Project	3
1.5 Project Plan	4
II. THE EXISTING SYSTEM	6
2.1 Background of the Organization	6
2.2 Existing Business Function	10
2.3 Current Problems and Areas for Improvement	10
III. THE PROPOSED SYSTEM	13
3.1 System Specification	13
3.2 System Design	13
3.3 Hardware and Software Requirement	18
3.4 System Cost Analysis	22
3.5 Security and Control	31
IV. PROJECT IMPLEMENTATION	33
4.1 Overview of Project Implementation	33

<u>Chapter</u>	<u>Page</u>
4.2 Software Development	33
4.3 Hardware Installation	34
4.4 Personnel Training	34
4.5 Test Plan	34
4.6 Conversion	35
4.7 Documentation	35
V. CONCLUSIONS AND RECOMMENDATIONS	36
5.1 Conclusions	36
5.2 Recommendations	39
APPENDIX A DATABASE DESIGN	41
APPENDIX B DATA DICTIONARY	50
APPENDIX C DATA FLOW DIAGRAM	54
APPENDIX D PROCESS SPECIFICATION	70
APPENDIX E USER INTERFACE DESIGN	78
APPENDIX F REPORT DESIGN	92
APPENDIX G ALTERNATIVE CANDIDATE SOLUTIONS	99
BIBLIOGRAPHY	126

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1.1 Project Plan of Inventory Information System	5
2.1 The Organization Chart of Zenith Products International Co., Ltd.	9
2.2 Context Level Data Flow Diagram of Existing Inventory Information System	12
3.1 Context Level Data Flow Diagram of Proposed Inventory Information System	15
3.2 Level 0 Data Flow Diagram of Proposed Inventory Information System	16
3.3 The Network Configuration of Inventory Information System	21
3.4 Cost Comparison between the Manual and Proposed Systems	26
3.5 Payback Period of Inventory Information System	29
A.1 Context Level of Entity Relationship Diagram of Inventory Information System	41
A.2 Key-based Attributed Entity Relationship Diagram of Inventory Information System	42
A.3 Fully Attributed Entity Relationship Diagram of Inventory Information System	43
C.1 Context Level Data Flow Diagram of the Proposed Inventory Information System	54
C.2 A Functional Decomposition Diagram of the Proposed Inventory Information System	55
C.3 Level 0 Data Flow Diagram of the Proposed Inventory Information System	56
C.4 Level 1 Data Flow Diagram of Purchase Order / Producing Plan Process	57
C.5 Level 2 Data Flow Diagram of Prepare Purchase Requisition / Produce Requisition Process	58
C.6 Level 3 Data Flow Diagram of Check Supplier Profile Process	59

<u>Figure</u>	<u>Page</u>
C.7 Level 2 Data Flow Diagram of Generate Purchase Order / Producing Plan Process	60
C.8 Level 1 Data Flow Diagram of Stock In Process	61
C.9 Level 1 Data Flow Diagram of Stock Out Process	62
C.10 Level 1 Data Flow Diagram of Report Process	63
C.11 Structure Chart of Process EOQ of Product	64
C.12 Structure Chart of Process Purchase / Product Requisition	65
C.13 Structure Chart of Process Purchase Order / Producing Plan	66
C.14 Structure Chart of Process Stock In	67
C.15 Structure Chart of Process Stock Out	68
C.16 Structure Chart of Process Generate Report and EOQ Report	69
E.1 Login Screen Form	78
E.2 Invalid User Screen Form	78
E.3 Main Menu Form	79
E.4 Menu of Information Form	80
E.5 Menu of Transaction Form	81
E.6 Menu of Report Form	82
E.7 Raw Material Information Form	83
E.8 Product Information Form	84
E.9 Supplier Information Form	85
E.10 EOQ Information Form	86
E.11 Stock In Form	87
E.12. Stock Out Form	88
E.13 Purchase Order Form	89

<u>Figure</u>	<u>Page</u>
E.14 Monthly Report Form	90
E.15 EOQ Report Form	91
F.1 Delivery Order Form	92
F.2 Purchasing Order Form	93
F.3 Stock In Report	94
F.4 Stock Out Report	95
F.5 Ourtstanding Inventory Information Report	96
F.6 Minimum Inventory Information Report	97
F.7 Maximum Inventory Information Report	98
G.1 Cost Comparison between the Manual and Proposed Systems for Candidate 1	107
G.2 Payback Period for Candidate 1	110
G.3 Cost Comparison between the Manual and Proposed Systems for Candidate 2	114
G.4 Payback Period for Candidate 2	117
G.5 Cost Comparison between the Manual and Proposed Systems for Candidate 3	121
G.6 Payback Period for Candidate 3	124

LIST OF TABLES

<u>Table</u>	<u>Page</u>
3.1 The Hardware Specification for the Server	18
3.2 The Software Specification for the Server	19
3.3 The Hardware Specification for Each Client Machine	19
3.4 The Software Specification for Each Client Machine	20
3.5 Other Hardware Requirements	20
3.6 Manual System Cost Analysis, Baht	22
3.7 Five Years' Accumulated Manual System Cost, Baht	22
3.8 Computerized System Cost Analysis, Baht	23
3.9 Five Years' Accumulated Computerized System Cost, Baht	24
3.10 The Comparison of the System Costs, Baht	25
3.11 Payback Analysis for the Proposed Inventory Information System, Baht	28
5.1 The Degree of Achievement of the Proposed System	37
A.1 Structure of Supplier Table	44
A.2 Structure of Supply Raw Material Table	44
A.3 Structure of Raw Material Table	45
A.4 Structure of Supply Product Table	45
A.5 Structure of Purchase Order Table	46
A.6 Structure of Producing Plan Table	46
A.7 Structure of Product Table	47
A.8 Structure of Raw Material Product Table	47
A.9 Structure of Product Type Table	48
A.10 Structure of Sales Order Product Table	48

<u>Table</u>	<u>Page</u>
A.11 Structure of Sales Order Table	49
B.1 Data Dictionary of Supplier Table	50
B.2 Data Dictionary of Raw Material Supplier Table	50
B.3 Data Dictionary of Raw Material Table	50
B.4 Data Dictionary of Supply Product Table	51
B.5 Data Dictionary of Purchase Order Table	51
B.6 Data Dictionary of Producing Plan Table	51
B.7 Data Dictionary of Product Table	52
B.8 Data Dictionary of Raw Material Product Table	52
B.9 Data Dictionary of Product Type Table	52
B.10 Data Dictionary of Sales Order Product Table	53
B.11 Data Dictionary of Sales Order Table	53
D.1 Process Specification of Process 1.1	70
D.2 Process Specification of Process 1.2.1	70
D.3 Process Specification of Process 1.2.2.1	71
D.4 Process Specification of Process 1.2.2.2	71
D.5 Process Specification of Process 1.2.3	72
D.6 Process Specification of Process 1.3.1	72
D.7 Process Specification of Process 1.3.2	73
D.8 Process Specification of Process 1.3.3	73
D.9 Process Specification of Process 2.1	74
D.10 Process Specification of Process 2.2	74
D.11 Process Specification of Process 2.3	75
D.12 Process Specification of Process 3.1	75

<u>Table</u>	<u>Page</u>
D.13 Process Specification of Process 3.2	76
D.14 Process Specification of Process 4.1	76
D.15 Process Specification of Process 4.2	77
G.1 Candidate Matrix	99
G.2 Comparison of Alternative Candidates	101
G.3 Feasibility Analysis Matrix	103
G.4 Computerized System Cost Analysis for Candidate 1, Baht	105
G.5 Five Years' Accumulated Cost for Candidate 1, Baht	106
G.6 The Comparison of the System Cost for Candidate 1, Baht	106
G.7 Payback Analysis for Candidate 1	109
G.8 Computerized System Cost Analysis for Candidate 2, Baht	112
G.9 Five Years' Accumulated Cost for Candidate 2, Baht	113
G.10 The Comparison of the System Cost for Candidate 2, Baht	113
G.11 Payback Analysis for Candidate 2	116
G.12 Computerized System Cost Analysis for Candidate 3, Baht	119
G.13 Five Years' Accumulated Cost for Candidate 3, Baht	120
G.14 The Comparison of the System Cost for Candidate 3, Baht	120
G.15 Payback Analysis for Candidate 3	123

I. INTRODUCTION

1.1 Background of the Project

The report is done according to the requirement of MS(CIS) program, CS6998 – CS6999 System Development Project, it includes studying and analyzing the problems of the existing system, defining user requirements, and designing the appropriate computerized system for a company. This report concerns replacing a manual system with a new computerized system.

Nowadays, every organization needs to develop to run a better business and goals are usually stated in very broad terms. For instance, business needs to maximize market share. Increasing of a company profits makes it think about how to run an easier business by minimizing problems which occur in the system.

As for Zenith Products International Co., Ltd., the main activity is a sales system and it has many problems in inventory. Each department of the company use stand alone computer. It does not provide links with each other. This leads to many problems such as inconsistencies of data, inefficient reporting system and slow processing. Therefore, inventory system is the first step of developing the company and also the computer based will take place of the old system in the company.

1.2 Objectives of the Project

The Inventory Information System is developed to generate all historical information of inventories, insert, update and delete inventory's record. The records are automatically stored and retrieved in the database by the officers for further activities. Meanwhile, a new system should be able to support the requirements for the operation (officers), and it must support decision-making for the management.

The objectives of developing the Inventory Information System for Zenith Products International Co., Ltd. are as follows:

- (1) To study the existing system and identify the current problems of the system.
- (2) To study the requirements of users and design computer information system according to those users' requirements.
- (3) To design the new system development for inventory system. This new system will be suitable to this operation environment and create outputs to support business operation management.
- (4) To create an inventory information system in order to support day-to-day operations and order planning along with timely and relevant information for management in making the right decisions.
- (5) To help access the data and information needed with speed and accuracy.
- (6) To reduce the cost of operation due to the ability to prepare order planning at the right time and quantity which causes the proper levels of stock control.
- (7) To improve the company's operation by using computer-base information system.

1.3 Scope of the Project

The project is to develop a new computerized inventory control system to replace the existing inventory system, which is currently based on manual operations. This project refers to the following areas:

- (1) Develop the system that can facilitate the day-to-day operation of the operating staffs.
- (2) Develop the system that can inquire immediately and update correctly.

- (3) Analyze and design the database, hardware and software for the projected Inventory Information System.
- (4) Create the screen layouts and report layouts for the users.
- (5) Products and materials should have unique code, and description for Inventory Information System to retrieve information, and to check inventory's availability and inventory's price.
- (6) By using EOQ (Economic Order Quantity) to determine type and quantity of inventory to reorder. Organize to achieve an appropriate balance between ordering too much inventory (excessive carrying costs) and not ordering enough inventory (stock outs).

1.4 Deliverables of the Project

The deliverables of the project Inventory Information System can be identified as follows:

- (1) Project Introduction
 - (a) Background of the project
 - (b) *Objectives
 - (c) Scope
- (2) The Existing System
 - (a) Background of the organization
 - (b) Existing business function
 - (c) Current problems and areas for improvements
- (3) The Proposed System
 - (a) System specification
 - (1) Context diagram
 - (2) Data flow diagram

- (b) System design
 - (1) Database Design
 - (2) Structure Chart
 - (3) Interface Design
 - (4) Report Design
 - (5) Data Dictionary
- (c) Hardware and software requirement
- (d) Security and controls
- (e) Cost/benefit analysis
- (4) Project Implementation
 - (a) Project implementation plan
 - (b) Test plan
- (5) Conclusions and Recommendations

1.5 Project Plan

The project plan is based on the concept of System Development Life Cycle (SDLC). The processes are divided into 3 main phases as follows:

- (1) Analysis of the existing system.
- (2) Analysis and design of the proposed system.
- (3) Implementation of the proposed system.

This project plan of Inventory Information System is given in Figure 1.1.

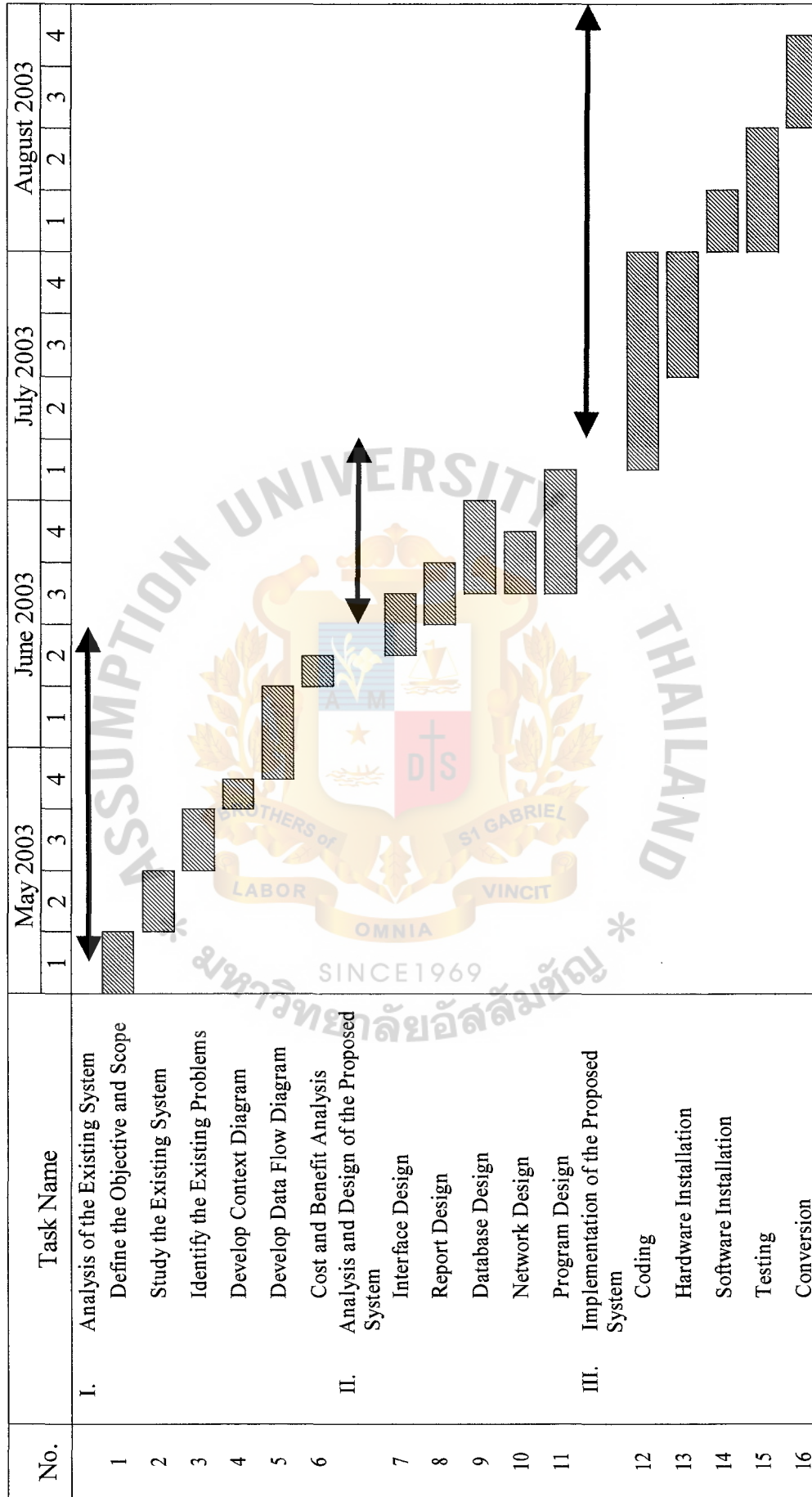


Figure 1.1. Project Plan of Inventory Information System.

II. THE EXISTING SYSTEM

2.1 Background of the Organization

Zenith Products International was established in 1983 and located in 44/2 Moo1, Theparak Road, Tambon Bangprieng, Amphur Bangbor, Samutprakarn Province, Thailand. It was mandated to produce hose clamps, as well as wheel balance weights, in order to support the growth of the local automotive industries,i.e motor vehicles and motorcycles and piping industries.

At present, Zenith Products International has three departments, which are Manufacturing, Administration and Sale & Marketing. All of the day-to-day operations and processes are currently done manually which have caused problems to the organization. Moreover, the data redundancy of the inventory records in the warehouse is also the major problem. For example, part number or code must be assigned to each part by storekeepers. New code will be generated to every single part category and type. Nonetheless, it is possible that one single part category may be assigned the code twice, which is a double count if all the records are kept in hardcopy, and a manual system is applied. Consequently, data redundancy and errors have unintentionally occurred. Thus, a new system is required to eliminate the errors that may occur in the business.

There are 3 departments in the organization.

(1) Manufacturing Department

This department is divided into 4 divisions:

(a) Warehouse Division

Warehouse division is responsible for setting categories of goods and spare parts inventory, keeping the inventory information

such as description, cost, including an up-to-date inventory outstanding for supporting any other business functions.

(b) Maintenance Division

Maintenance division is responsible for repairing the damaged or dilapidated machines in a plant.

(c) Production Division

Production division is responsible for producing the hose clamps and wheel balance weighs.

(d) Quality Acceptance Division

Quality Acceptance division is responsible for testing and controlling product's quality against the standard.

(2) Administration Department

This department is divided into 3 divisions:

(a) Personnel Division

Personnel division is responsible for human resources of the company.

(b) Purchasing Division

Purchasing division is responsible for purchasing the products to resell and materials to produce.

(c) Financial & Accounting Division

Financial and Accounting division is responsible for preparing all required accounting working papers such as general ledger, balance sheet, statement of change in shareholding and equity, and statement of porfit and loss. This division is also responsible for setting

accounting standard, processing payroll of all employees, processing debt payment and billing.

(3) Sales & Marketing Department

Sales and Marketing department is responsible for selling, expanding the market share, increasing the transaction volume and promoting the company's product.

This department is divided into 2 divisions:

(a) Wholesale Division

Wholesale division is responsible for selling the products to automobile manufacturing companies.

(b) Retail Division

Retail division is responsible for selling the products to retail shops.

The organization chart is shown in Figure 2.1.

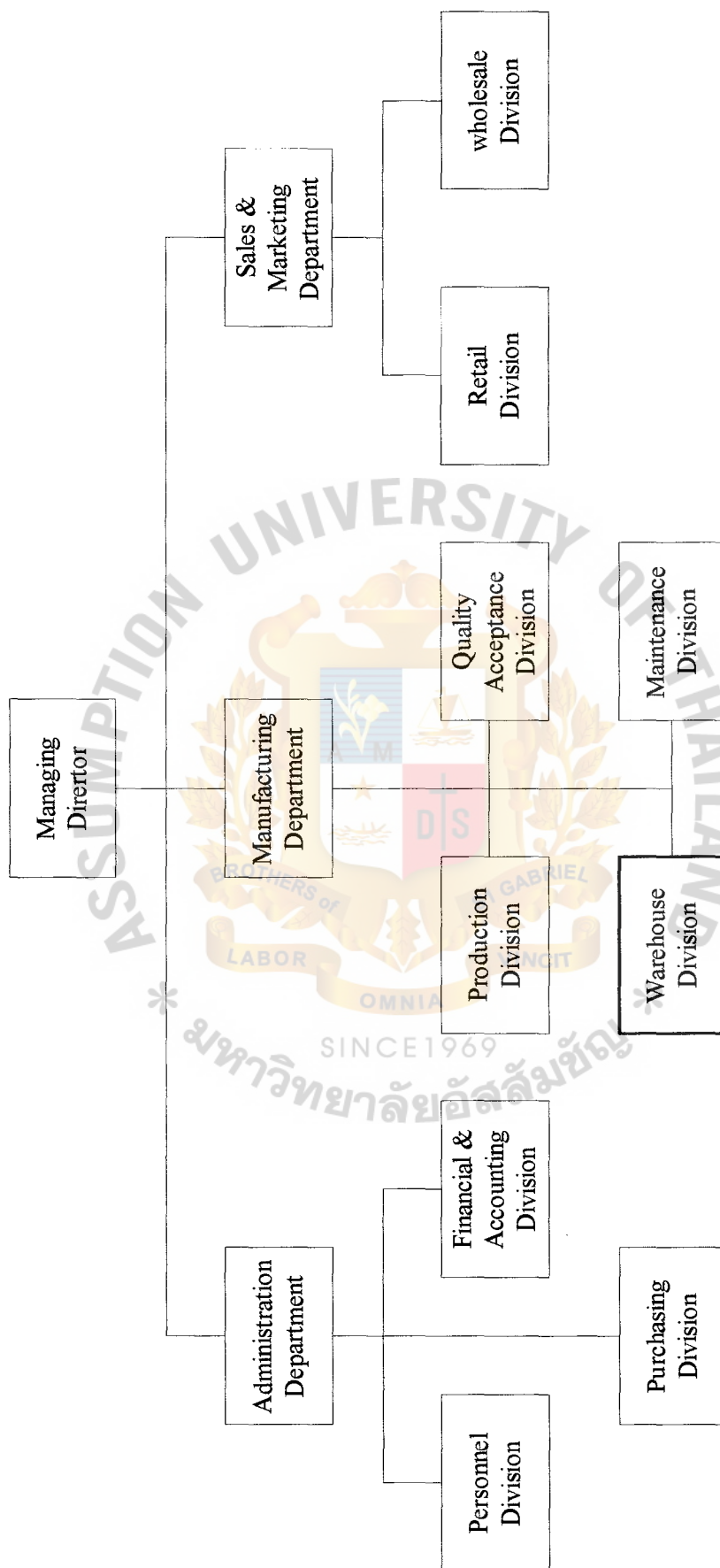


Figure 2.1. The Organization Chart of Zenith Products International Co., Ltd.

2.2 Existing Business Function

There are several functions for Inventory Information System. It can be divided into 5 major functions:

- (1) Accept order request: A staff member of Warehouse Division accepts a product order list from Sales & Marketing Department.
- (2) Check availability of production: After the staff receive order from Sale & Marketing Department, they will check the ordered product in the stock file.
- (3) Update and balance product: After selling or buying products, the staff will record a decrease or an increase of product in the stock record of the warehouse. And he/she also calculates the remaining quantity.
- (4) Check minimum safety stock of the product: At the end of each day, the chief worker checks the quantity of each product. He recognizes which product should be reordered or reproduced according to the ordering calculation system of each product.
- (5) Create purchase requisition: The chief worker lists the unavailable product to reorder/reproduce to the suppliers or production division.

2.3 Current Problems and Areas for Improvement

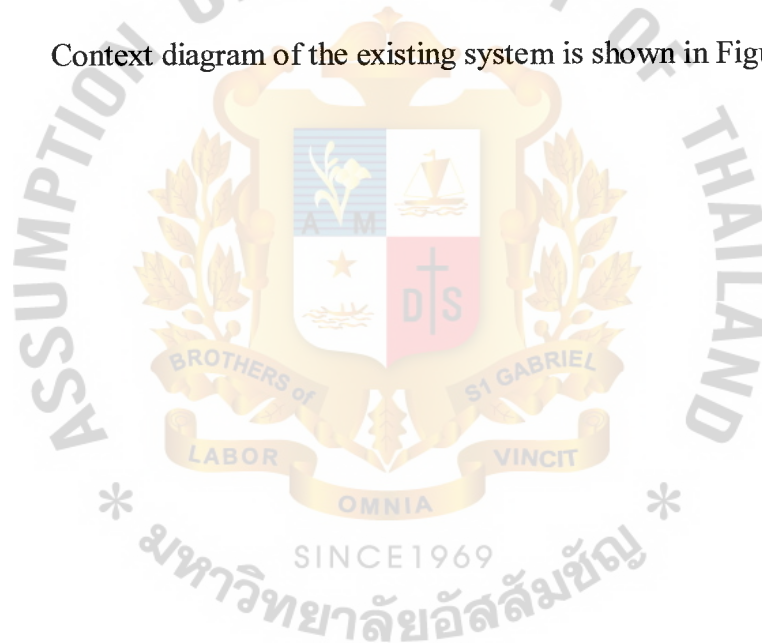
All the existing systems are based on manual systems that generate problems as follows:

- (1) It is difficult and it takes more time to check the inventory status and inventory valuation of all transactions.
- (2) Since the number or transaction items are large, it is difficult to update all transactions completely.
- (3) Information is not up-to-date because the transactions are updated only occasionally.

- (4) It is difficult in receiving information and controlling the status of items.
- (5) Product type is not clearly identified.
- (6) No minimum stock is set; some products are not available when customers need them.
- (7) There is a lack of good planning because the calculation of the product needed is done

manually and randomly. Thus there is no systematic planning, so information base is almost useless for decisions making, forecasting and controlling.

Context diagram of the existing system is shown in Figure 2.2.



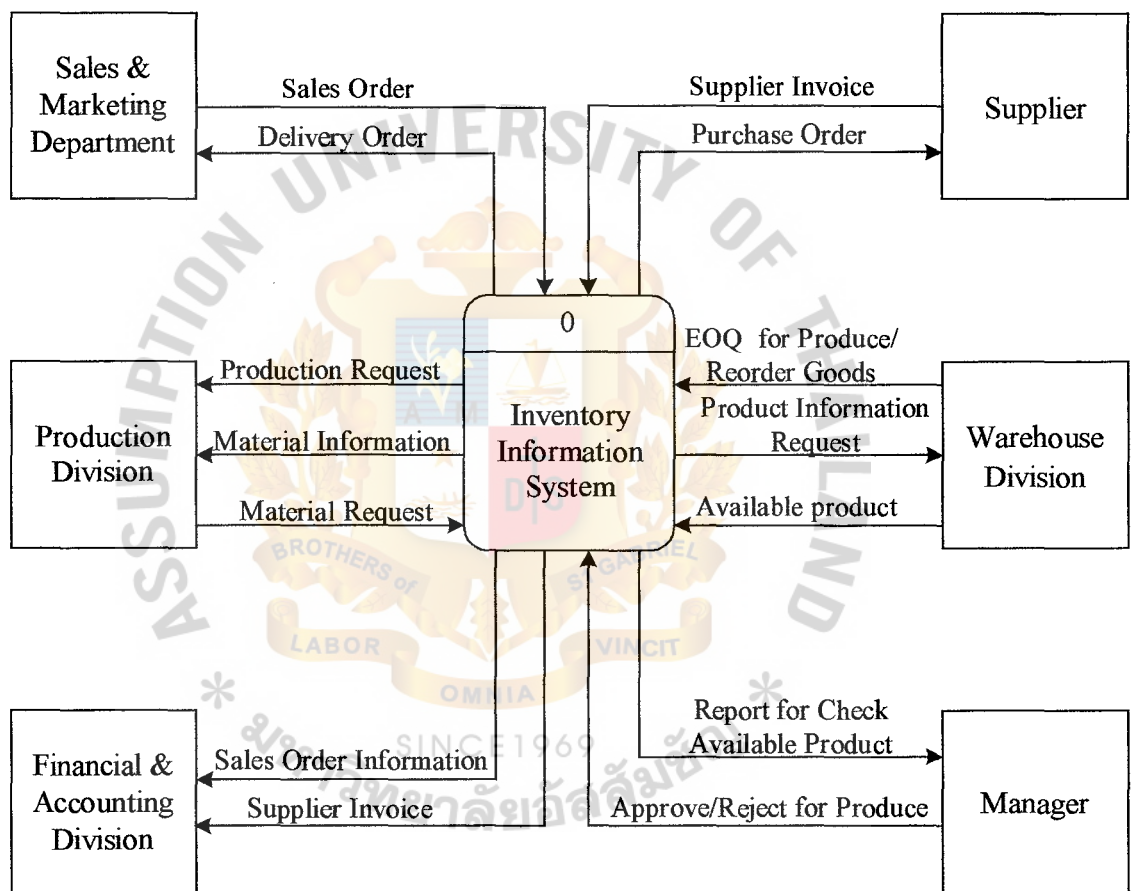


Figure 2.2. Context Level Data Flow Diagram of Existing Inventory Information System.

III. THE PROPOSED SYSTEM

3.1 System Specification

According to the previous section, Zenith Productions International should have an effective computerized Inventory Information System that can provide more accurate information and solve the problems occurring from the existing manual system and some ineffective computerized information system.

In order to achieve the target, the new proposed Inventory Information System should have the following components:

- (1) The database applications for the new system can be easily obtained and there are varieties of choices to select from. The applications such as Microsoft Access and MS Window 2000 Server will lead to lower application expense than propriety application.
- (2) All the functions are displayed by GUI, which is easy for use and has a nice graphic display. The system user and system owner will be highly satisfied.
- (3) The DBMS at server supports and allows multi-users to retrieve information from database simultaneously.

3.2 System Design

(1) Entity Relationship Diagram

ERD data modeling is the technique used in organizing and documenting a system data. Data modeling, which is called database modeling, is usually a database implementation.

The ERD of the new system is shown in Appendix A as follows:

- (a) A context level of entity relationship diagram
- (b) A key-based attributed relationship diagram

(c) A fully attributed relationship diagram

The Data Dictionary, is the table that describes the details of each entity and attribute in ERD, and is shown in Appendix B.

(2) Data Flow Diagrams (DFDs)

The logical Data Flow Diagrams (DFDs) are the structure analysis and design tools that analysts can use to understand the process of system and the movement of the data through the system.

The logical data flow diagram will indicate the flow of the requirement and the data type used in developing the program to support the new system. With DFDs, the analyst can design the file to cover the requirements of the users and support the report design of the system.

The proposed system is designed with the aim to solve the problems of the existing system as stated previously and to meet all user requirements as well. Context diagram of the proposed system is given in Figure 3.1. and level 0 Data flow Diagram of the proposed system is given in Figure 3.2.

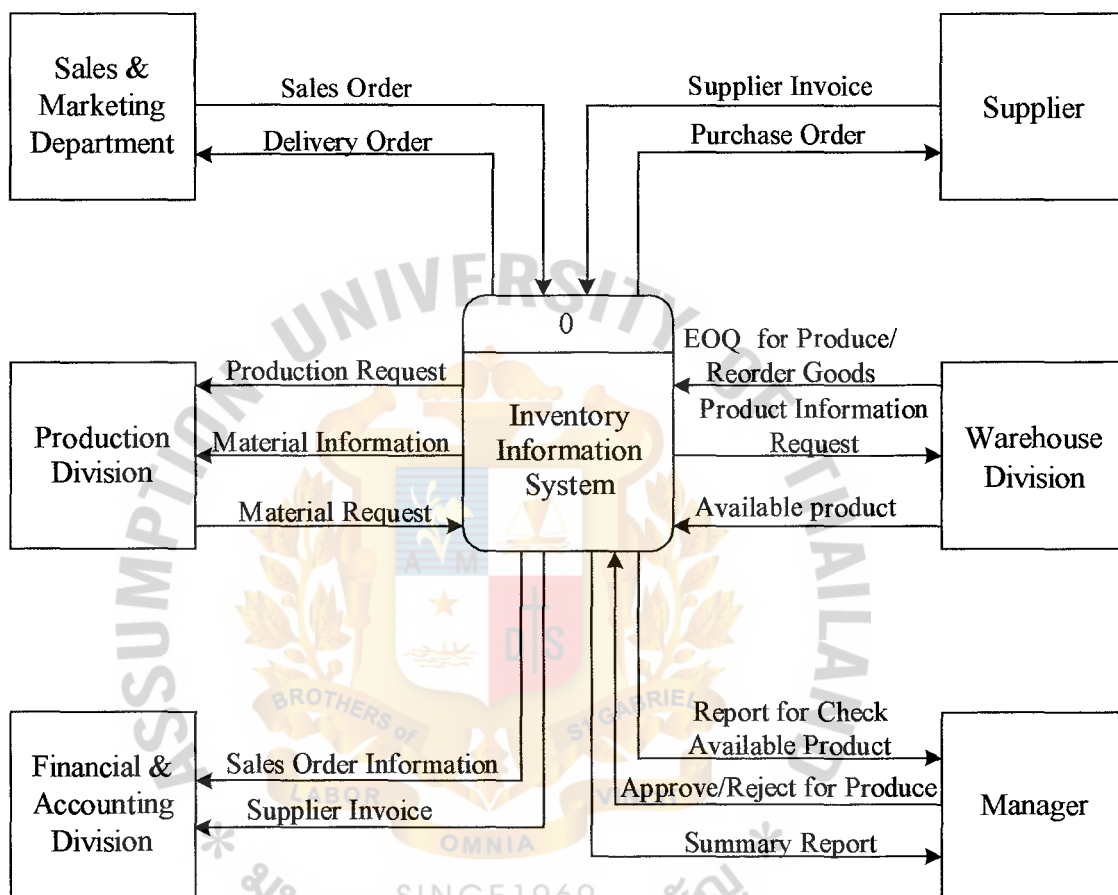


Figure 3.1. Context Level Data Flow Diagram of Proposed Inventory Information System.

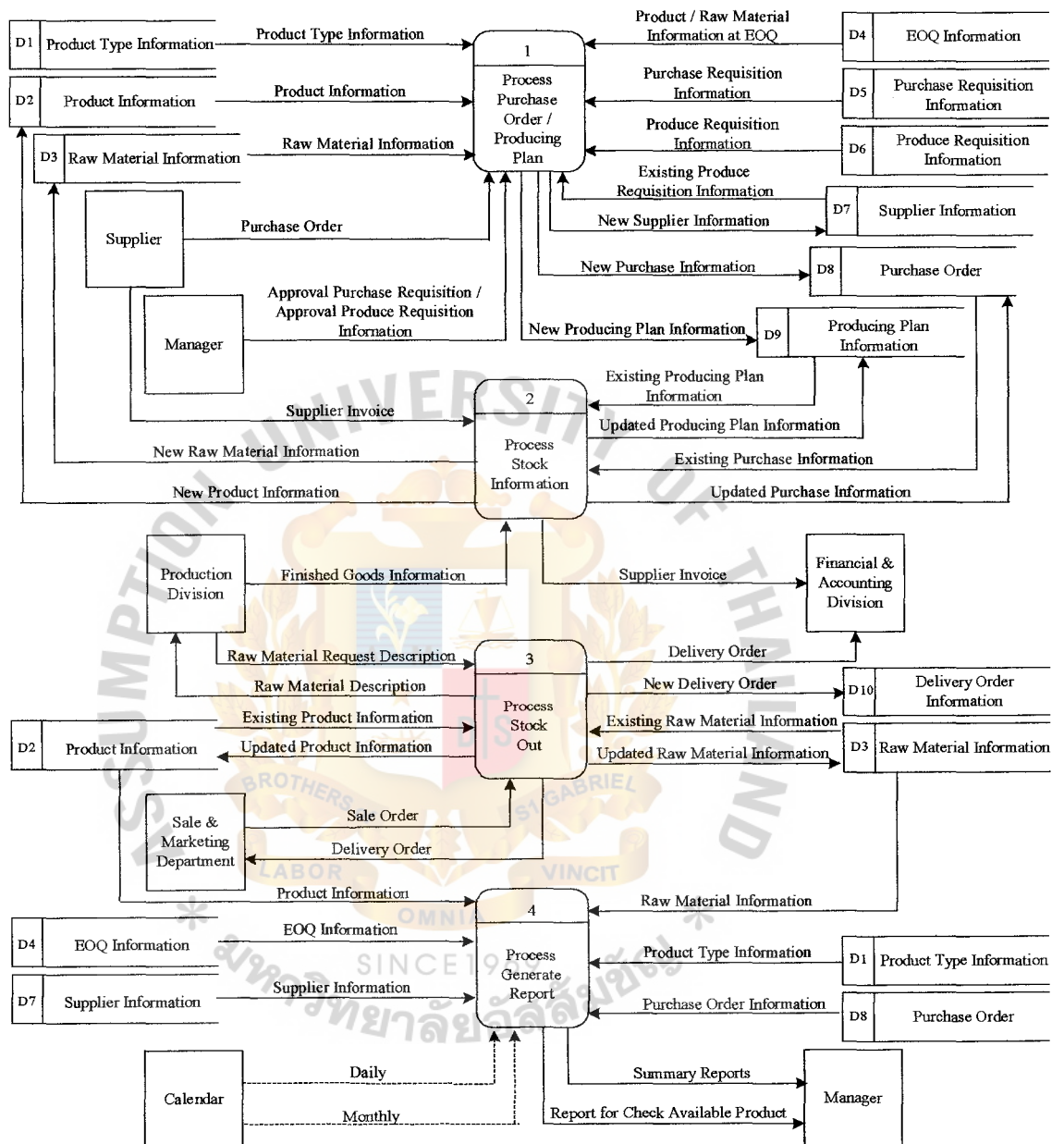


Figure 3.2. Level 0 Data Flow Diagram of Proposed Inventory Information System.

The details of data flow diagram of Inventory Information System are shown in Appendix C, which includes:

- (a) Context Data Flow Diagram
- (b) Functional Decomposition Diagram
- (c) Level 0 of Data Flow Diagram
- (d) Level 1 of Data Flow Diagram
- (e) Structure Chart

To understand the details of each process in data flow diagram, the process specification is shown in Appendix D.

(3) Economic Order Quantity (EOQ) Requirements

EOQ is essentially an accounting formula that determines the point at which the combination of order costs and inventory carrying costs are the least. The result is the most cost effective quantity to order. In purchasing this is known as the order quantity, in manufacturing it is known as the production lot size. The basic Economic Order Quantity (EOQ) formula is as follows:

$$EOQ = \sqrt{\frac{2(\text{Annual usage in units})(\text{Order cost})}{(\text{Annual carrying cost per unit})}}$$

So, the new system must be built-in EOQ with automatically calculation to minimize costs.

(4) Input Design

The input screens of the system are in many forms for the various purpose as shown in Appendix E.

(5) Output Design

There are 2 types of system output forms that are in the form of hardcopy and in the form of displayed screen. Some reports are generated periodically such as on a weekly, monthly or yearly basis. The outputs in the displayed screen are for monitoring daily operation purpose.

All the reports and outputs generated by the system are shown in Appendix F.

3.3 Hardware and Software Requirement

The proposed Inventory Information System will be developed in the form of windows based. Microsoft Access 2000 is the major software tool used to develop the input and output design of the system. The hardware & software specifications for servers are shown in the Tables 3.1, 3.2 respectively.

Table 3.1. The Hardware Specification for the Server.

Hardware	Specification
CPU	Intel Pentium IV Processor 2.0 GHz.
Memory	256 MB
Cache	1 GB or higher
Hard Disk	60 GB
CD-ROM Drive	52x CD-ROM Drive
Floppy Drive	1.44 MB diskette drive
Network Adapter	10/100 Ethernet NIC
Display Screen	17"SVGA Monitor
Display Adapter	SVGA Card

Table 3.1. The Hardware Specification for the Server (Continued).

Hardware	Specification
Keyboard	USB Internet Keyboard (104-key)
Mouse	Internet Scroll Mouse
UPS	UPS 1000 VA

Table 3.2. The Software Specification for the Server.

Software	Specification
Operating System	Microsoft Windows 2000 Server
Application Software	Microsoft office 2000

The client machines should be at least standard to support Microsoft Windows 98 and Microsoft Office 2000 professional. The hardware & software specifications for each client machine are shown in the Tables 3.3, 3.4 respectively.

Table 3.3. The Hardware Specification for Each Client Machine.

Hardware	Specification
CPU	Intel Pentium III or higher
Memory	128 MB
Cache	256 MB or higher
Hard Disk	20 GB
CD-ROM Drive	52x CD-ROM Drive
Floppy Drive	1.44 MB diskette drive
Network Adapter	10/100 Ethernet NIC

Table 3.3. The Hardware Specification for Each Client Machine (Continued).

Hardware	Specification
Display Screen	15"SVGA Monitor
Display Adapter	SVGA Card
Keyboard	USB Internet Keyboard (104-key)
Mouse	Internet Scroll Mouse
UPS	UPS 1000 VA

Table 3.4. The Software Specification for Each Client Machine.

Software	Specification
Operating System	Microsoft Window 98
Application Software	Microsoft office 2000 Professional Edition

Other important hardware required for the proposed system is switch, network printer and cable. The specification of this hardware is shown in Table 3.5.

Table 3.5. Other Hardware Requirements.

Hardware	Specification
Switch	Share switch 24 ports
Cable	LAN Cable UTP
Printer	Laser Printer, Dot Matrix Printer

The network configuration of the proposed Inventory Information System is shown in Figure 3.3.

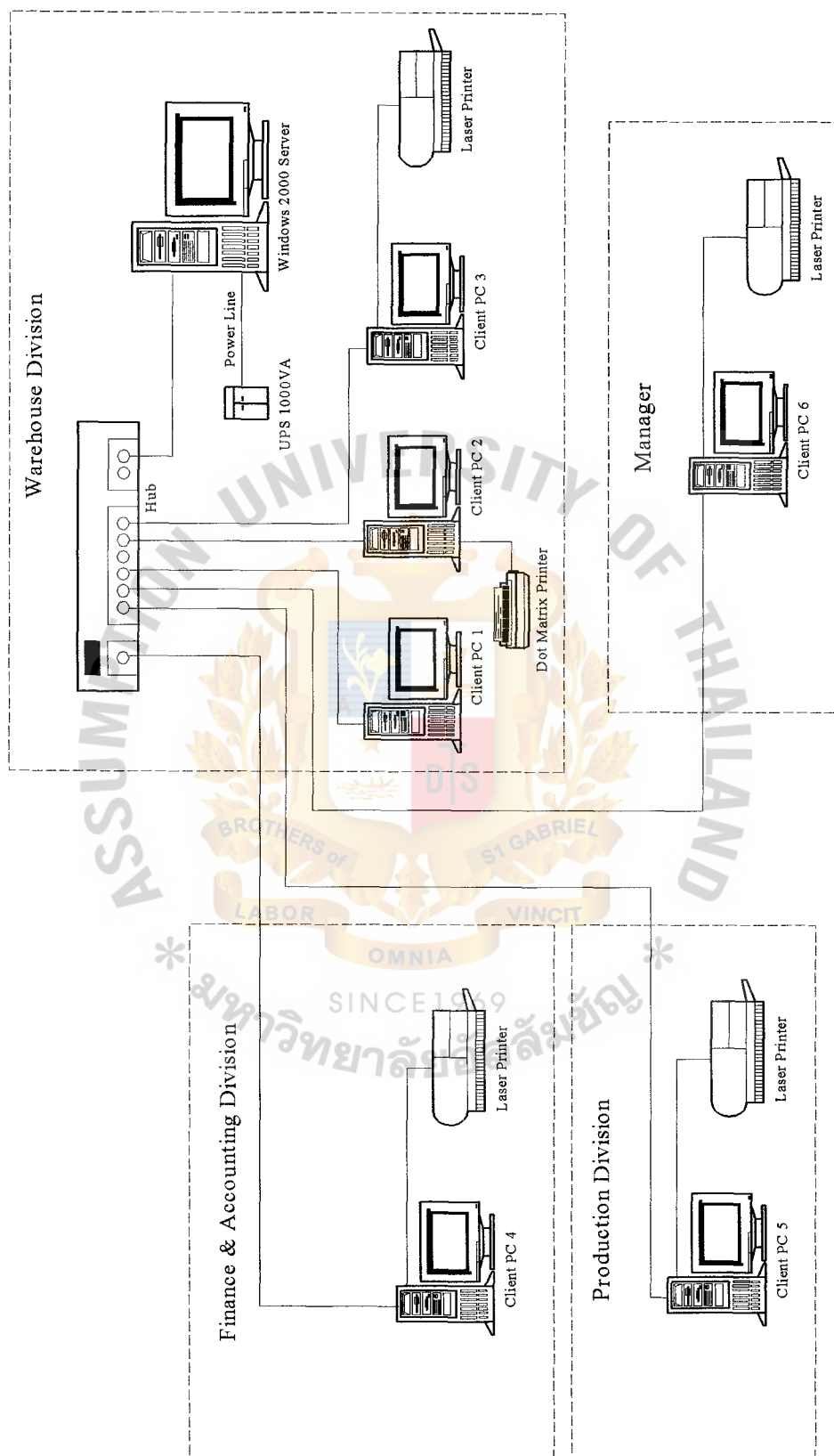


Figure 3.3. The Network Configuration of Inventory Information System.

3.4 System Cost Analysis

(1) Cost of Manual System

Table 3.6. Manual System Cost Analysis, Baht.

Cost items		Years				
		1	2	3	4	5
<u>Fixed Cost</u>						
Desktop Computer	2 units @ 20,000	8,000.00	8,000.00	8,000.00	8,000.00	8,000.00
Dot Matrix Printer	1 unit @ 9,900	1,980.00	1,980.00	1,980.00	1,980.00	1,980.00
Total Fixed Cost		9,980.00	9,980.00	9,980.00	9,980.00	9,980.00
<u>Operating Cost</u>						
Salary Cost:						
Inventory Manager	1 person @ 25,000	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Inventory Officer	4 persons @15,000	60,000.00	66,000.00	72,600.00	79,860.00	87,846.00
Total Monthly Salary Cost		85,000.00	93,500.00	102,850.00	113,135.00	124,448.50
Total Annual Salary Cost		1,020,000.00	1,122,000.00	1,234,200.00	1,357,620.00	1,493,382.00
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annum	13,000.00	14,300.00	15,730.00	17,303.00	19,033.30
Paper	Per Annum	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Utility	Per Annum	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Miscellaneous	Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Annual Office Supplies & Miscellaneous Cost		52,000.00	57,200.00	62,920.00	69,212.00	76,133.20
Total Annual Operating Cost		1,072,000.00	1,179,200.00	1,297,120.00	1,426,832.00	1,569,515.20
Total Manual System Cost		1,081,980.00	1,189,180.00	1,307,100.00	1,436,812.00	1,579,495.20

Table 3.7. Five Years' Accumulated Manual System Cost, Baht.

Year	Total Manual System Cost	Accumulated Cost
1	1,081,980.00	1,081,980.00
2	1,189,180.00	2,271,160.00
3	1,307,100.00	3,578,260.00
4	1,436,812.00	5,015,072.00
5	1,579,495.20	6,594,567.20
Total	6,594,567.20	-

(2) Cost of the Proposed System

Table 3.8. Computerized System Cost Analysis, Baht.

Cost items		Years				
		1	2	3	4	5
Fixed Cost						
Hardware Cost:						
Computer Server Cost	1 unit @ 52,000	10,400.00	10,400.00	10,400.00	10,400.00	10,400.00
Client Machine Cost	6 units @ 32,000	38,400.00	38,400.00	38,400.00	38,400.00	38,400.00
Laser Printer	4 units @ 15,000	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Dot Matrix Printer	1 unit @ 7,000	1,400.00	1,400.00	1,400.00	1,400.00	1,400.00
UPS 1000 VA	1 unit @ 5,900	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00
Total Hardware Cost		63,380.00	63,380.00	63,380.00	63,380.00	63,380.00
Software Cost:						
Windows 2000 Server	1 unit @ 30,000	6,000.00	6,000.00	6,000.00	6,000.00	6,000.00
MS Windows 98	6 units @ 8,000	9,600.00	9,600.00	9,600.00	9,600.00	9,600.00
MS Office 2000	6 units @ 12,000	14,400.00	14,400.00	14,400.00	14,400.00	14,400.00
Network Cost		9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
Total Software Cost		39,000.00	39,000.00	39,000.00	39,000.00	39,000.00
Implementation Cost:						
Software Development Cost		94,000.00	-	-	-	-
Training Cost		50,000.00	-	-	-	-
Total implementation Cost		144,000.00	-	-	-	-
Maintenance Cost		-	20,000.00	22,000.00	24,200.00	26,620.00
Total Fixed Cost		246,380.00	122,380.00	124,380.00	126,580.00	129,000.00
Operating Cost						
Salary Cost:						
Inventory Manager	1 person @ 25,000	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Inventory Supervision	1 person @ 18,000	18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Inventory Officer	2 persons @ 15,000	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Total Monthly Salary Cost		73,000.00	80,300.00	88,330.00	97,163.00	106,879.30
Total Annual Salary Cost		876,000.00	963,600.00	1,059,960.00	1,165,956.00	1,282,551.60

Table 3.8. Computerized System Cost Analysis, Baht (Continued).

Cost items		Years				
		1	2	3	4	5
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annum	11,000.00	12,100.00	13,310.00	14,641.00	16,105.10
Paper	Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Utility	Per Annum	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Miscellaneous	Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Annual Office Supplies & Miscellaneous Cost		45,000.00	49,500.00	54,450.00	59,895.00	65,884.50
Total Operating Cost		921,000.00	1,013,100.00	1,114,410.00	1,225,851.00	1,348,436.10
Total Computerized System Cost		1,167,380.00	1,135,480.00	1,238,790.00	1,352,431.00	1,477,436.10

Table 3.9. Five Years' Accumulated Computerized System Cost, Baht.

Year	Total Computerized System Cost	Accumulated Cost
1	1,167,380.00	1,167,380.00
2	1,135,480.00	2,302,860.00
3	1,238,790.00	3,541,650.00
4	1,352,431.00	4,894,081.00
5	1,477,436.10	6,371,517.10
Total	6,371,517.10	-

(3) The Comparison of the System Cost between manual System and Computerized System.

Table 3.10. The Comparison of the System Cost, Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,081,980.00	1,167,380.00
2	2,271,160.00	2,302,860.00
3	3,578,260.00	3,541,650.00
4	5,015,072.00	4,894,081.00
5	6,594,567.20	6,371,517.10



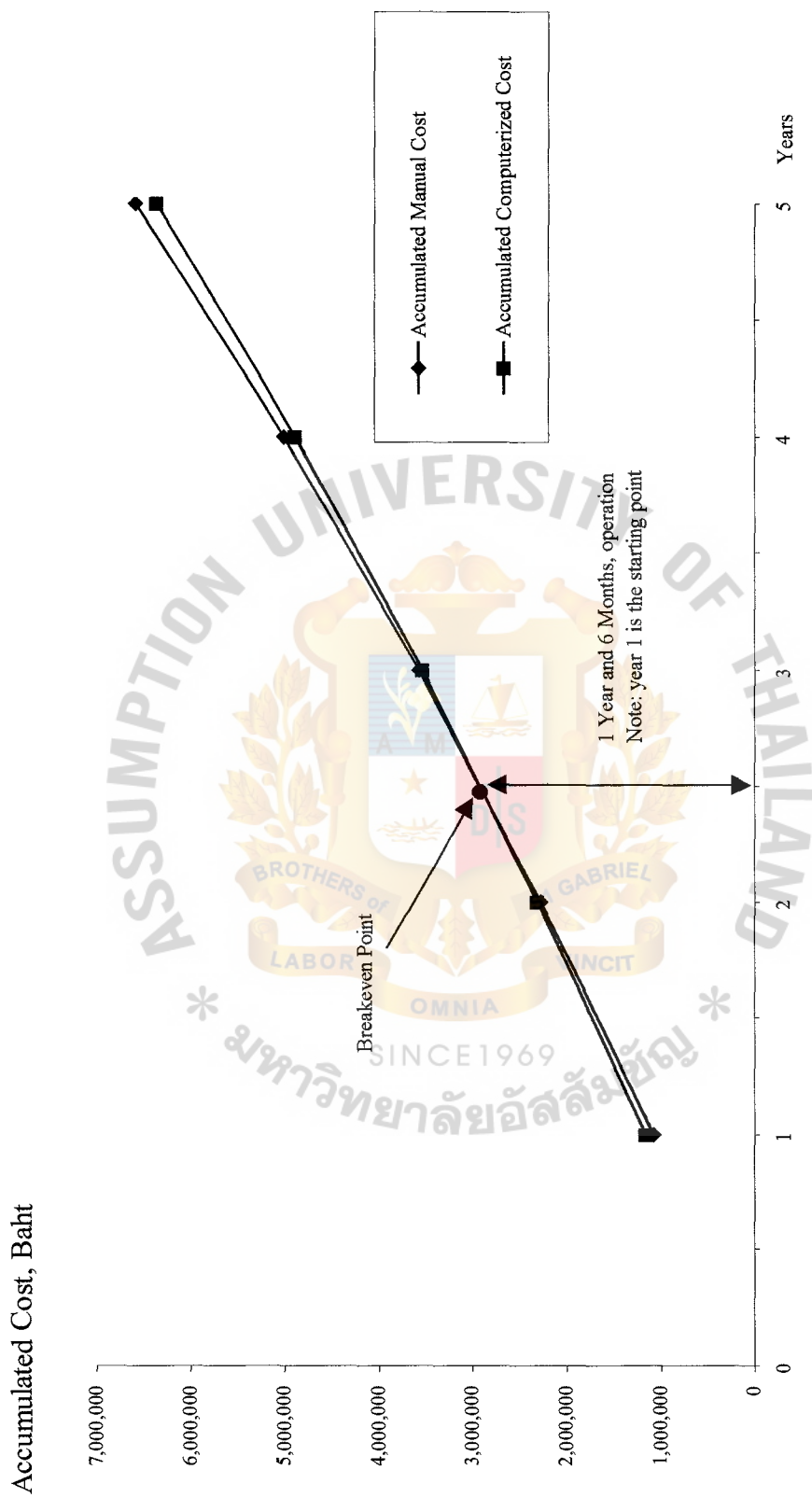


Figure 3.4. Cost Comparison between the Manual and Proposed System.

(4) Payback Analysis

The following cost items are required, as shown in Table 3.11.

Investment Cost:

Hardware cost	316,900	Baht
Software cost	195,000	Baht
Software Development cost	94,000	Baht
Training cost	50,000	Baht
Total Investment Cost	655,900	Baht

Annual Operating Cost:

People-ware cost	876,000	Baht
Office Supplies & Miscellaneous cost	65,900	Baht
Total Annual Operating Cost	941,900	Baht

Annual Cost:

The formula of annual cost of the Computerized system is

$$\begin{aligned}\text{Annual Cost} &= (\text{Investment Cost/Estimated System Life}) + \\ &\quad \text{Annual Operating Cost} \\ &= (655,900/5) + 941,900 \\ &= 1,073,080 \text{ Baht}\end{aligned}$$

Saving:

Staff	144,000	Baht
Office Supplies & Miscellaneous	7,000	Baht
Opportunity cost & Intangible Benefit	1,302,200	Baht
Total Saving	1,453,200	Baht

Table 3.11. Payback Analysis for the Proposed Inventory Information System, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development cost:	655,900.00						
Operation & Maintenance cost:		941,900.00	1,036,090.00	1,139,699.00	1,253,668.90	1,379,035.79	1,516,939.37
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted costs (adjusted to present value):	655,900.00	856,187.10	855,810.34	855,913.95	856,255.86	856,381.23	855,553.80
Cumulative time-adjusted costs over life time	655,900.00	1,512,087.10	2,367,897.44	3,223,811.39	4,080,067.25	4,936,448.47	5,792,002.28
Benefits derived from operation of new system:	0.00	1,453,200.00	1,598,520.00	1,758,372.00	1,934,209.20	2,127,630.12	2,340,393.13
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted benefits (adjusted to present value):	0.00	1,320,958.80	1,320,377.52	1,320,537.37	1,321,064.88	1,321,258.30	1,319,981.73
Cumulative time-adjusted benefits over life time:	0.00	1,320,958.80	2,641,336.32	3,961,873.69	5,282,938.58	6,604,196.88	7,924,178.61
Cumulative lifetime time-adjusted costs + benefits:	-655,900.00	-191,128.30	273,438.88	738,062.30	1,202,871.33	1,667,748.41	2,132,176.33

Payback period is the commonly used technique to assess the value of investment. Generally, payback period is the period when cash inflows can recover the initial investment within a specified period. To reflect the real value of money, the time value of money concept is also applied in this analysis. The discount rate is required to calculate discount value of all costs and benefits after the first year to the present value at the present year. Then the Payback period is calculated to judge the profitability of the system as Table 3.11. and Figure 3.5.

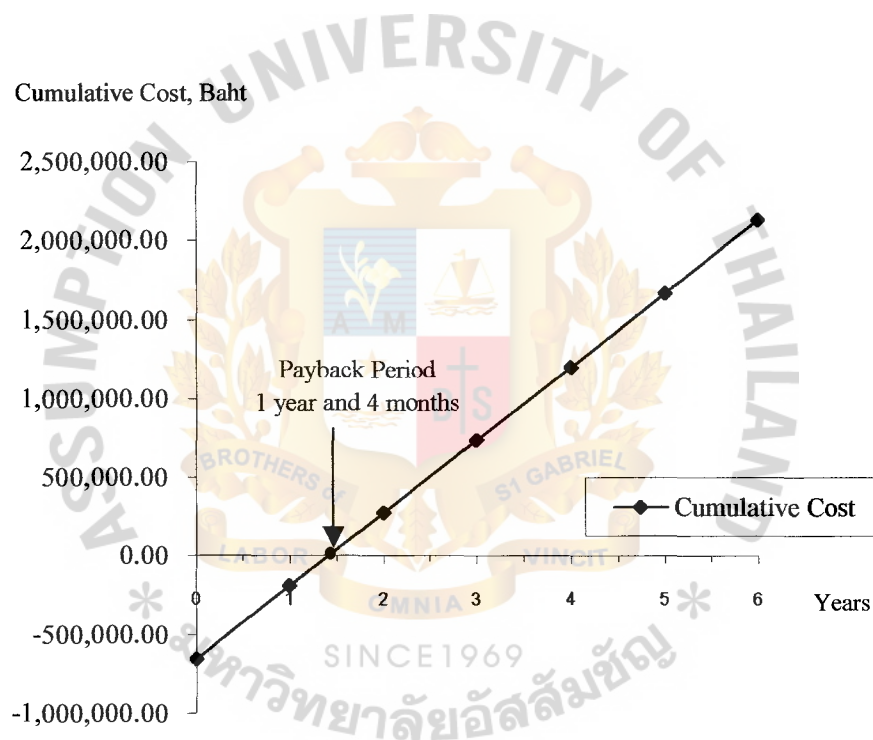


Figure 3.5. Payback Period of Inventory Information System.

As in Figure 3.5 the graph of cumulative cost of computerized system crosses the x-axis at 1.4 years or the payback period of the computerized system is 1 year and 4 months.

Moreover, the payback period can be calculated by the formula as follows:

$$P = \frac{\text{Last year of negative Cash flow difference}}{\text{Cumulative different last negative year Absolute value of cumulative difference (last negative plus first year positive year)}}$$

Where P Payback Period

$$P = 1 + \{191,128.30 / (191,128.30 + 273,438.88)\}$$

$$= 1.4 \text{ years or 1 year and 4 months}$$

(5) Return-on-Investment Analysis (ROI)

Return-on-Investment Analysis technique compares the lifetime profitability of alternative solutions or projects. The ROI for a project is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. The ROI for a potential project is calculated by using the data from Table 3.11 as follows:

$$ROI = \frac{(\text{Estimated lifetime benefits} - \text{Estimated lifetime costs})}{\text{Estimated lifetime costs}}$$

$$ROI = ((7,924,178.61 - 5,792,002.28) / 5,792,002.28) \times 100$$

$$= 0.37 \times 100$$

$$= 37\%$$

Therefore, the lifetime ROI is 37 percent.

3.5 Security and Control

The information that is stored in the Inventory Information System is so important for many departments. The data in database must always be available to users when needed. A satisfactory level of share ability must be achieved and the unauthorized access must be prevented. The following security and controls should be attained by the proposed computerized system.

- (1) The user's password is a must for log-in security control in order to prevent unauthorized users from accessing the system.
- (2) There must be back up data and programs in form of diskettes or CD-ROM every month.
- (3) The user profile needed to exist in the Inventory Information System to classify the group of user who can read, update and execute the data in the database.
- (4) Input validation must exist in the Inventory Information System in each menu screen to protect the human errors.
- (5) Data must be inputted, created, updated, and deleted during working hours only.
- (6) The company should set the rules for using the computer to protect physical components as well as computer system:
 - (a) Do not smoke near a computer.
 - (b) Do not eat or drink any food near a computer.
 - (c) Shut down the computer when not using it.
 - (d) Do not allow users fix any physical part of computer by themselves.
 - (e) Do not allow users download any program into the computer by themselves.

- (f) User has to check virus before opening any file from diskette.
- (g) All media such as floppy disk, CD-ROM must be kept in safe place.
- (h) All computer and Server must have routine checking virus at a specified time every week.

In addition to this, there are some general controls to ensure the effective operation of programmed procedures. General Controls include the following:

- (1) Implementation controls
- (2) Software controls
- (3) Physical hardware controls
- (4) Computer operation controls
- (5) Data file security controls
- (6) Administrative controls (Segregation of functions)

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

System Implementation is the conversion process from a current manual system to the new computerized information system. The final design should be evaluated first by the users and management teams to guarantee that the new computerized system can meet the requirements and objectives, and then the other remaining processes will be performed. It is expected that the system implementation would take approximately six weeks. The duration may vary depending on the readiness of the staff to use the new system. The processes of System Implementation are:

- (1) Software development
- (2) Hardware installation
- (3) Personnel training
- (4) Test Plan
- (5) Conversion
- (6) Documentation

4.2 Software Development

Using Microsoft Access as DBMS develops the Inventory Information System. The computerized system is developed based on user friendly and the capability in making report. The system allows user to add, edit and delete the data and also search for desired data. In order to generate reports, the system will join tables in database file and make the calculation in the required field based on user and management requirements.

4.3 Hardware Installation

In order to establish the computerized system, the company requires new File Server as shown in the Cost/ Benefit Analysis section in previous section. Six clients and one server need to be installed with LAN card so they can work in the network system in the proposed system.

4.4 Personnel Training

User training course is an important process in the system implementation phase. The objective of training course is to make users understand, be familiar and able to use the program correctly. The training course should include computer concepts, functions of hardware and software, functions of the proposed system and how to use the system properly and efficiently. Users should be given the system manual, class lecture about the procedure and hands on experience on using new equipment. Furthermore, the programmer or system analyst when initially using the system also should supervise the users.

4.5 Test Plan

After the program has been designed and installed, module testing, program testing and system testing are required to ensure that the new system are free from errors and can work well with the other systems in the company.

Module testing would help to check errors in program module. It can detect errors in coding and errors in logic. After finishing all module testing, program testing is used to check the program to verify the way the system works and to check whether each module can work together or not. System testing checks whether the proposed system can share data or work with the other manual systems properly, and whether the proposed system can work well on the operating system or not. When finishing all testing, the testing document plans and testing results should be filed as a benchmark.

Therefore, whenever the company does the testing again in the future, programmers can use benchmark as a reference. Moreover, security and recovery testing is tested to ensure that the system can protect unauthorized users from access into the system. If failure happens to the database, the system should be able to recover those data.

The effective testing of the program does not guarantee system reliability. Therefore, the test case should include the Input Validation, Functionality, and Access Control.

4.6 Conversion

Conversion is the process of changing from the existing system to a new proposed system. The conversion process is set up based on the replacing concept. Since the existing system is the combination of manual and computer system, users have to key in the data to create the database because the records from the existing system are not convertible.

4.7 Documentation

Documentation of the proposed system is separated into 2 documents. Firstly, user's guide or manual, which describes how to access and use the program, how to correct the problems and how to use interface screens. Secondly, it is the flow of the system and data dictionary. Both documents can help the users whenever they need or get the problem when using the program and also can help the programmer to develop and maintain the system.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The purpose of this project is to design and implement the Inventory Information System for Zenith Products International Co., Ltd., During the analysis of the existing system, the problems are found to be out of item stocks, items missing or misplaced, unfulfilled orders, excessive stock, improper data entry and time consuming.

This Inventory Information System is proposed to increase the efficiency of the manual system. It is expected to provide the accurate information and allow immediate access to the desired information including facilitating the routine tasks of the operational level and help the company to utilize the people and resources effectively. Moreover, it also provides more up-to-date and reliable information to support decision-making to the management.

The new computerized system consists of six clients and a server connected by LAN and is implemented on the Microsoft Access program. The cost analysis of the computerized system is determined by using payback method and the break-even point between manual system and computerized system. In the beginning the computerized system costs are higher than the manual system but in two years and six months, both system will cost the same and then the accumulating cost of the computerized system will be lower in the long run. The payback period of the computerized system is one year and four months and the ROI is 37% in five years (system lifetime). The new system also can increase the security and control of the information in the system. It uses User Identification to ensure that only authorized users can enter to the system and access to the information and user Data Entry Control to prevent data entry errors that may be caused by users. The system has several benefits; the computerized system was

also identified after system development and implementation; it was found that the system meets all the project objectives. The time required to finish a job for operational level is shorter and reduced the number of staff in the department. The new system is also considered to be user friendly and can provide many useful information that the manual system cannot generate. Many processes of the computerized system also perform in less time than the manual system.

Table 5.1 is the table of achievement that shows the time performance on each process of the computerized system compared with the manual system.

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

Process	Manual System	Computerized System
Check EOQ of Products	10 Minutes	1 Minute
Purchase Requisition	20 Minutes	2 Minutes
Purchase Order	10 Minutes	2 Minutes
Stock In	5 Minutes	2 Minutes
Check Available Product	10 Minutes	10 Seconds
Stock Out	5 Minutes	2 Minutes
Generate the Monthly Report	60 Minutes	1 Minute
Generate the EOQ Report	60 Minutes	1 Minute

From the table, the time required to finish each process of the computerized system is less than in the manual system. In the existing system, all processes are done manually, the time taken to operate all work steps is quite long.

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

(1) Check EOQ of Products:

It takes ten minutes to check the products that meet the EOQ because all information is recorded in separate files in the existing system. For the proposed system, in one minute the system can check the same information from the database.

(2) Purchase Requisition

This process in the existing system takes twenty minutes to generate purchase requisition since the user has to get the information from many sources and to type the information in a form. The user has many tasks to do, so they may forget or get the inaccurate information. With the proposed system, in only two minutes the process can be finished.

(3) Purchase Order

The proposed system offers a better way to shortcut this process using GUI form for the officers to retrieve the information of the suppliers and products in order to speed up the process. It has shortened the time from ten minutes with the existing system to two minutes with the new system.

(4) Stock In

It takes five minutes to record the product information because the information is recorded in separate files in the existing system. For the proposed system, in two minutes the user can record the same information into the database.

(5) Check Available Product

By the existing system, ten minutes are taken to find the product available because the information is recorded in separate files. For the

proposed system, the same information can search in the database within ten seconds.

(6) Stock Out

The existing system takes ten minutes to record the stock out information and prepare the delivery order form for Financial & Accounting Division. The computerized system takes only one minute to record and automatically generate the delivery order form.

(7) Generate Monthly Report

The existing system uses Microsoft Excel file to generate the reports by searching, reformatting data and printing reports. The proposed system will automate the process and reduce the processing time to only one minute rather than sixty minutes.

(8) Generate EOQ Report

The existing system takes a long time to generate EOQ report because all information is recorded in separate files. For the proposed system, in one minute the system can retrieve the information and generate the report for the management.

5.2 Recommendations

There are some recommendations that the company has to be concerned in order to be successful in implementing the new computerized system.

- (1) After the Inventory Information System is implemented, the company should continuously monitor the working procedure and look at the feedback of the system.
- (2) The new system must be able to link with other systems the system can receive various information from many departments that may be useful in

the future. Furthermore, other departments also can use the information from this system to do the job. This can enhance the processing performance and reduce some work cycle of the company.

- (3) The system should use graph or graphic to make reports so it can help manager to better understand the information.
- (4) In the future, the company may want to develop the computerized system for other departments, or extend the system to other departments. The studying experience and results from implementing this proposed system will greatly benefit and can be applied by the company.
- (5) Besides concentrating on the business procedure process, the company should consider security and control too. Security and control are essential for the company to prevent unauthorized users to access to the Inventory Information System. The new system should have the user profile for granting the level of authority to access the functions and the database.



APPENDIX A
DATABASE DESIGN

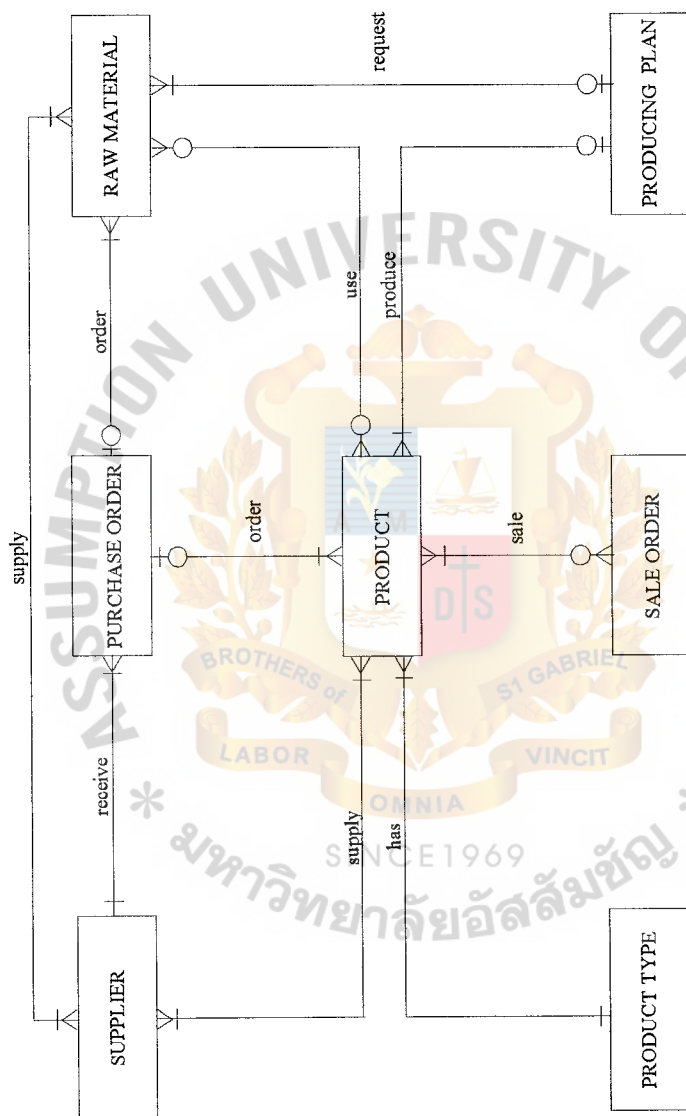


Figure A.1. Context Level Entity Relationship Diagram of Inventory Information System.

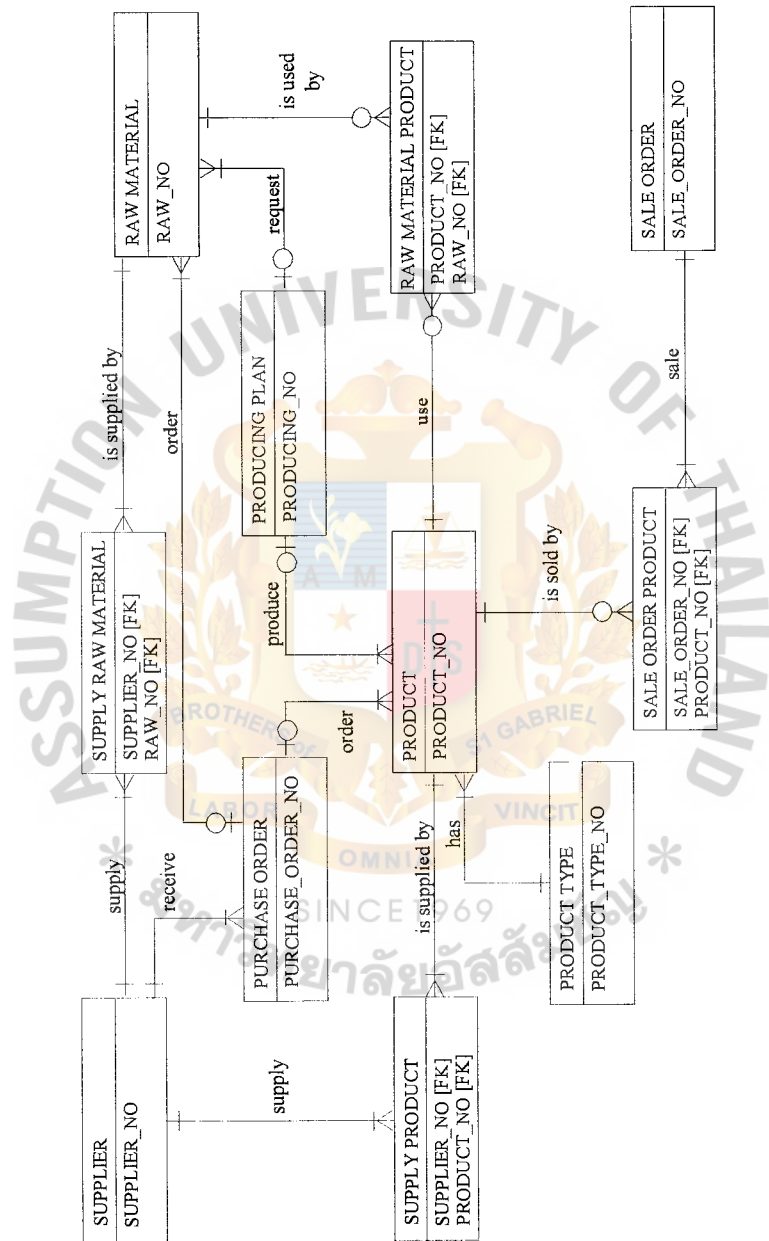


Figure A.2. Key-Based Attributed Entity Relationship Diagram of Inventory Information System.

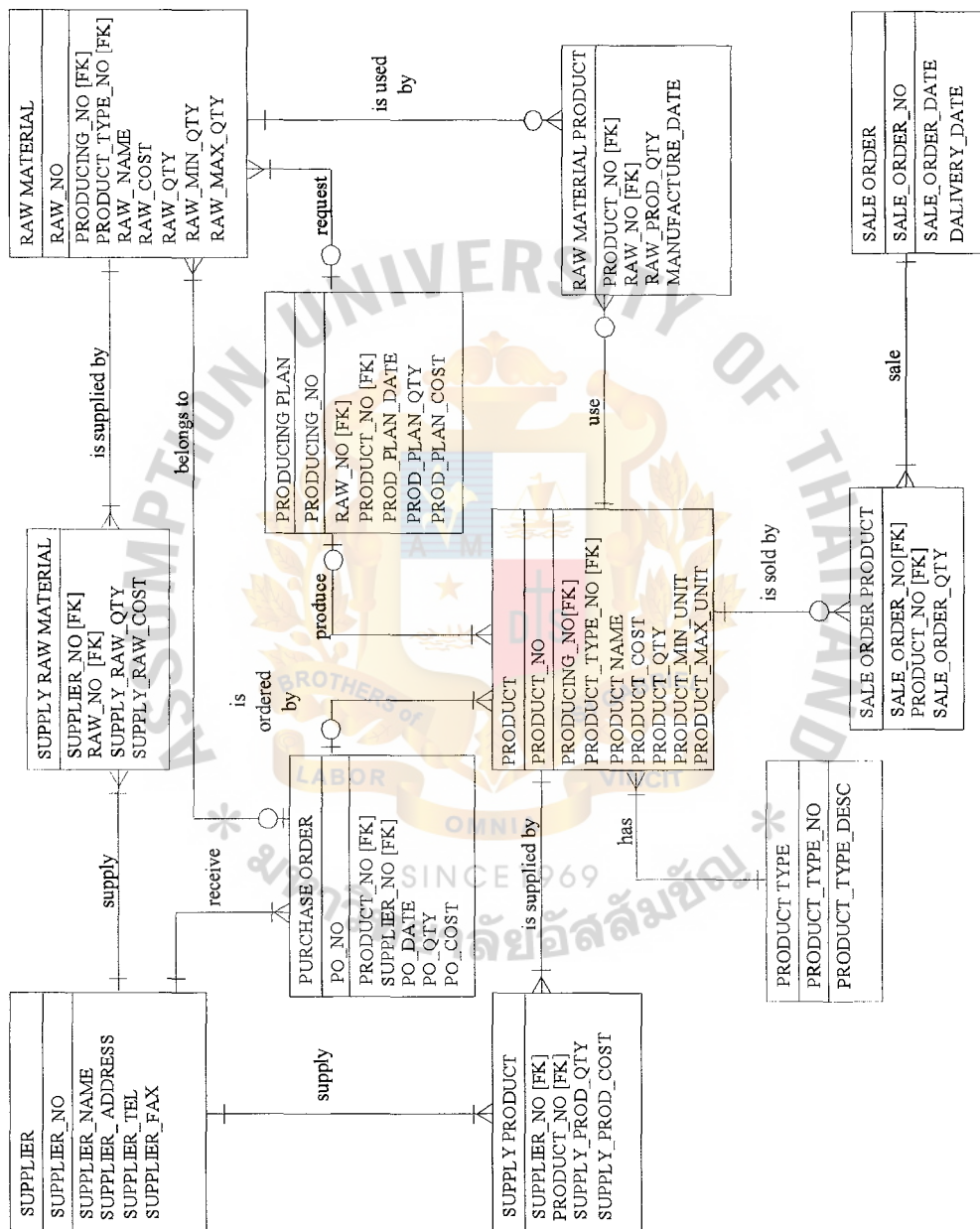


Figure A.3. Fully Attributed Entity Relationship Diagram of Inventory Information System.

Table A.1. Structure of Supplier Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Supplier_No	Varchar (5)	Y	Y		Purchase Order		Primary Key
2	Supplier_Name	Varchar (30)						Attribute
3	Supplier_Address	Varchar (50)						Attribute
4	Supplier_Tel	Int (13)						Attribute
5	Supplier_Fax	Int (13)						Attribute

Table A.2. Structure of Supply Raw Material Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Supplier_No	Varchar (5)	Y	Y				Foreign Key
2	Raw_No	Varchar (7)						Foreign Key
3	Supply_Raw_Qty	Decimal(7,2)						Attribute
4	Supply_Raw_Cost	Decimal(10,2)						Attribute

Table A.3. Structure of Raw Material Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Raw_No	Varchar (7)	Y	Y		Producing Plan		Primary Key
2	Producing_No	Varchar (5)						Foreign Key
3	Product_Type_No	Int (2)						Foreign Key
4	Raw_Name	Varchar (25)						Attribute
5	Raw_Cost	Decimal(10,2)						Attribute
6	Raw_Qty	Decimal(7,2)						Attribute
7	Raw_Min_Qty	Decimal(7,2)						Attribute
8	Raw_Max_Qty	Decimal(7,2)						Attribute

Table A.4. Structure of Supply Product Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Supplier_No	Varchar (5)	Y	Y				Foreign Key
2	Product_No	Varchar (7)						Foreign Key
3	Supply_Prod_Qty	Decimal(7,2)						Attribute
4	Supply_Prod_Cost	Decimal(10,2)						Attribute

Table A.5. Structure of Purchase Order Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Po_No	Varchar (4)	Y	Y				Primary Key
2	Product_No	Varchar (7)						Foreign Key
3	Supplier_No	Varchar (5)						Foreign Key
4	Po_Date	Date						Attribute
5	Po_Qty	Decimal(7,2)						Attribute
6	Po_Cost	Decimal(10,2)						Attribute

Table A.6. Structure of Producing Plan Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Producing_No	Varchar (5)	Y	Y		Raw Material, Product		Primary Key
2	Raw_No	Varchar (7)						Foreign Key
3	Product_No	Varchar (7)						Foreign Key
4	Prod_Plan_Date	Date						Attribute
5	Prod_Plan_Qty	Decimal(7,2)						Attribute
6	Prod_Plan_Cost	Decimal(10,2)						Attribute

Table A.7. Structure of Product Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Product_No	Varchar (7)	Y	Y		Purchase Order, Producing Plan,		Primary Key
2	Producing_No	Varchar (5)						Foreign Key
3	Product_Type_No	Int (2)						Foreign Key
4	Product_Name	Varchar (25)						Attribute
5	Product_Cost	Decimal(10,2)						Attribute
6	Product_Qty	Decimal(7,2)						Attribute
7	Product_Min_Qty	Decimal(7,2)						Attribute
8	Product_Max_Qty	Decimal(7,2)						Attribute

Table A.8. Structure of Raw Material Product Table.*

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Product_No	Varchar (7)	Y	Y				Foreign Key
2	Raw_No	Varchar (7)						Foreign Key
3	Raw_Prod_Qty	Decimal(7,2)						Attribute
4	Manufacture_Date	Date						Attribute

Table A.9. Structure of Product Type Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Product_Type_No	Int (2)	Y	Y		Product, Raw Material		Primary Key
2	Product_Type_Desc	Varchar (30)						Foreign Key

Table A.10. Structure of Sales Order Product Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Sale_Order_No	Int (4)	Y	Y				Foreign Key
2	Product_No	Varchar (7)						Foreign Key
3	Sale_Order_Qty	Decimal(7,2)						Attribute

Table A.11. Structure of Sales Order Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Sale_Order_No	Int (4)	Y	Y				Primary Key
2	Sale_Order_Date	Date						Attribute
3	Delivery_Date	Date						Attribute



Table B.1. Data Dictionary of Supplier Table.

Field Name	Meaning
Supplier_No	Supplier Number
Supplier_Name	Name of Supplier
Supplier_Address	Contact Address
Supplier_Tel	Contact Telephone Number of Supplier
Supplier_Fax	Contact Facsimile Number of Supplier

Table B.2. Data Dictionary of Supply Raw Material Table.

Field Name	Meaning
Supplier_No	Supplier Number
Raw_No	Raw Material Number
Supply_Raw_Qty	Quantity Order of Raw Material
Supply_Raw_Cost	Cost Order of Raw Material

Table B.3. Data Dictionary of Raw Material Table.

Field Name	Meaning
Raw_No	Number of Raw Material
Producing_No	Producing Plan Number
Product_Type_No	Product Type Number
Raw_Name	Raw Material Name
Raw_Cost	Cost of Raw Material
Raw_Qty	Quantity of Raw Material
Raw_Min_Qty	Minimum Quantity of Raw Material
Raw_Max_Qty	Maximum Quantity of Raw Material

Table B.4. Data Dictionary of Supply Product Table.

Field Name	Meaning
Supplier_No	Supplier Number
Product_No	Product Number
Supply_Prod_Qty	Quantity Order of Product
Supply_Prod_Cost	Cost Order of Product

Table B.5. Data Dictionary of Purchase Order Table.

Field Name	Meaning
Po_No	Purchase Order Number
Product_No	Product Number
Supplier_No	Supplier Number
Po_Date	Date of Purchase Order
Po_Qty	Quantity Order of Purchase Order
Po_Cost	Cost Order of Purchase Order

Table B.6. Data Dictionary of Producing Plan Table.

Field Name	Meaning
Producing_No	Producing Plan Number
Raw_No	Raw Material Number
Product_No	Product Number
Prod_Plan_Date	Date of Producing Plan
Prod_Plan_Qty	Quantity Product of Producing Plan
Prod_Plan_Cost	Cost of Product of Producing Plan

Table B.7. Data Dictionary of Product Table.

Field Name	Meaning
Product_No	Product Number
Producing_No	Producing Plan Number
Product_Type_No	Product Type Number
Product_Name	Product Name
Product_Cost	Cost of Product
Product_Qty	Quantity of Product
Product_Min_Qty	Minimum Quantity of Product
Product_Max_Qty	Maximum Quantity of Product

Table B.8. Data Dictionary of Raw Material Product Table.

Field Name	Meaning
Product_No	Product Number
Raw_No	Raw Material Number
Raw_Prod_Qty	Quantity of Raw Material of Producing Product
Manufacture_Date	Date of Manufacture

Table B.9. Data Dictionary of Product Type Table.

Field Name	Meaning
Product_Type_No	Product Type Number
Product_Type_Desc	Description of Product Type

Table B.10. Data Dictionary of Sales Order Product Table.

Field Name	Meaning
Sale_Order_No	Sale Order Number
Product_No	Product Number
Sale_Order_Qty	Quantity of Sale Order

Table B.11. Data Dictionary of Sales Order Table.

Field Name	Meaning
Sale_Order_No	Sale Order Number
Sale_Order_Date	Date of Sale Order
Delivery_Date	Date of Delivery Product



APPENDIX C
DATA FLOW DIAGRAM

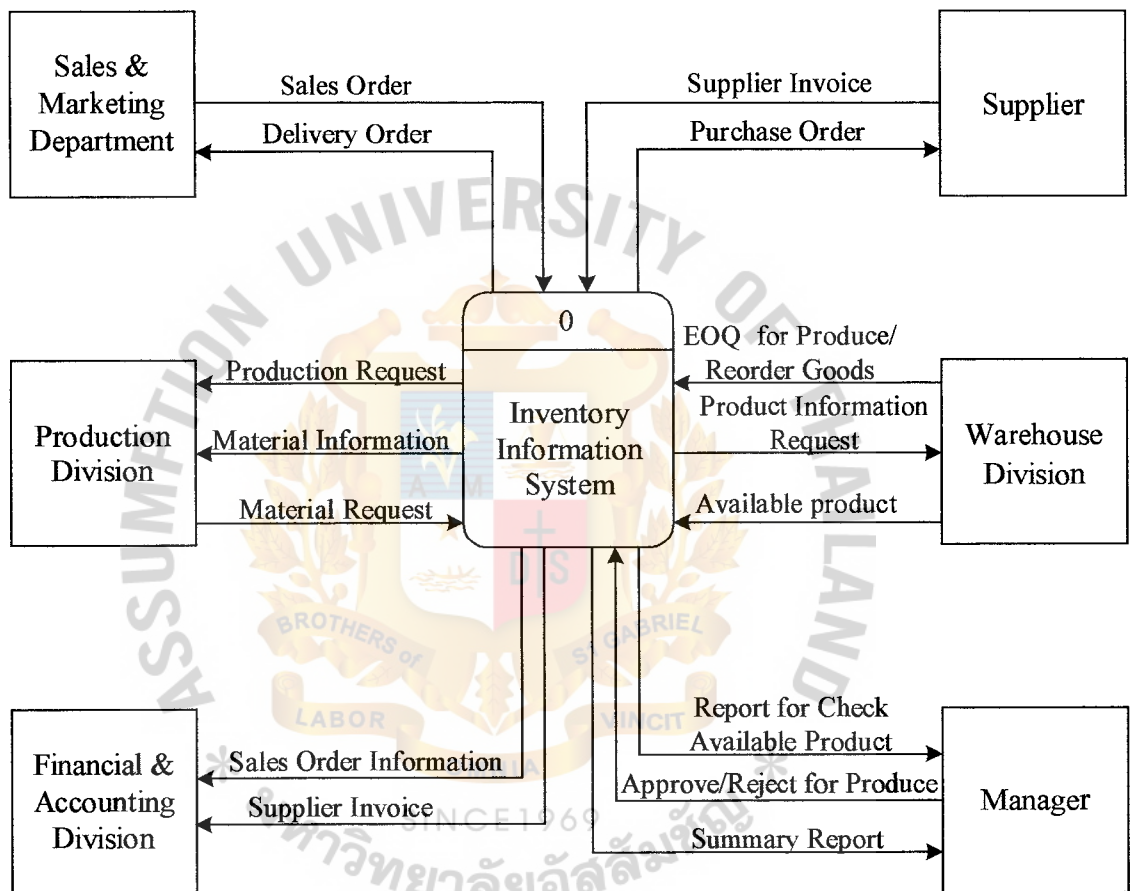


Figure C.1. Context Level Data Flow Diagram of Proposed Inventory Information System.

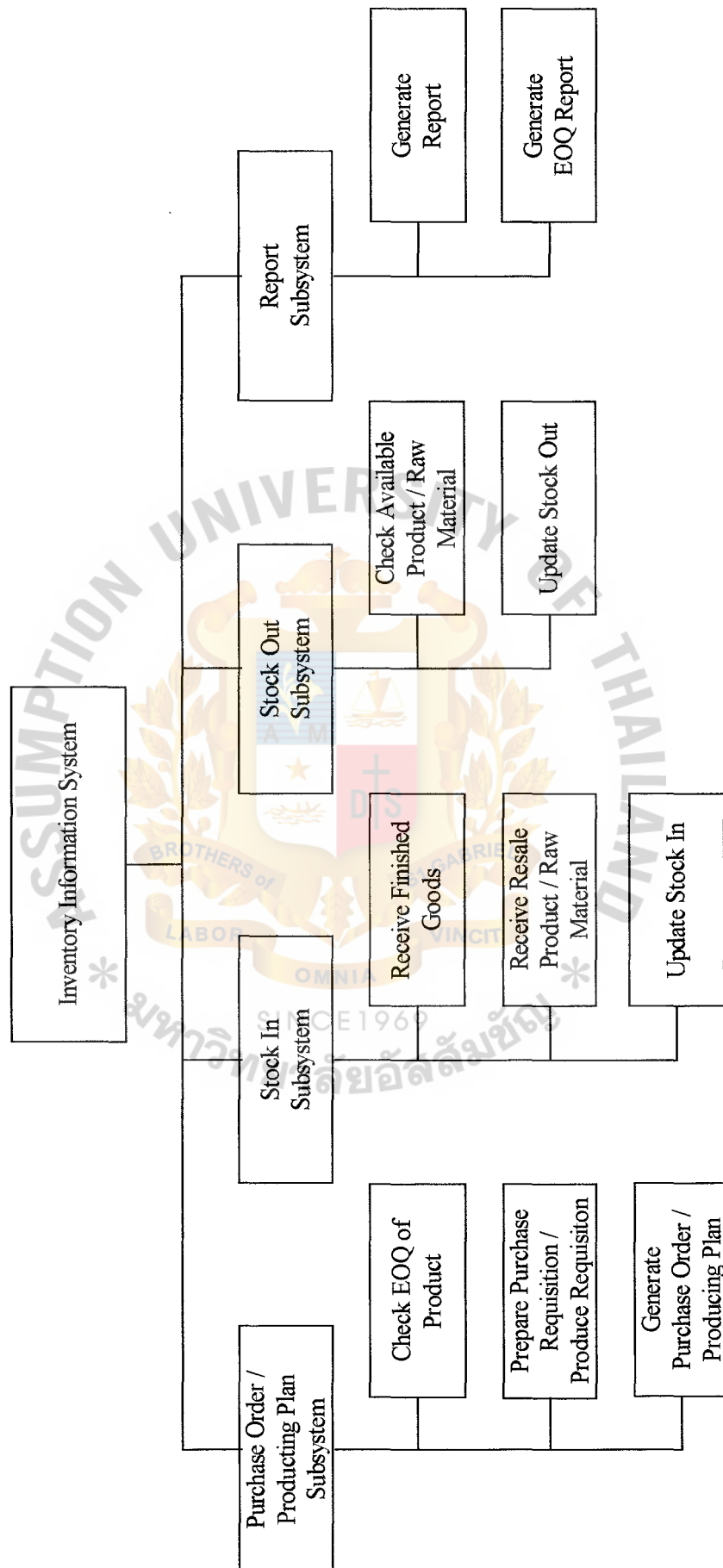


Figure C.2. A Functional Decomposition Diagram of Proposed Inventory Information System.

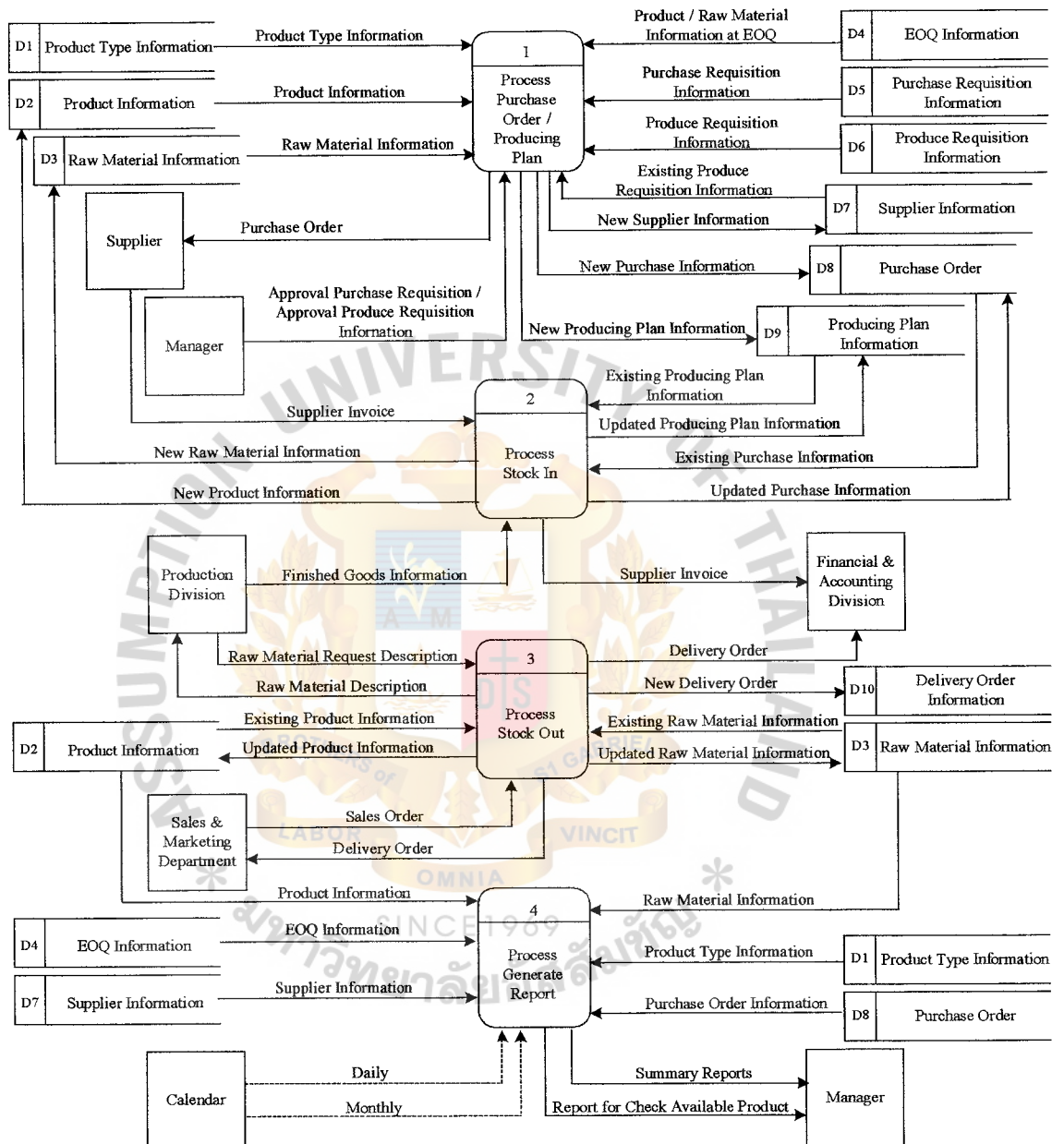


Figure C.3. Level 0 Data Flow Diagram of Proposed Inventory Information System.

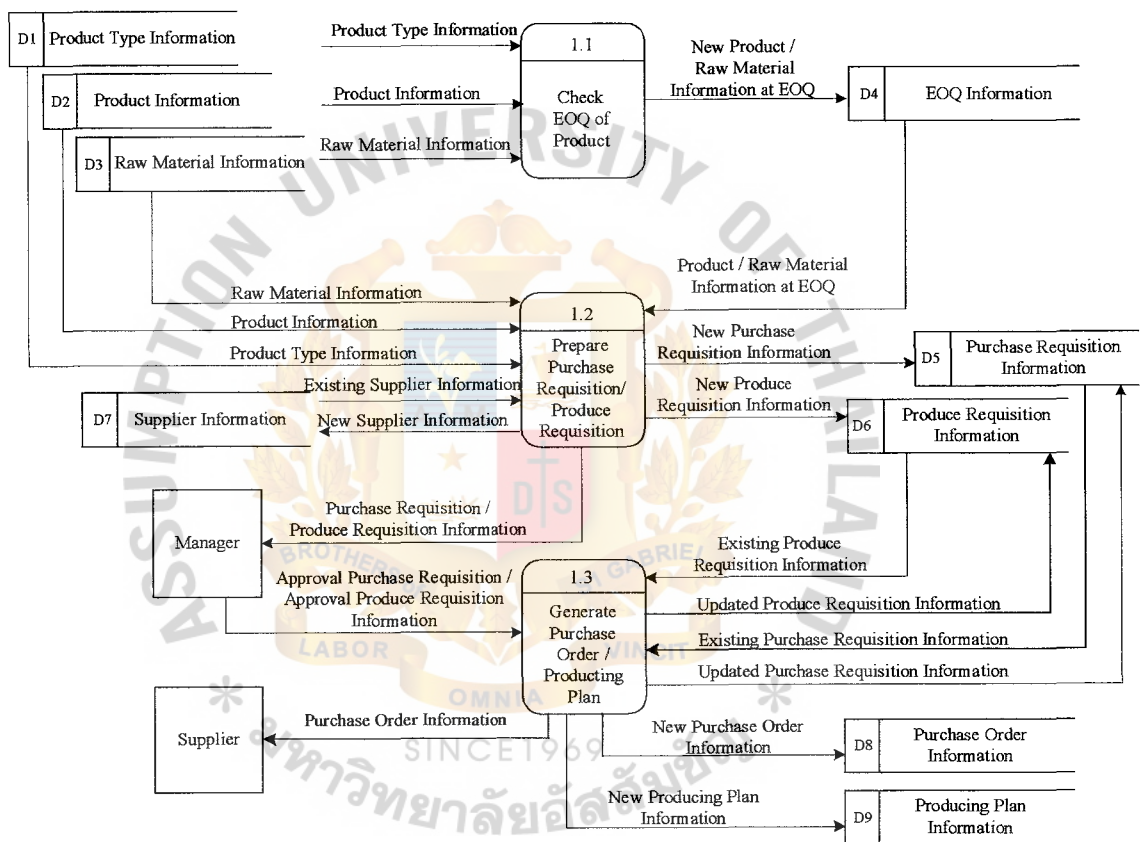


Figure C.4. Level 1 Data Flow Diagram of Purchase Order / Producing Plan Process.

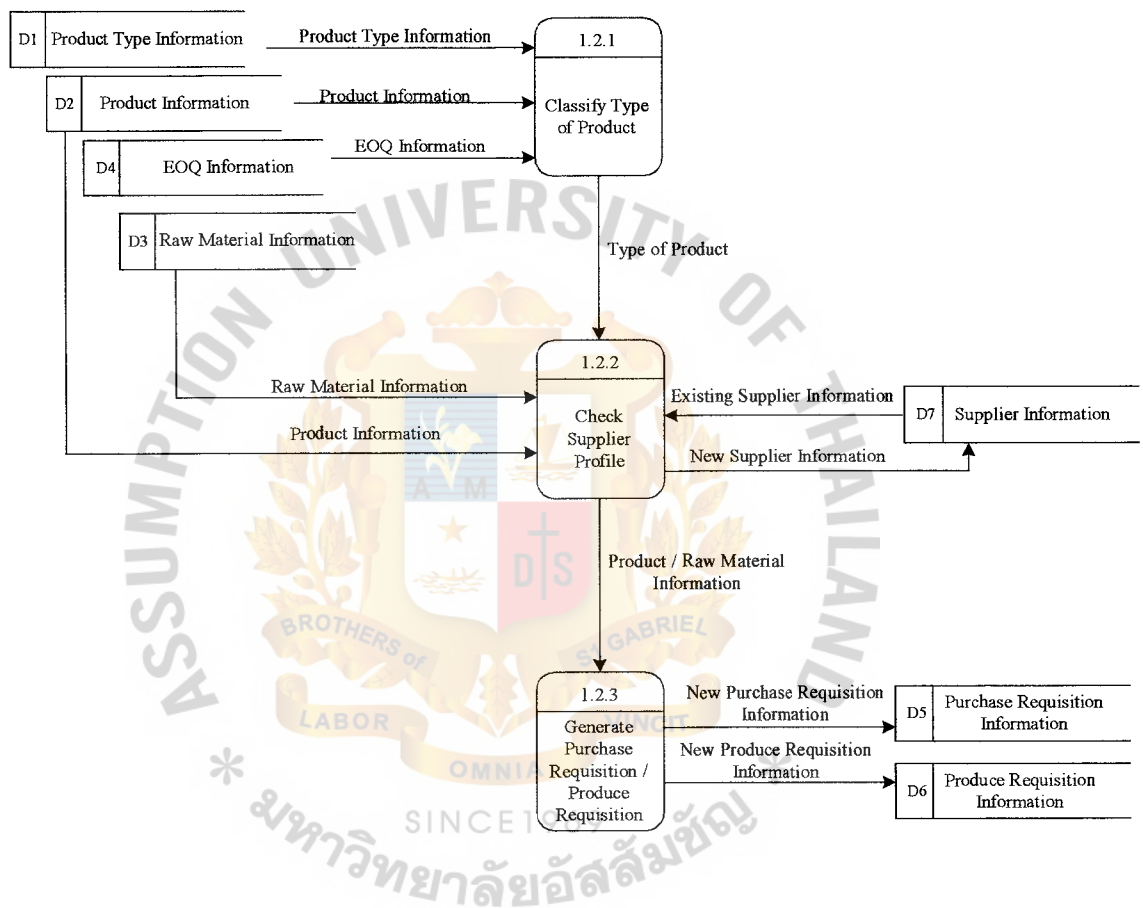


Figure C.5. Level 2 Data Flow Diagram of Prepare Purchase Requisition / Produce Requisition Process.

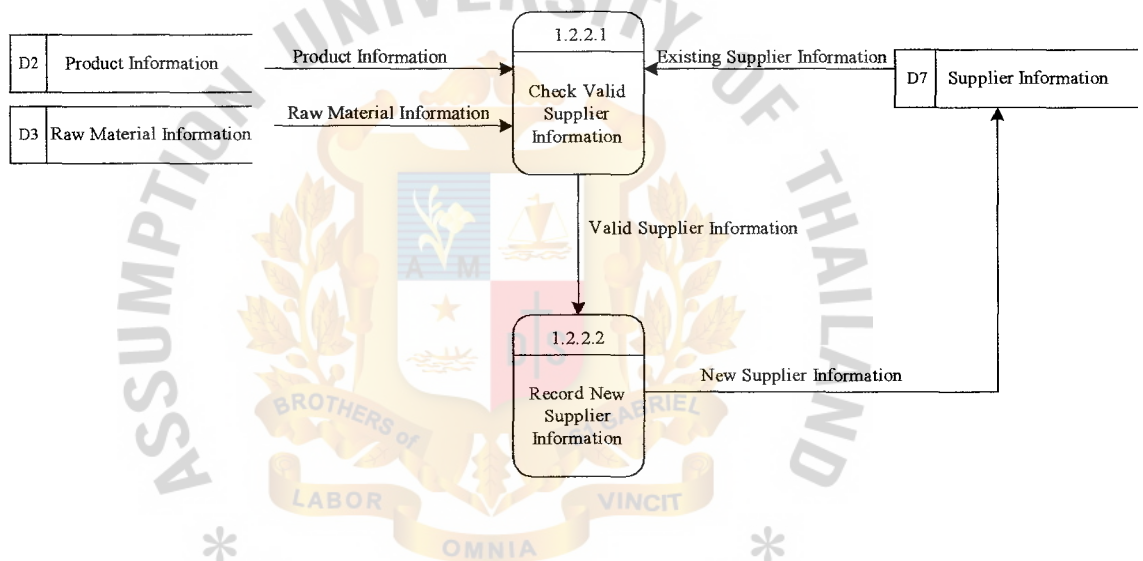


Figure C.6. Level 3 Data Flow Diagram of Check Supplier Profile Process.

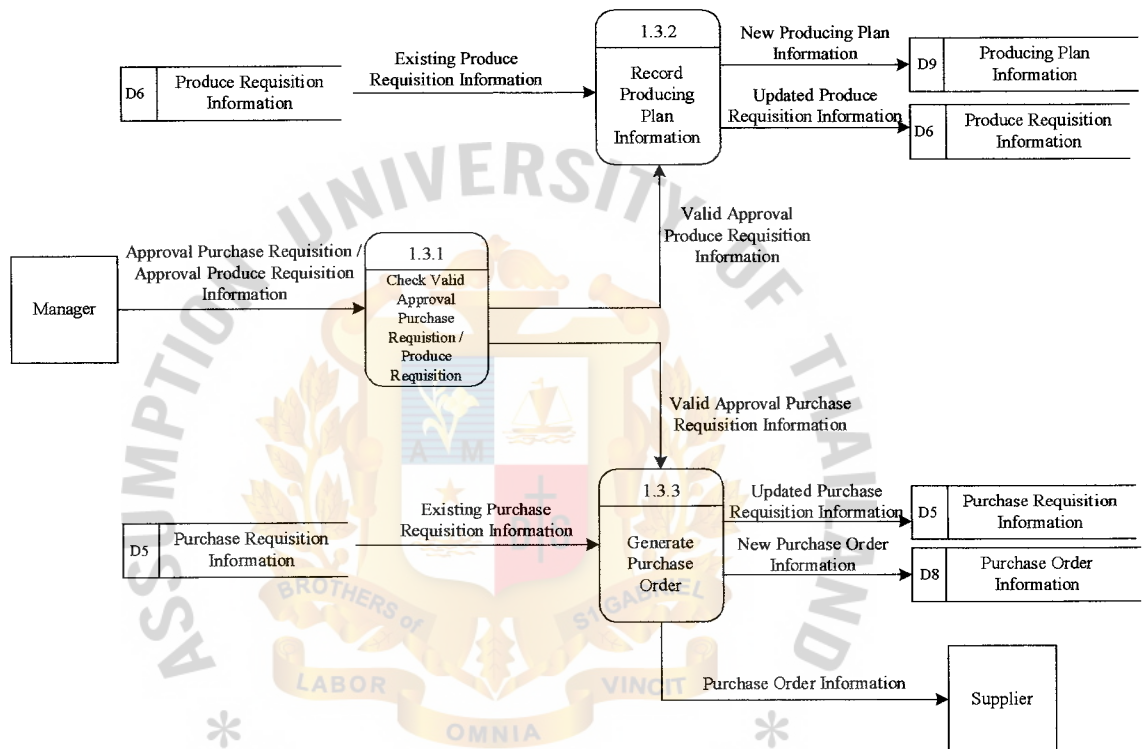


Figure C.7. Level 2 Data Flow Diagram of Generate Purchase Order / Producing Plan Process.

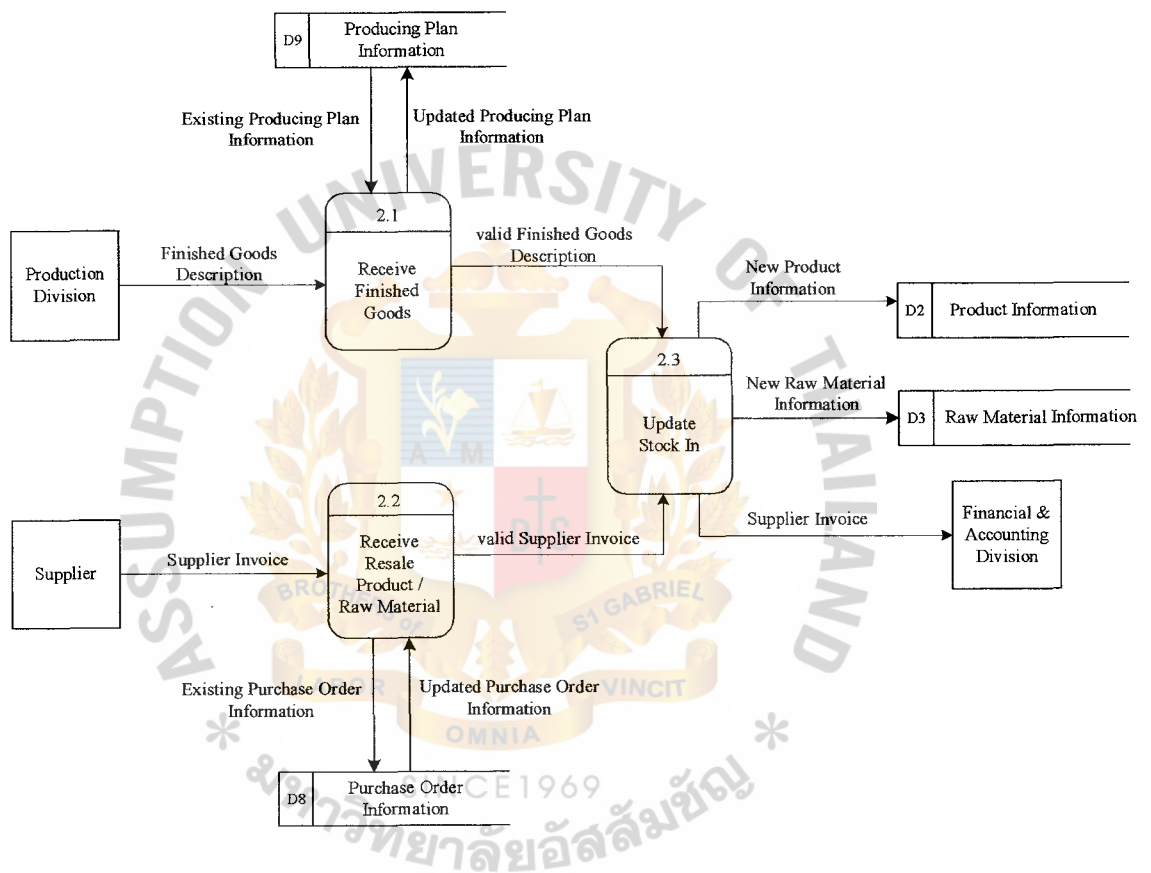


Figure C.8. Level 1 Data Flow Diagram of Stock In Process.

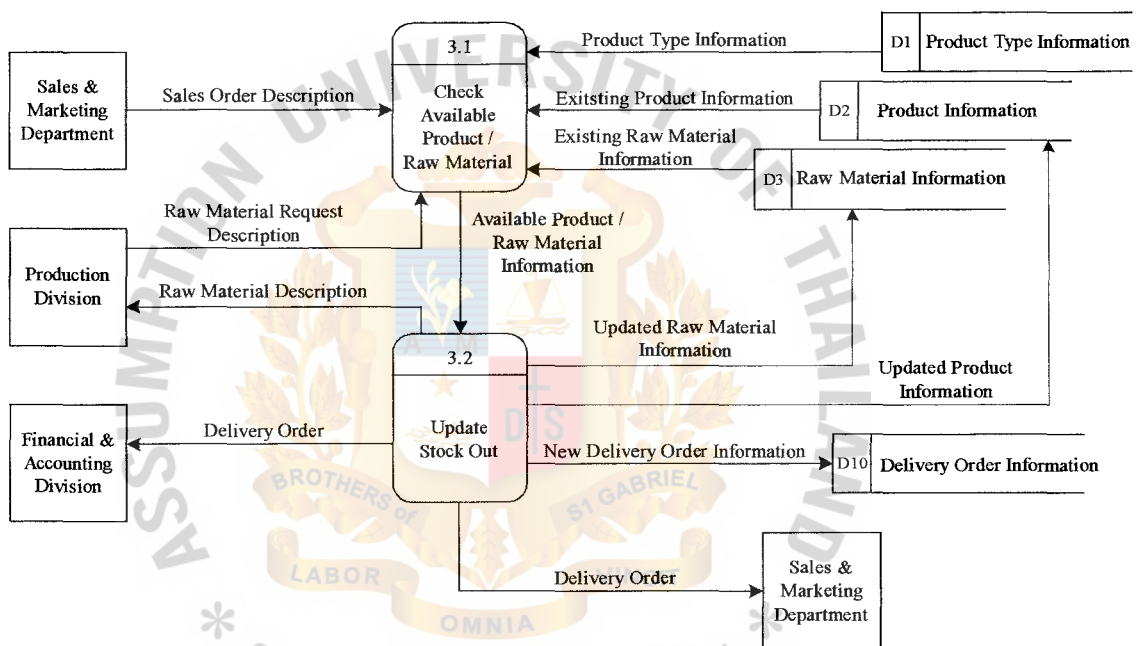


Figure C.9. Level 1 Data Flow Diagram of Stock Out Process.

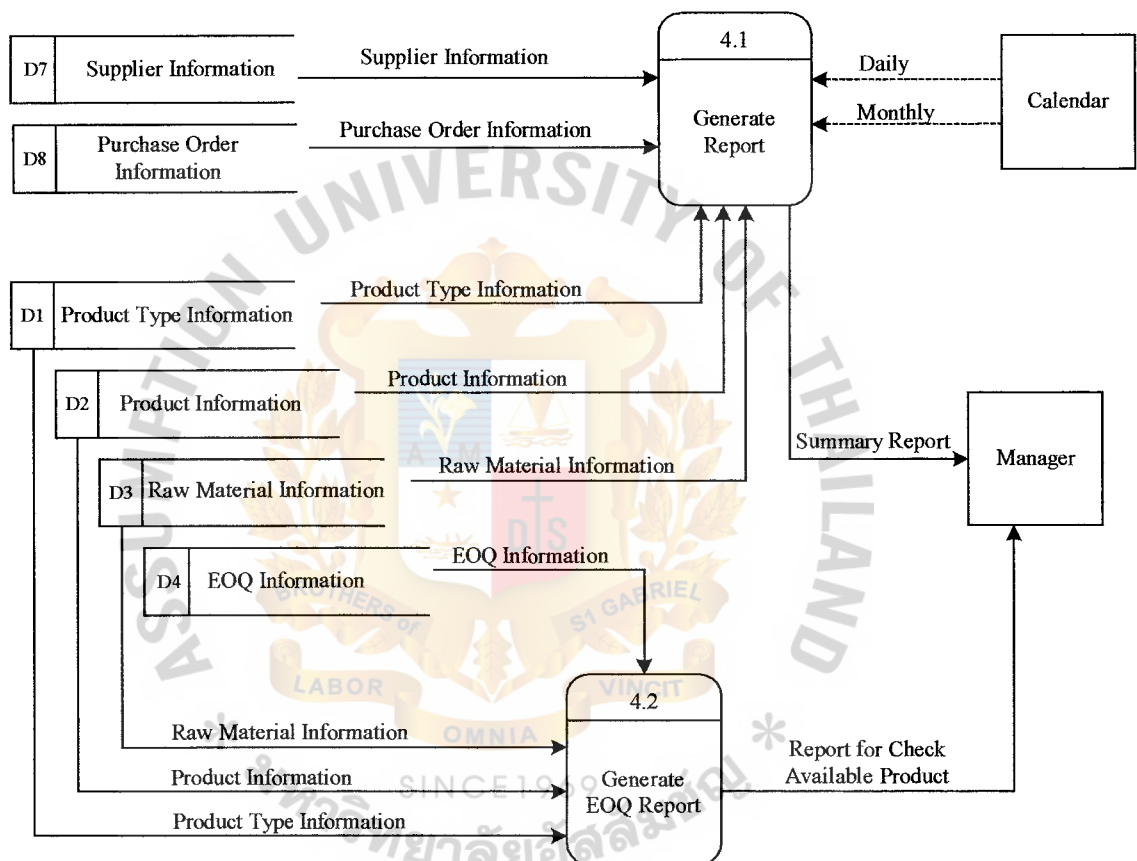


Figure C.10. Level 1 Data Flow Diagram of Report Process.

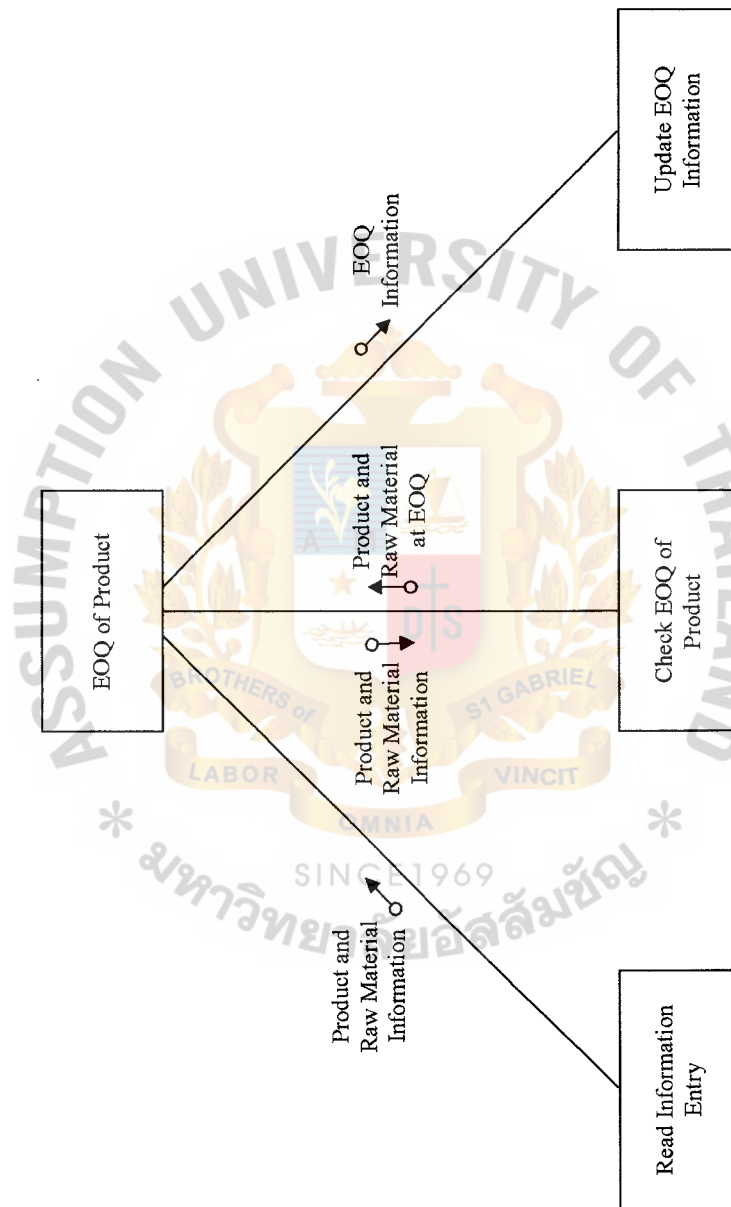


Figure C.11. Structure Chart of Process EOQ of Product.

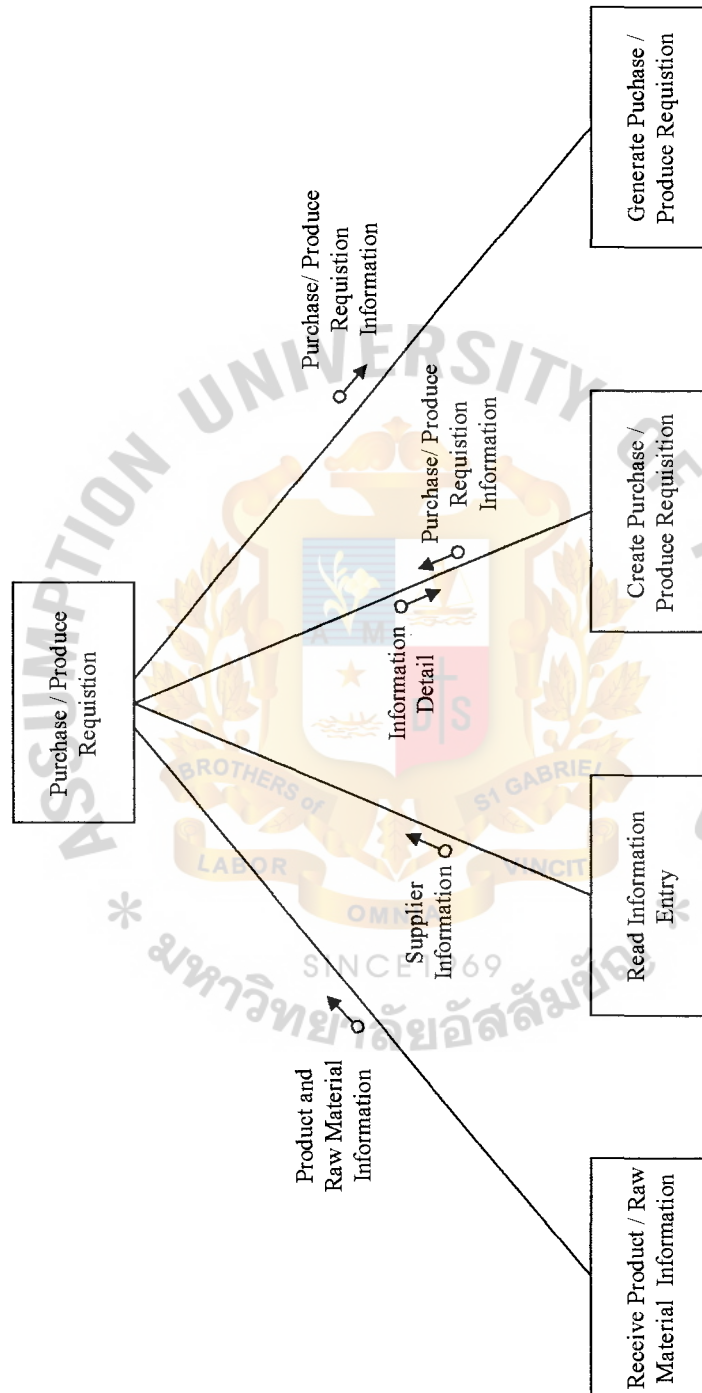


Figure C.12. Structure Chart of Process Purchase / Produce Requisition.

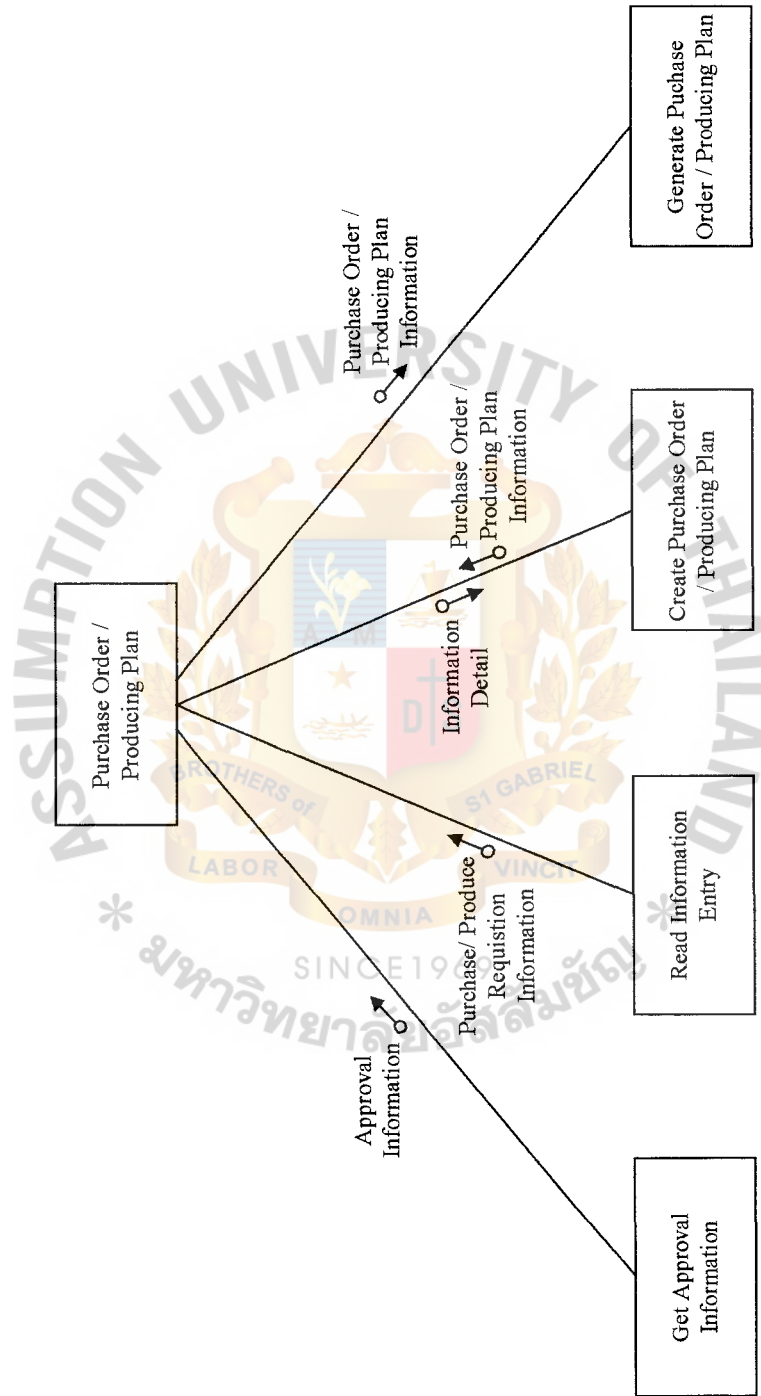


Figure C.13. Structure Chart of Process Purchase Order / Producing Plan.

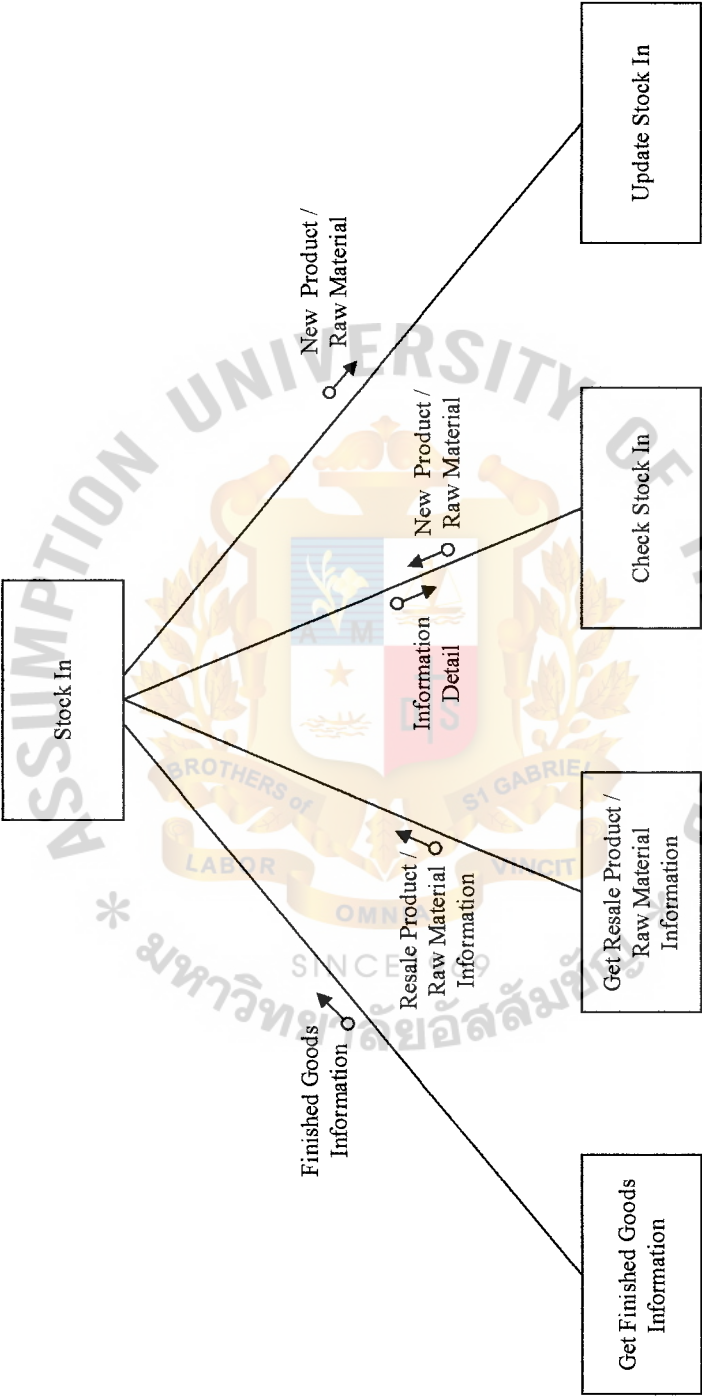


Figure C.14. Structure Chart of Process Stock In.

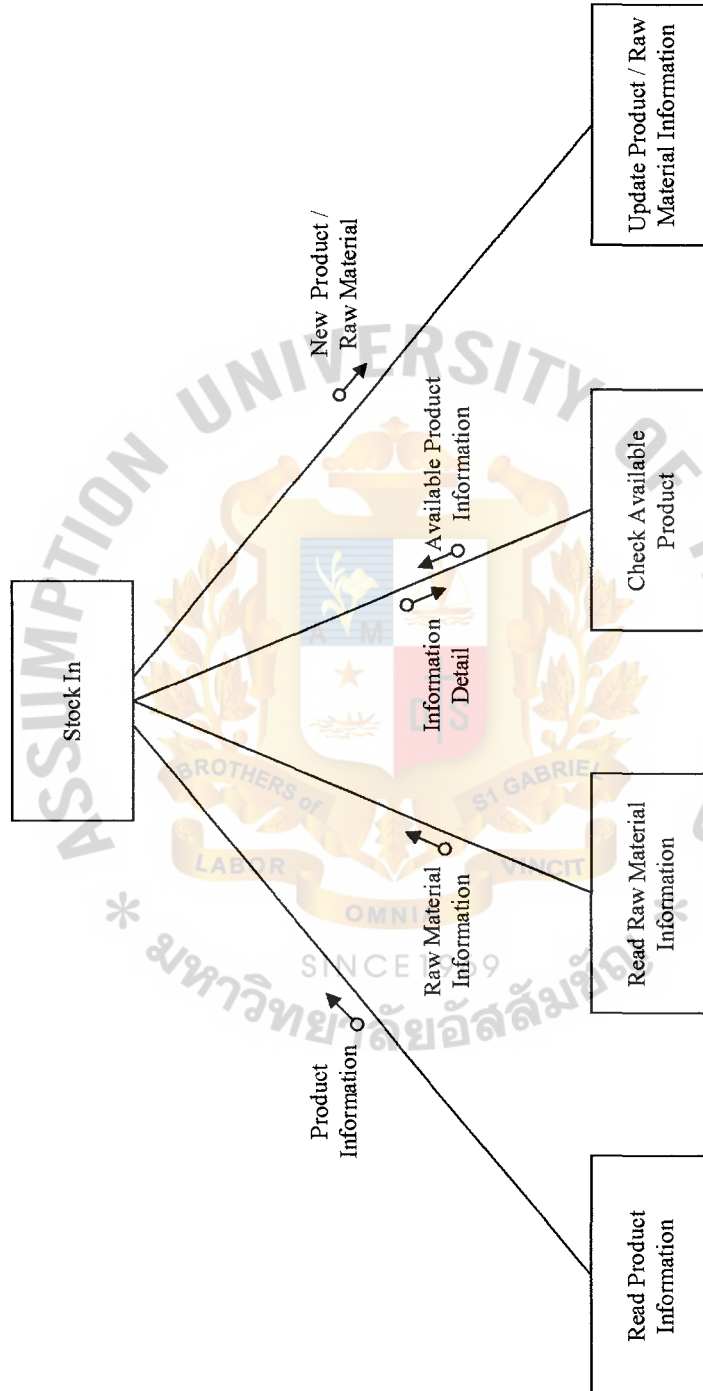


Figure C15. Structure Chart of Process Stock Out.

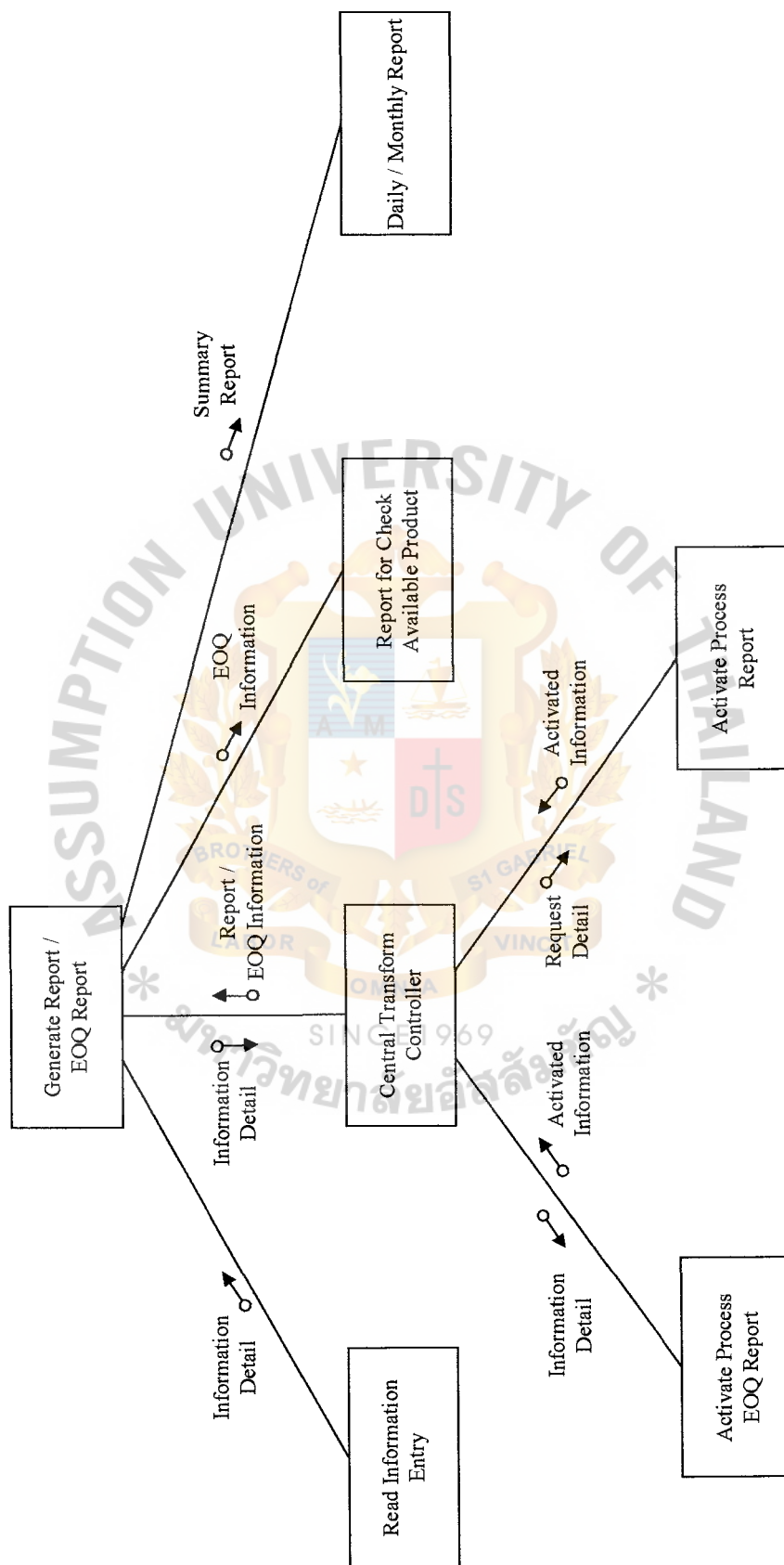


Figure C.16. Structure Chart of Process Generate Report and EOQ Report.



Table D.1. Process Specification of Process 1.1.

Data Item	Description
Process Name:	Check EOQ of Product
Data In:	(1) Product Type Information (2) Product Information (3) Raw Material Information
Data Out:	New Product / Raw Material Information at EOQ
Process:	(1) Inquiry Product or Raw Material at EOQ (2) Record new Product or Raw Material in EOQ Database
Attachment	(1) Data Store D1 (Product Type Information) (2) Data Store D2 (Product Information) (3) Data Store D3 (Raw Material Information) (4) Data Store D4 (EOQ Information)

Table D.2. Process Specification of Process 1.2.1.

Data Item	Description
Process Name:	Classify Type of Product
Data In:	(1) Product Type Information (2) Product Information (3) EOQ Information
Data Out:	Type of Product
Process:	(1) Retrieve Product Information (2) Classify Type of Product
Attachment	(1) Data Store D1 (Product Type Information) (2) Data Store D2 (Product Information) (3) Data Store D4 (EOQ Information)

Table D.3. Process Specification of Process 1.2.2.1.

Data Item	Description
Process Name:	Check Valid Supplier Information
Data In:	(1) Product Information (2) Raw Material Information (3) Existing Supplier Information
Data Out:	Valid Supplier Information
Process:	(1) Retrieve Supplier Information (2) Validate Supplier Information
Attachment	(1) Data Store D2 (Product Information) (2) Data Store D3 (Raw Material Information) (4) Data Store D7 (Supplier Information)

Table D.4. Process Specification of Process 1.2.2.2.

Data Item	Description
Process Name:	Record New Supplier Information
Data In:	Valid Supplier Information
Data Out:	New Supplier Information
Process:	(1) Get Supplier Information (2) Add or Update Supplier Information (If something changed)
Attachment	Data Store D7 (Supplier Information)

Table D.5. Process Specification of Process 1.2.3.

Data Item	Description
Process Name:	Generate Purchase Requisition / Produce Requisition
Data In:	Product / Raw Material Information
Data Out:	(1) New Purchase Requisition Information (2) New Produce Requisition Information
Process:	(1) Get Product or Raw Material Information (2) Generate Purchase Requisition or Produce Requisition (3) Record New Purchase Requisition or Produce Requisition in database
Attachment	(1) Data Store D5 (Purchase Requisition Information) (2) Data Store D6 (Produce Requisition Information)

Table D.6. Process Specification of Process 1.3.1.

Data Item	Description
Process Name:	Check Valid Approval Purchase Requisition / Produce Requisition
Data In:	Approval Purchase Requisition / Produce Requisition Information
Data Out:	(1) Valid Approval Purchase Requisition Information (2) Valid Approval Produce Requisition Information
Process:	(1) Get Purchase Requisition / Produce Requisition Information (2) Validate Purchase Requisition / Produce Requisition Information
Attachment	Manager

Table D.7. Process Specification of Process 1.3.2.

Data Item	Description
Process Name:	Record Producing Plan Information
Data In:	(1) Existing Produce Requisition Information (2) Valid Approval Produce Requisition Information
Data Out:	(1) New Producing Plan Information (2) Update Produce Requisition Information
Process:	(1) Get Valid Approval Produce Requisition Information (2) Retrieve Produce Requisition Information (3) Record New Producing Plan Information (4) Update status of Produce Requisition to complete
Attachment	(1) Data Store D6(Produce Requisition Information) (2) Data Store D9 (Producing Plan Information)

Table D.8. Process Specification of Process 1.3.3.

Data Item	Description
Process Name:	Generate Purchase Order
Data In:	(1) Valid Approval Purchase Requisition Information (2) Existing Purchase Requisition Information
Data Out:	(1) Updated Purchase Requisition Information (2) New Purchase Order Information (3) Purchase Order Information
Process:	(1) Get Valid Approval Purchase Requisition Information (2) Retrieve Purchase Requisition Information (3) Record New Purchase Order Information (4) Update status of Purchase Requisition to complete (5) Send the Purchase Order to Supplier
Attachment	(1) Data Store D5 (Purchase Requisition Information) (2) Data Store D8 (Purchase Order Information) (3) Supplier

Table D.9. Process Specification of Process 2.1.

Data Item	Description
Process Name:	Receive Finished Goods
Data In:	(1) Finished Goods Information (2) Existing Producing Plan Information
Data Out:	Valid Finished Goods Information
Process:	(1) Receive Finished Goods Information from Production Division (2) Retrieve Producing Plan Information (3) Validate Finished Goods Information
Attachment	(1) Data Store D9 (Producing Plan Information) (2) Production Division

Table D.10. Process Specification of Process 2.2.

Data Item	Description
Process Name:	Receive Resale Product / Finished Goods.
Data In:	(1) Supplier Invoice (2) Existing Purchase Order Information
Data Out:	Valid Product / Raw Material Information
Process:	(1) Receive Supplier Invoice from Supplier (2) Retrieve Purchase Order Information (3) Validate Product or Raw Material Information
Attachment	(1) Data Store D8 (Purchase Order Information) (2) Supplier

Table D.11. Process Specification of Process 2.3.

Data Item	Description
Process Name:	Update Stock In
Data In:	(1) Valid Finished Goods Description (2) Valid Supplier Invoice
Data Out:	(1) New Product Information (2) New Raw Material Information
Process:	(1) Get Valid Finished Goods Description (2) Get Valid Supplier Invoice (3) Add New Product Information or New Raw Material Information in database (4) Send Supplier Invoice to Financial & Accounting Division
Attachment	(1) Data Store D2 (Product Information) (2) Data Store D3 (Raw Material Information) (3) Financial & Accounting Division

Table D.12. Process Specification of Process 3.1.

Data Item	Description
Process Name:	Check Available Product /Raw Material
Data In:	(1) Sale Order Description (2) Raw Material Request Description (3) Product Type Information (4) Existing Product Information (5) Existing Raw Material Information
Data Out:	Available Product / Raw Material Information
Process:	(1) Receive Sale Order Description from Sale & Marketing Department or get Raw Material Request Description from Production Division (2) Check Available Product or Raw Material in stock
Attachment	(1) Data Store D1 (Product Type Information) (2) Data Store D2 (Product Information) (3) Data Store D3 (Raw Material Information) (4) Sales & Marketing Department (5) Production Division

Table D.13. Process Specification of Process 3.2.

Data Item	Description
Process Name:	Update Stock Out
Data In:	Available Product / Raw Material Information
Data Out:	(1) Raw Material Description (2) Update Raw Material Information (3) Update Product Information (4) Delivery Order
Process:	(1) Get Available Product / Raw Material Information (2) Update quantity in Product Information Database or Raw Material Information Database (3) Generate Delivery Order (4) Send Deliver Order to Financial & Accounting Division and Sales & Marketing Department
Attachment	(1) Data Store D2 (Product Information) (2) Data Store D3 (Raw Material Information) (3) Data Store D10 (Delivery Order Information) (4) Producing Division (5) Financial & Accounting Division (6) Sales & Marketing Department

Table D.14. Process Specification of Process 4.1.

Data Item	Description
Process Name:	Generate Report
Data In:	(1) Supplier Information (2) Purchase Order Information (3) Product Type Information (4) Product Information (5) Raw Material Information
Data Out:	Summary Reports
Process:	(1) Retrieve Information (2) Generate Report that activate by time to manager
Attachment	(1) Data Store D1 (Product Type Information) (2) Data Store D2 (Product Information) (3) Data Store D3 (Raw Material Information) (4) Data Store D7 (Supplier Information) (5) Data Store D8 (Purchase Order Information) (6) Calendar (7) Manager

Table D.15. Process Specification of Process 4.2.

Data Item	Description
Process Name:	Generate EOQ Report
Data In:	(1) Product Type Information (2) Product Information (3) Raw Material Information (4) EOQ Information
Data Out:	Report for Check Available Product
Process:	(1) Retrieve EOQ Information (2) Generate EOQ Report
Attachment	(1) Data Store D1 (Product Type Information) (2) Data Store D2 (Product Information) (3) Data Store D3 (Raw Material Information) (4) Data Store D4 (EOQ Information) (5) Manager





A screenshot of a Windows-style login window titled "Log On". The window has a textured background and displays the company name "Zenith Products International Co.,Ltd." at the top. Below the name are two input fields: "User Name" containing the text "thichakorn" and "Password" containing seven asterisks "*****". At the bottom of the window are two buttons labeled "OK" and "CANCEL".

Figure E.1. Login Screen Form.

A screenshot of the same login window as in Figure E.1, but with an error dialog box overlaid. The error dialog is titled "Logon Error" and features a red "X" icon. The message inside the dialog reads "Invalid Password ! Pls.try again". There is an "OK" button at the bottom of the error dialog. The background login window's "User Name" and "Password" fields are still visible, along with its "OK" and "CANCEL" buttons.

Figure E.2. Invalid User Login Form.

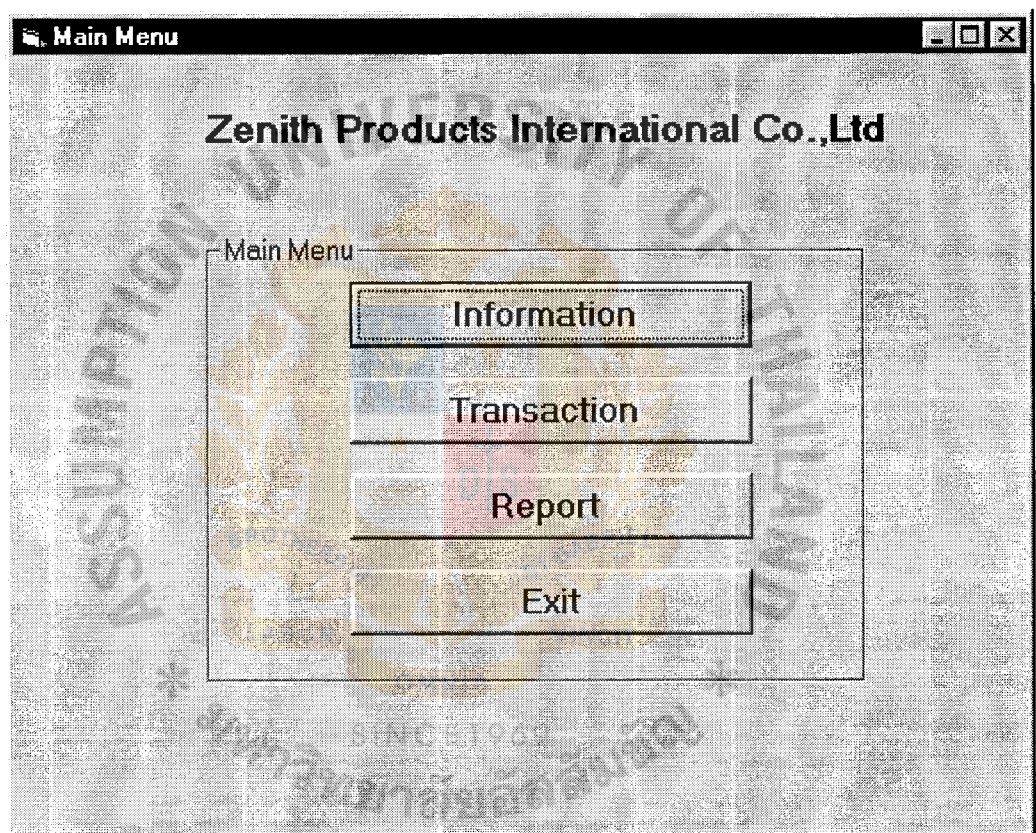


Figure E.3. Main Menu Form.

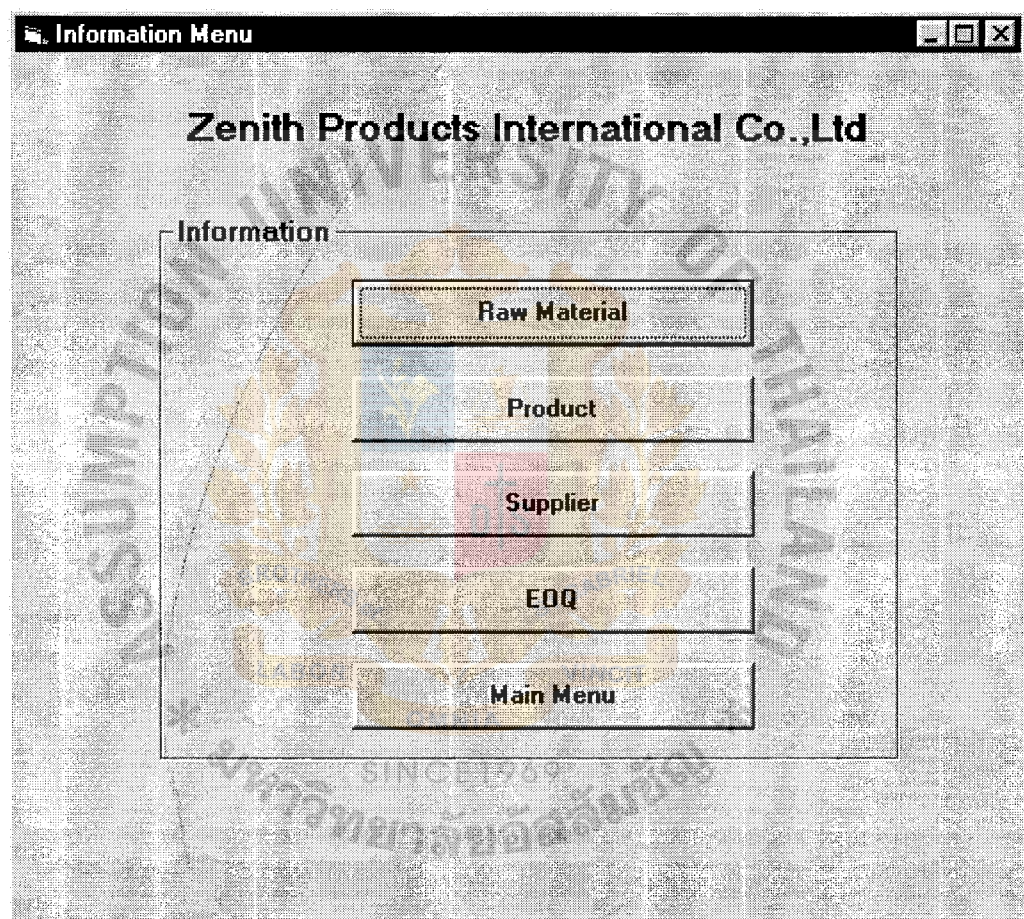


Figure E.4. Menu of Information Form.



Figure E.5. Menu of Transaction Form.

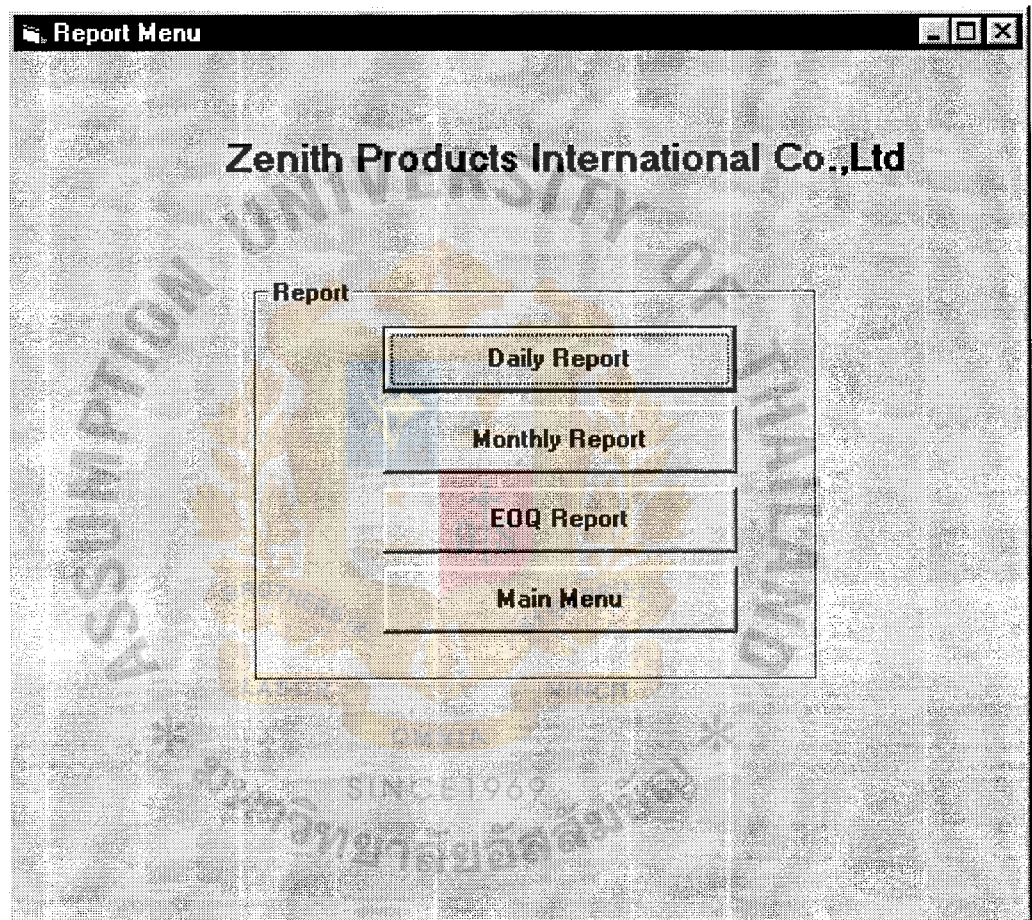


Figure E.6. Menu of Report Form.

Raw Material Information Form

Zenith Products International Co.,Ltd

Raw Material No. :	G202020
Raw Material Name :	CLAMP GENI SX9 12-20 W2 (00)
Description :	
Minimum Quantity :	100
Maximum Quantity :	300
Outstanding Quantity :	174

Add Edit Save Delete Search Exit

Figure E.7. Raw Material Information Form.

Product Information Form

Zenith Products International Co.,Ltd.

Product No	:	PG01020
Product Name	:	แผ่นประยางนอก PP 1
Description	:	แผ่นกลม ขนาด 1-9/16"
Minimum Quantity	:	200
Maximum Quantity	:	500
Outstanding Quantity	:	360

Add Edit Save Delete Search Exit

Figure E.8. Product Information Form.

Supplier Information Form

Zenith Products International Co.,Ltd.

Supplier ID: BJ001

Name - Surname: B & J Rocket International

Address:

No.	74/654	Street	สน. ทำข้าม
Sub District	แสมดำ	District	บางขุนเทียน
Province	กรุงเทพ	Postal Code	10150
Tel No.	0-2294-3416	Fax No.	0-2294-3415

Add Edit Save Delete Search Exit

Figure E.9. Supplier Information Form.

EOQ Information Form

Zenith Products International Co.,Ltd

Date: 31/08/03

Product / Raw Material ID. :	BJ08050
Product / Raw Material Name :	มุ้งทกเหลี่ยม 65*1/2" 23 กริด
Description :	ขนาด 65*1/2' ความหนา 23 กริด
Outstanding Quantity :	42
Minimum Quantity :	100
Maximum Quantity :	300
Lead Time (Days) :	20
Last Order Date :	13/05/03
Last Order Unit :	250

Figure E.10. EOQ Information Form.

Stock In Form

Zenith Products International Co.,Ltd.

Date : 02/09/03

Invoice No. : 19334 P/O No. : 10478

Supplier ID : BJ001 Supplier Name : B & J Rocket International

Product Items

No.	Product No.	Description	@	Qty	Amount
1	PG01020	แผ่นปะยางนอก PP 1	250.00	55	13,750.00
2	PG01040	แผ่นปะยางนอก PP 3	239.00	48	11,472.00
3	PG01170	แผ่นปะยางนอก PP 4/2	190.00	44	8,360.00
4	PG01200	แผ่นปะยางนอก PP 2/3	210.00	39	8,190.00
Total					41,772.00
VAT					2,924.04
Grand Total					44,696.04

Add Edit Save Delete Search Print Exit

Figure E.11. Stock In Form.

Stock Out Form

Zenith Products International Co.,Ltd.

Date : 25/09/03

D/O NO. : 43035

Sale Order No. : 03728 Saleman ID : SR60

Sold To : วิชัยการช่าง Saleman Name : ปราโมทย์ เลิศพันธ์

Product Items

No	Product No.	Description	@	Qty	Amount
1	KP01070	กาแฟปะเย็น 200 ML	40.00	40	1,600.00
2	PG01040	แผ่นปะยางนอก PP5	239.00	50	11,950.00
3	PG02010	แผ่นปะเดือยเล็ก	210.00	50	10,500.00
Total					24,050.00
VAT					1,683.50
Grand Total					25,733.50

Figure E.12. Stock Out Form.

Purchase Order Form

Zenith Products International Co.,Ltd.

Date : 05/09/03

P/O No. : 10503 P/B No. : 10711

Supplier ID : PG010 Supplier Name : Pang Ruber Products

Order Items

No.	Product No.	Description	@	Qty	Amount
1	PG01040	แผ่นปะยางนอก PP3	235.00	100	23,500.00
2	PG01170	แผ่นปะยางนอก PP4/2	190.00	100	19,000.00
3	PG02010	แผ่นปะเดือยเล็ก	90.00	150	13,500.00
4	PG02030	แผ่นปะเดือย PS2	90.00	100	9,000.00
5	PG02081	แผ่นปะเดือย RTS4	95.00	100	9,500.00
Total					74,500.00
VAT					5,215.00
Grand Total					79,715.00

Add Edit Save Delete Search Print Exit

Figure E.13. Purchase Order Form.

Monthly Report Form

Zenith Products International Co.,Ltd.

Type of Reports

☐ Stock In Report

☐ Stock Out Report

☒ Outstanding Report

Date As At: 30 / Sep / 2003

Print Exit

Figure E.14. Monthly Report Form.

EOQ Report Form

Zenith Products International Co.,Ltd.

Type of EOQ Reports

☒ Minimum Inventory Information (รายงานแสดงปริมาณสินค้าที่ต่ำกว่าระดับ)

☐ Maximum Inventory Information (รายงานแสดงปริมาณสินค้าที่เกินกว่าระดับ)

Date As At: 31 / Aug / 2003

Print Exit

Figure E.15. EOQ Report Form.



APPENDIX F
REPORT DESIGN

ZENITH PRODUCTS INTERNATIONAL CO., LTD. บริษัท ซินิธ โปรดักต์ อินเตอร์เนชั่นแนล จำกัด 44/2 MOO 1 TAMBON BANGPRIENG AMPUR BANGBO SAMUTPRAKARN 10560 TEL : (02) 807-1442 (9 Lines) FAX : (02) 807-1441 44/2 หมู่ 1 ต. บางเพรียง อ. บางบ่อ จ. สมุทรปราการ 10560 D/O No. 43035 Date: 25/9/2003 ใบสั่งของ/DELIVERY ORDER FORM					
Sold To : วิชัยการช่าง					
Product No. รหัสสินค้า	Quantity จำนวน หน่วย		Description รายการสินค้า	Price/Unit ราคา/หน่วย	Total ราคารวม
KP01070	40	กล่อง	กาวน้ำปะเย็น 200 ML	40.00	1,600.00
PG01040	50	กล่อง	แผ่นปะยางนอก PP5	239.00	11,950.00
PG02010	50	กล่อง	แผ่นปะเดือยเล็ก	210.00	10,500.00
รวม					24,050.00
Customer Due Date :				ภาษีมูลค่าเพิ่ม %	1,683.50
				รวมทั้งสิ้น	25,733.50
Sale Order No. : 03728			Delivery Place :		
Saleman's Signature :		Inventory Manager Signature :		Date :	

Figure F.1. Delivery Order Form.

ZENITH PRODUCTS INTERNATIONAL CO., LTD. บริษัท ซินิธ โปรดักส์ อินเตอร์เนชันแนล จำกัด 44/2 MOO 1 TAMBON BANGPRIENG AMPUR BANGBO SAMUTPRAKARN 10560 TEL : (02) 807-1442 (9 Lines) FAX : (02) 807-1441 44/2 หมู่ 1 ต. บางเพรียง อ. บางบ่อ จ. สมุทรปราการ 10560 P/O No. 10503 Date: 05/09/03 ใบสั่งซื้อ/PURCHASING ORDER FORM					
บริษัท/ห้าง/ร้าน Pang Ruber Products Company Supplier Name				เลขที่ P/R 10711	
No.	Product No.	Description	Quantity	Price/Unit	Total
1	PG01040	แผ่นปะยางนอก PP3	100	235.00	23,500.00
2	PG01170	แผ่นปะยางนอก PP4/2	100	190.00	19,000.00
3	PG02010	แผ่นปะเดือยเล็ก	150	90.00	13,500.00
4	PG02030	แผ่นปะเดือย PS2	100	90.00	9,000.00
5	PG02081	แผ่นปะเดือย RTS4	100	95.00	9,500.00
รวม					74,500.00
ภาษีมูลค่าเพิ่ม %					5,215.00
รวมทั้งสิ้น					79,715.00
..... Inventory Manager Signature		 Purchasing Manager Signature		

Figure F.2. Purchasing Order Form.

Zenith Products International Co., Ltd.

รายงานสินค้ารับเข้า

ณ วันที่ 30/09/03

วันที่	เลขที่ใบเสร็จ	รหัสสินค้า	ชื่อสินค้า	จำนวน	ราคา/หน่วย	มูลค่าสินค้า
02/09/03	19334	PG01020	แผ่นปะยางนอก PP1	55	250.00	13,750.00
		PG01040	แผ่นปะยางนอก PP 3	48	239.00	11,472.00
		PG01170	แผ่นปะยางนอก PP 4/2	44	190.00	8,360.00
		PG01200	แผ่นปะยางนอก PP 2/3	39	210.00	8,190.00
			ยอดรวมรายวัน	186	889.00	41,772.00
10/09/03	22961	BJ01040	ใบมีดชุดยาง R-3-25 SC DK	50	200.00	10,000.00
	30489	DJ01010	ผ้าเจ็คเก็ค 184 MM	42	340.00	14,280.00
		DJ01030	ผ้าเจ็คเก็ค 238 MM	58	420.00	24,360.00
		DJ01070	ผ้าเจ็คเก็ค 200 MM	87	390.00	33,930.00
			ยอดรวมรายวัน	237	1,350.00	82,570.00
			ยอดรวมทั้งสิ้น	423	2,239.00	124,342.00

Figure F.3. Stock In Report.

Zenith Products International Co., Ltd.

รายงานสินค้าขายไป

ณ วันที่ 30/09/03

หน้า 1

วันที่	เลขที่ใบส่งของ	รหัสสินค้า	ชื่อสินค้า	จำนวน	ราคา/หน่วย	มูลค่าสินค้า
17/09/03	43029	EF01010	กาต้มน้ำสายพาน ELI-FLEX 100G	26	850.00	22,100.00
		EF01020	กาต้มน้ำสายพาน ELI-FLEX 150G	4	2,250.00	9,000.00
22/09/03	43030	DJ01030	ผ้าเช็ดมือ 238 MM	20	420.00	8,400.00
			ยอดรวมรายวัน	50	3,520.00	39,500.00
25/09/03	43031	GY01050	สายลมดูดเชื้อ 1/2 HORISON 250 ปอนด์	15	70.00	1,050.00
		GS01020	สว่านลม 22000 รอบ GP-854A	29	750.00	21,750.00
		KP01070	กาต้มน้ำประป็น 200 ML	30	40.00	1,200.00
		MY39080	APARTER 9192	1	1,200.00	1,200.00
			ยอดรวมรายวัน	75	2,060.00	25,200.00
			ยอดรวมทั้งสิ้น	125	5,580.00	64,700.00

Figure F.4. Stock Out Report.

Zenith Products International Co., Ltd.

รายงานแสดงปริมาณสินค้าคงเหลือ

ณ วันที่ 30/09/03

					หน้า 1
ลำดับที่	รหัสสินค้า	ชื่อสินค้า	ระดับต่ำสุด	ระดับสูงสุด	จำนวนคงเหลือ
1	BJ01030	ใบมีดชุดยาง R-3-STD DK	50	200	150
2	BJ02060	หัวจับใบมีดชุดยาง R-4-AP 1 1/2 AH	50	200	98
3	BJ08050	ปั๊มหกเหลี่ยม 65x1/2" 23 กริต	100	300	247
4	CM01010	เครื่องถ่วงล้อ CEMB C20	10	50	19
5	EF01010	กาวต่อสายพาน ELI-FLEX 100G	100	300	288
6	EF01020	กาวต่อสายพาน ELI-FLEX 150G	100	300	174
7	EF01030	กาวต่อสายพาน ELI-FLEX 300G	100	300	142
8	PG01020	แผ่นปะยางนอก PP 1	200	500	360
9	PG01040	แผ่นปะยางนอก PP 3	200	500	472
10	PG01060	แผ่นปะยางนอก PP 5	200	500	297
11	PG02010	แผ่นปะเดือยเล็ก	100	250	148
12	PG02030	แผ่นปะเดือย PS 2	100	300	153
13	PG02081	แผ่นปะเดือย RTS 4	100	250	131

Figure F.5. Outstanding Inventory Information Report.

Zenith Products International Co., Ltd.

รายงานแสดงปริมาณสินค้าต่ำกว่าระดับ

ณ วันที่ 31/08/03

ลำดับที่	รหัสสินค้า	ชื่อสินค้า	ระดับต่ำสุด	จำนวนคงเหลือ
1	BJ02060	หัวจับใบมีดชุดยาง R-4-AP I 1/2 AH	50	21
2	BJ08050	ปั๊มทกเหลี่ยม 65x1/2" 23 กริต	100	42
4	EF01030	กาวต่อสายพาน ELI-FLEX 300G	100	73
5	KP01070	กาวน้ำปะเซ็น 200 ML	100	54
6	PG02010	แผ่นปะเดือยเล็ก	100	54

Figure F.6. Minimum Inventory Information Report.

Zenith Products International Co., Ltd.

รายงานแสดงปริมาณสินค้าที่เกินกว่าระดับ

ณ วันที่ 31/08/03

ลำดับที่	รหัสสินค้า	ชื่อสินค้า	ระดับสูงสุด	จำนวนคงเหลือ
1	CM01010	เครื่องถ่วงล้อ CEMB C20	50	67
2	EF01010	กาวต่อสายพาน ELI-FLEX 100G	300	475

หน้า 1

Figure F.7. Maximum Inventory Information Report.



APPENDIX G

ALTERNATIVE CANDIDATE SOLUTIONS

G.1 Alternative Candidate

There are alternatives for the new system as presented below:

Table G.1. Candidate Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
(1) <u>Portion of System Computerized</u> Brief description of portion of the system that would be computerized in this candidate.	Inventory Information operations which include inquiry and reports	Same as candidate 1, but more powerful and more flexible to expand the portion of system to support other operations.	Same as candidate 2.
(2) <u>Benefit</u> Brief description the business benefit gained from this candidate.	This solution can support all user requirements.	This solution fully supports all user requirements, provides efficient interaction between user, and support large database.	Same as candidate 2, and this solution is not too expensive
(3) <u>Method of Data Processing</u> Generally some combination of: online, batch, deferred batch, remote batch, and real time.	Client/Server	Same as candidate 1.	Same as candidate 1.
(4) <u>Server and Clients</u> A description of the servers and clients needed to support this candidate.	Server: Intel Pentium IV Processor 2.0 GHz., 60GB. HDD, Cache 1 GB., RAM 256 MB., 1.44 MB. Floppy Drive, with MS Windows 2000 Server	Same as candidate 1.	Same as candidate 1.

Table G.1. Candidate Matrix (Continued).

Characteristics	Candidate 1	Candidate 2	Candidate 3
	Clients: Intel Pentium III Processor 1.0 GHz., 20GB. HDD, Cache 256 KB., RAM 128 MB., 1.44 MB. Floppy Drive, with MS Windows 98		
(5) <u>Software Tools needed</u> Software tools needed to design and build the candidate. Not generally applicable if applications software packages are to be purchased.	C++ and MS DOS	Oracle Developer Release 5.0	Microsoft Access 2000 Microsoft Visual Basic 6.0
(6) <u>Application Software</u> A description of the software to be purchased, built, accessed, or some combination of these techniques.	Custom Solution	Outsourcing Solution	Same as candidate 2.
(7) <u>Storage Database Method</u> Brief description of how data would be organized, and what storage media would be used.	File and Diskette	Oracle v8.x	Microsoft Access 2000
(8) <u>Input Devices and Implications</u> A description of input methods to be used, input devices, special input requirements, and input considerations.	Keyboard and Mouse	Same as candidate 1.	Same as candidate1.

Table G.1. Candidate Matrix (Continued).

Characteristics	Candidate 1	Candidate 2	Candidate 3
<p>(9) <u>Output Devices and Implications</u> A description of output devices that would be used, special output requirements, and output considerations.</p>	<p>4 Laser Printers, 1 Dot Matrix Printer, 17 inches SVGA Monitor, 15 inches SVGA Monitor.</p>	<p>Same as candidate 1.</p>	<p>Same as candidate 1.</p>

There are the differences among those three alternative candidates. Not only the characteristics, but also the processing efficiency, flexibility, end-user friendliness, and programming complexity should be considered. The capacity of each alternative can be determined from Table G.2.

Table G.2. Comparison of Alternative Candidates.

Alternative	Processing Efficiency	Flexibility	End-User Friendliness	Programming Complexity
Candidate 1	Low	Low	Low	Low
Candidate 2	Medium –High	High	Medium	High
Candidate 3	High	High	High	Low

Explanation of the degree of capacity:

(1) Processing Efficiency

Candidate 1 uses C++ Application for processing. So the processing efficiency is lower than others. For candidate 2 and 3, Oracle and Microsoft Access 2000 support high speed processing.

(2) Flexibility

Candidate 1 uses C++, so the flexibility is lower than others. While the flexibility of candidate 2 and 3 can be done according to the characteristic of the candidate to expand the porting of system supporting other operations.

(3) End-User Friendliness

The interface of candidate 1 generating from C++ is not object-oriented, which is not user friendly as interface of candidate 2 and 3.

(4) Programming Complexity

The programming of candidate 1 can use custom solution, so the programming complexity is too low. While the programming of candidate 2 cannot use custom solution and require programming license, so the programming complexity is too high. For the programming of candidate 3, it can use both custom solution and outsourcing because the programming complexity is low.

G.2 Feasibility Analysis

From the Feasibility Analysis Matrix below, the Candidate 3 is the best overall solution, as it gets the highest score of 91 in ranking.

Table G.3. Feasibility Analysis Matrix.

Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3
<p>(1) <u>Operational Feasibility</u></p> <p>Functionality: A description of to what degree the candidate would benefit the company and how well the system would work.</p> <p>Political: A description of how well received this solution would be from both user, management, and organization perspective.</p>	30%	<p>Support the required functionality.</p> <p>Many users and management accept this solution, as it supports all their requirements. But the system may not be able to support large database.</p> <p>Score: 80</p>	<p>Fully supports the required functionality.</p> <p>Many users and management accept this candidate, as it fully supports their requirements and can be expanded to support other functions in the future. Moreover, The system can be able to support large database.</p> <p>Score: 95</p>	<p>Same as candidate 2</p> <p>Score: 95</p>
<p>(2) <u>Technical Feasibility</u></p> <p>Technology: An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate.</p> <p>Expertise: An assessment of the technical expertise needed to develop, operate, and maintain the candidate system.</p>	30%	<p>Microsoft DOS and C++ can easily be used to design and build the system. It can operate the system, but the system is not user friendly.</p> <p>Required to hire or train C++ expertise to perform modifications for integration requirements.</p> <p>Score: 80</p>	<p>Oracle can effectively be used to design and build the system. It is very good at support large database, but it may be complex and hard to learn.</p> <p>Require hiring a computer company to construct all the system, and the system engineer to take care of the system.</p> <p>Score: 85</p>	<p>Microsoft Access 2000 and Microsoft Visual 6.0 can effectively be used to design and build the system. It can easily learn and it is the user-friendly system. Moreover, it is very good at support large database.</p> <p>Require hiring a computer company to construct all the system, and the users can do maintenance.</p> <p>Score: 95</p>

Table G.3. Feasibility Analysis Matrix (Continued).

Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3
(3) <u>Economic Feasibility</u>	30%	Approximately	Approximately	Approximately
Development Cost:		679,900.00 baht	736,900.00 baht	655,900.00 baht
Break-Even Point:		1 year and 5 months	2 year and 3 months	1 year and 6 months
Payback Period:		1 year and 5 months	1 year and 6 months	1 year and 4 months
Detailed Calculations:		See page 105-111	See page 112-118	See page 119-125
		Score: 95	Score: 70	Score: 85
(4) <u>Schedule Feasibility</u>	10%	About 1.5 month	About 3 months	About 2.5 months
An assessment of how long the solution will take to design and implement.		Score: 95	Score: 85	Score: 85
Ranking	100%	★ 86	83.5	91

G.3 Cost/Benefit Analysis for Candidate 1

(1) Cost of Candidate 1 Computerized System

Table G.4. Computerized System Cost for Candidate 1, Baht.

Cost items		Years				
		1	2	3	4	5
<u>Fixed Cost</u>						
Hardware Cost:						
Computer Server Cost	1 unit @ 52,000	10,400.00	10,400.00	10,400.00	10,400.00	10,400.00
Client Machine Cost	6 units @ 32,000	38,400.00	38,400.00	38,400.00	38,400.00	38,400.00
Laser Printer	4 units @ 15,000	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Dot Matrix Printer	1 unit @ 7,000	1,400.00	1,400.00	1,400.00	1,400.00	1,400.00
UPS 1000 VA	1 unit @ 5,900	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00
Total Hardware Cost		63,380.00	63,380.00	63,380.00	63,380.00	63,380.00
Software Cost:						
Windows 2000 Server	1 unit @ 30,000	6,000.00	6,000.00	6,000.00	6,000.00	6,000.00
Microsoft Windows 98	6 units @ 8,000	9,600.00	9,600.00	9,600.00	9,600.00	9,600.00
MS Office 2000	6 units @ 12,000	14,400.00	14,400.00	14,400.00	14,400.00	14,400.00
Network Cost		9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
Total Software Cost		39,000.00	39,000.00	39,000.00	39,000.00	39,000.00
Implementation Cost:						
Software Development Cost		90,000.00	-	-	-	-
Training Cost		50,000.00	-	-	-	-
Total implementation Cost		140,000.00	-	-	-	-
Maintenance Cost		-	20,000.00	22,000.00	24,200.00	26,620.00
Total Fixed Cost		242,380.00	122,380.00	124,380.00	126,580.00	129,000.00
<u>Operating Cost</u>						
Salary Cost:						
Inventory Manager	1 person @ 25,000	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Inventory Supervision	1 person @ 18,000	18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Inventory Officer	2 persons @ 15,000	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Total Monthly Salary Cost		73,000.00	80,300.00	88,330.00	97,163.00	106,879.30
Total Annual Salary Cost		876,000.00	963,600.00	1,059,960.00	1,165,956.00	1,282,551.60

Table G.4. Computerized System Cost for Candidate 1, Baht (Continued).

Cost items		Years				
		1	2	3	4	5
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annum	11,000.00	12,100.00	13,310.00	14,641.00	16,105.10
Paper	Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Utility	Per Annum	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Miscellaneous	Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Annual Office Supplies & Miscellaneous Cost		45,000.00	49,500.00	54,450.00	59,895.00	65,884.50
Total Operating Cost		921,000.00	1,013,100.00	1,114,410.00	1,225,851.00	1,348,436.10
Total Computerized System Cost		1,163,380.00	1,135,480.00	1,238,790.00	1,352,431.00	1,477,436.10

Table G.5. Five Years' Accumulated Cost for Candidate 1, Baht.

Year	Total Computerized System Cost	Accumulated Cost
1	1,163,380.00	1,163,380.00
2	1,135,480.00	2,298,860.00
3	1,238,790.00	3,537,650.00
4	1,352,431.00	4,890,081.00
5	1,477,436.10	6,367,517.10
Total	6,367,517.10	-

(2) Cost Comparison and Breakeven Analysis for Candidate 1.

Table G.6. The Comparison of the System Cost for Candidate 1, Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,081,980.00	1,163,380.00
2	2,271,160.00	2,298,860.00
3	3,578,260.00	3,537,650.00
4	5,015,072.00	4,890,081.00
5	6,594,567.20	6,367,517.10

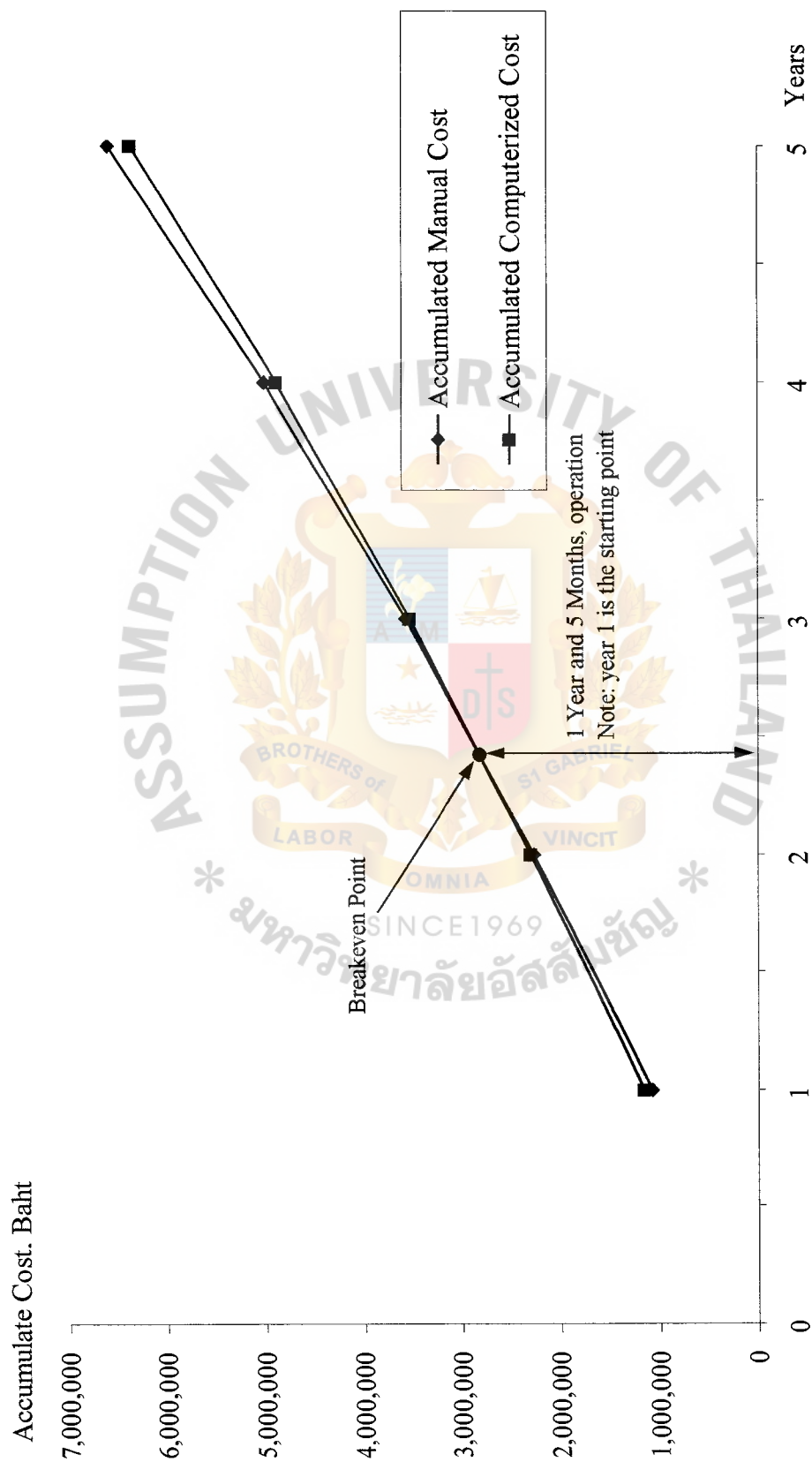


Figure G.1. Cost Comparison between the Manual and Proposed System for Candidate 1.

(3) Payback Analysis

The following cost items are required, as shown in Table G.7.

Investment Cost:

Hardware cost	316,900	Baht
Software cost	223,000	Baht
Software Development cost	90,000	Baht
Training cost	50,000	Baht
Total Investment Cost	679,900	Baht

Annual Operating Cost:

People-ware cost	876,000	Baht
Office Supplies & Miscellaneous cost	65,900	Baht
Total Annual Operating Cost	941,900	Baht

Annual Cost:

The formula of annual cost of the Computerized system is

$$\begin{aligned}\text{Annual Cost} &= (\text{Investment Cost/Estimated System Life}) + \\ &\quad \text{Annual Operating Cost} \\ &= (679,900/5) + 941,900 \\ &= 1,077,880 \text{ Baht}\end{aligned}$$

Saving:

Staff	144,000	Baht
Office Supplies & Miscellaneous	7,000	Baht
Opportunity cost & Intangible Benefit	1,302,200	Baht
Total Saving	1,453,200	Baht

Table G.7. Payback Analysis for Candidate 1, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development cost:	679,900.00						
Operation & Maintenance cost:		941,900.00	1,036,090.00	1,139,699.00	1,253,668.90	1,379,035.79	1,516,939.37
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted costs (adjusted to present value):	679,900.00	856,187.10	855,810.34	855,913.95	856,255.86	856,381.23	855,553.80
Cumulative time-adjusted costs over life time	679,900.00	1,552,087.10	2,407,897.44	3,263,811.39	4,120,067.25	4,976,448.47	5,832,002.28
Benefits derived from operation of new system:	0.00	1,453,200.00	1,598,520.00	1,758,372.00	1,934,209.20	2,127,630.12	2,340,393.13
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted benefits (adjusted to present value):	0.00	1,320,958.80	1,320,377.52	1,320,537.37	1,321,064.88	1,321,258.30	1,319,981.73
Cumulative time-adjusted benefits over life time:	0.00	1,320,958.80	2,641,336.32	3,961,873.69	5,282,938.58	6,604,196.88	7,924,178.61
Cumulative lifetime time-adjusted costs + benefits:	-679,900.00	-215,128.30	249,438.88	714,062.30	1,178,871.33	1,643,748.41	2,108,176.33

Then the Payback period is calculated to judge the profitability of the system as in Table G.7. and Figure G.2.

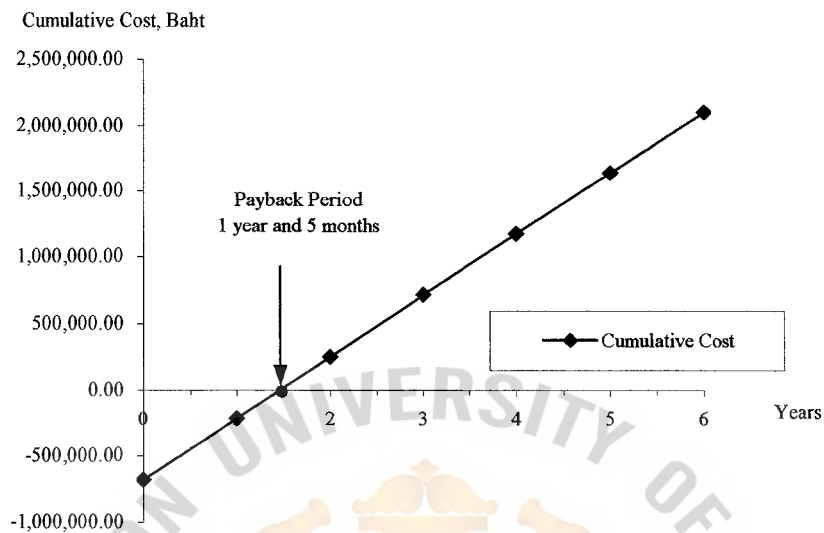


Figure G.2. Payback Period for Candidate 1.

As in Figure G.2. the graph of cumulative cost of computerized system crosses the x-axis at 1.46 years or the payback period of the computerized system is 1 year and 5 months.

Moreover, the payback period can be calculated by the formula as follows:

$$P = \frac{\text{Last year of negative Cash flow difference}}{\text{Cumulative different last negative year}} + \frac{\text{Absolute value of cumulative difference (last negative plus first year positive year)}}{\text{Cumulative different last negative year}}$$

Where P Payback Period

$$P = 1 + \{215,128.30 / (215,128.30 + 249,438.88)\}$$

$$= 1.46 \text{ years or 1 year and 5 months}$$

(4) Return-on-Investment Analysis (ROI)

Return-on-Investment Analysis technique compares the lifetime profitability of alternative solutions or projects. The ROI for a project is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. The ROI for a potential project is calculated by using the data from Table G.7. as follows:

$$\text{ROI} = \frac{(\text{Estimated lifetime benefits} - \text{Estimated lifetime costs})}{\text{Estimated lifetime costs}}$$

$$\begin{aligned}\text{ROI} &= ((7,924,178.61 - 5,816,002.28) / 5,816,002.28) \times 100 \\ &= 0.36 \times 100 \\ &= 36\%\end{aligned}$$

Therefore, the lifetime ROI is 36 percent.

G.4 Cost/Benefit Analysis for Candidate 2

(1) Cost of Candidate 2 Computerized System

Table G.8. Computerized System Cost for Candidate 2, Baht.

Cost items		Years				
		1	2	3	4	5
<u>Fixed Cost</u>						
Hardware Cost:						
Computer Server Cost	1 unit @ 52,000	10,400.00	10,400.00	10,400.00	10,400.00	10,400.00
Client Machine Cost	6 units @ 32,000	38,400.00	38,400.00	38,400.00	38,400.00	38,400.00
Laser Printer	4 units @ 15,000	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Dot Matrix Printer	1 unit @ 7,000	1,400.00	1,400.00	1,400.00	1,400.00	1,400.00
UPS 1000 VA	1 unit @ 5,900	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00
Total Hardware Cost		63,380.00	63,380.00	63,380.00	63,380.00	63,380.00
Software Cost:						
Windows 2000 Server	1 unit @ 30,000	6,000.00	6,000.00	6,000.00	6,000.00	6,000.00
Microsoft Windows 98	6 units @ 8,000	9,600.00	9,600.00	9,600.00	9,600.00	9,600.00
MS Office 2000	6 units @ 12,000	14,400.00	14,400.00	14,400.00	14,400.00	14,400.00
Oracle License	1 unit @ 42,000	8,400.00	8,400.00	8,400.00	8,400.00	8,400.00
Network Cost		9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
Total Software Cost		47,400.00	47,400.00	47,400.00	47,400.00	47,400.00
Implementation Cost:						
Software Development Cost		103,000.00	-	-	-	-
Training Cost		80,000.00	-	-	-	-
Total implementation Cost		183,000.00	-	-	-	-
Maintenance Cost		-	22,000.00	24,200.00	26,620.00	29,282.00
Total Fixed Cost		293,780.00	132,780.00	134,980.00	137,400.00	140,062.00
<u>Operating Cost</u>						
Salary Cost:						
Inventory Manager	1 person @ 25,000	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Inventory Supervision	1 person @ 18,000	18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Inventory Officer	2 persons @ 15,000	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Total Monthly Salary Cost		73,000.00	80,300.00	88,330.00	97,163.00	106,879.30
Total Annual Salary Cost		876,000.00	963,600.00	1,059,960.00	1,165,956.00	1,282,551.60

Table G.8. Computerized System Cost for Candidate 2, Baht (Continued).

Cost items		Years				
		1	2	3	4	5
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annum	11,000.00	12,100.00	13,310.00	14,641.00	16,105.10
Paper	Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Utility	Per Annum	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Miscellaneous	Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Annual Office Supplies & Miscellaneous Cost		45,000.00	49,500.00	54,450.00	59,895.00	65,884.50
Total Operating Cost		921,000.00	1,013,100.00	1,114,410.00	1,225,851.00	1,348,436.10
Total Computerized System Cost		1,214,780.00	1,145,880.00	1,249,390.00	1,363,251.00	1,488,498.10

Table G.9. Five Years' Accumulated Cost for Candidate 2, Baht.

Year	Total Computerized System Cost	Accumulated Cost
1	1,214,780.00	1,214,780.00
2	1,145,880.00	2,360,660.00
3	1,249,390.00	3,610,050.00
4	1,363,251.00	4,973,301.00
5	1,488,498.10	6,461,799.10
Total	6,461,799.10	-

(2) Cost Comparison and Breakeven Analysis for Candidate 2.

Table G.10. The Comparison of the System Cost for Candidate 2, Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,081,980.00	1,214,780.00
2	2,271,160.00	2,360,660.00
3	3,578,260.00	3,610,050.00
4	5,015,072.00	4,973,301.00
5	6,594,567.20	6,461,799.10

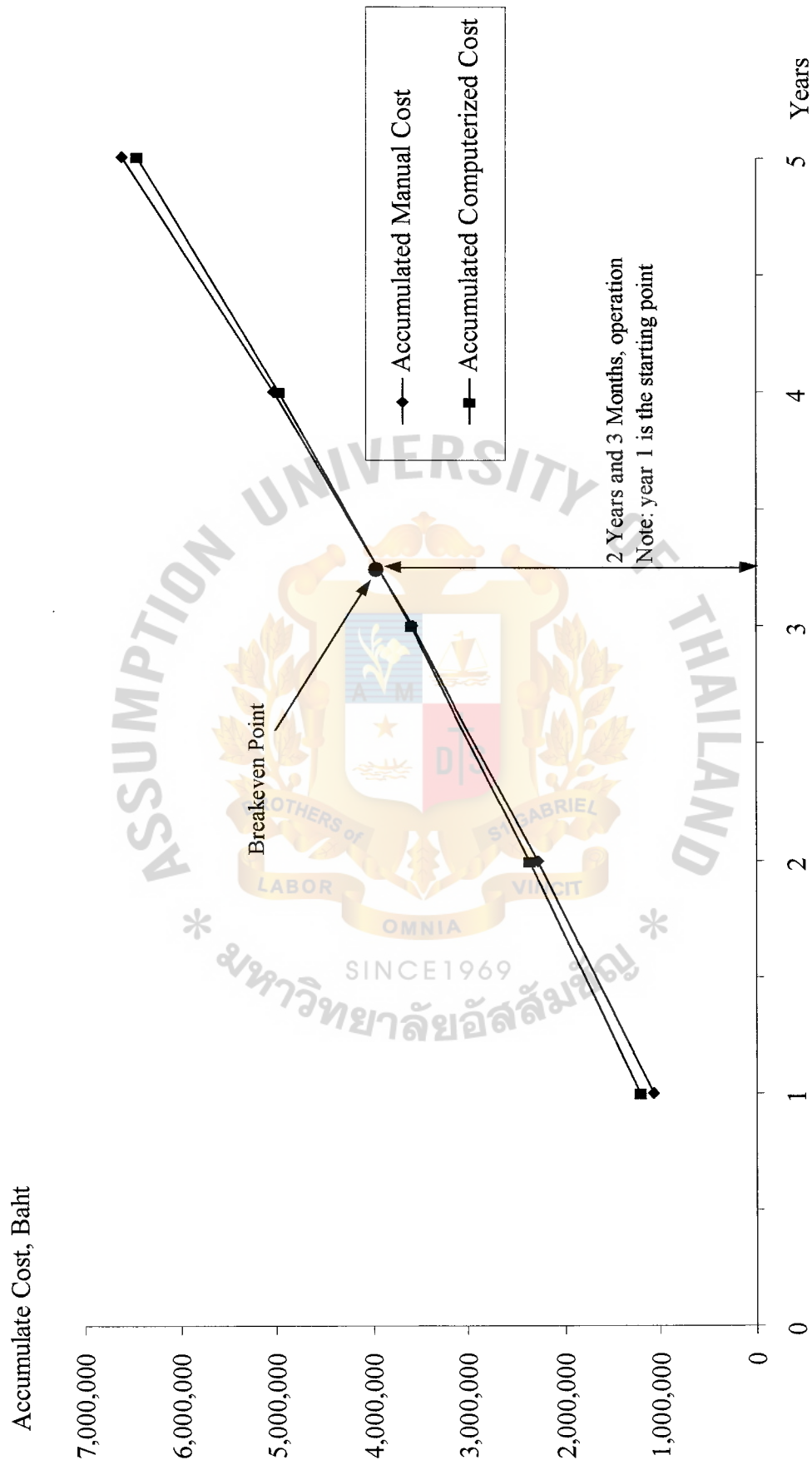


Figure G.3. Cost Comparison between the Manual and Proposed System for Candidate 2.

(3) Payback Analysis

The following cost items are required, as shown in Table G.11.

Investment Cost:

Hardware cost	316,900	Baht
Software cost	237,000	Baht
Software Development cost	103,000	Baht
Training cost	80,000	Baht
Total Investment Cost	736,900	Baht

Annual Operating Cost:

People-ware cost	876,000	Baht
Office Supplies & Miscellaneous cost	65,900	Baht
Total Annual Operating Cost	941,900	Baht

Annual Cost:

The formula of annual cost of the Computerized system is

$$\begin{aligned}\text{Annual Cost} &= (\text{Investment Cost/Estimated System Life}) + \\ &\quad \text{Annual Operating Cost} \\ &= (736,900/5) + 941,900 \\ &= 1,089,280 \text{ Baht}\end{aligned}$$

Saving:

Staff	144,000	Baht
Office Supplies & Miscellaneous	7,000	Baht
Opportunity cost & Intangible Benefit	1,302,200	Baht
Total Saving	1,453,200	Baht

Table G.11. Payback Analysis for Candidate 2, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development cost:	736,900.00						
Operation & Maintenance cost:		941,900.00	1,036,090.00	1,139,699.00	1,253,668.90	1,379,035.79	1,516,939.37
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted costs (adjusted to present value):	736,900.00	856,187.10	855,810.34	855,913.95	856,255.86	856,381.23	855,553.80
Cumulative time-adjusted costs over life time	736,900.00	1,593,087.10	2,448,897.44	3,304,811.39	4,161,067.25	5,017,448.47	5,873,002.28
Benefits derived from operation of new system:	0.00	1,453,200.00	1,598,520.00	1,758,372.00	1,934,209.20	2,127,630.12	2,340,393.13
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted benefits (adjusted to present value):	0.00	1,320,958.80	1,320,377.52	1,320,537.37	1,321,064.88	1,321,258.30	1,319,981.73
Cumulative time-adjusted benefits over life time:	0.00	1,320,958.80	2,641,336.32	3,961,873.69	5,282,938.58	6,604,196.88	7,924,178.61
Cumulative lifetime time-adjusted costs + benefits:	-736,900.00	-272,128.30	192,438.88	657,062.30	1,121,871.33	1,586,748.41	2,051,176.33

Then the Payback period is calculated to judge the profitability of the system as in Table G.11. and Figure G.4.

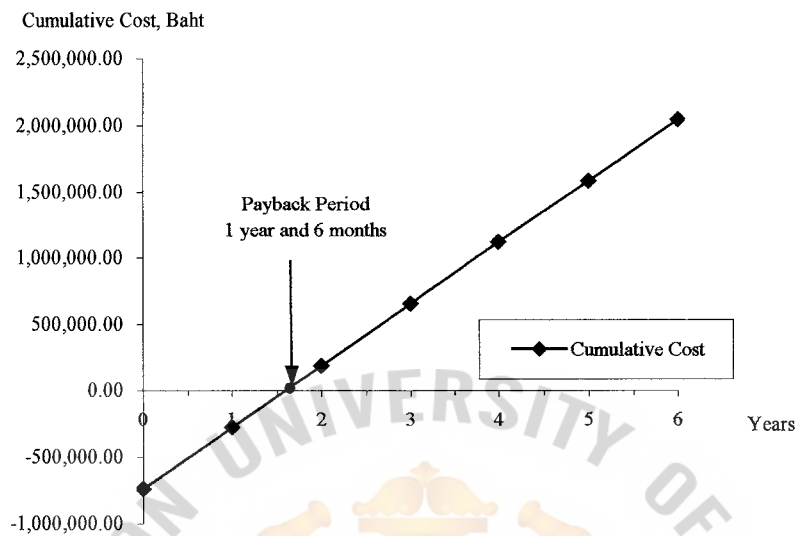


Figure G.4. Payback Period for Candidate 2.

As in Figure G.4. the graph of cumulative cost of computerized system crosses the x-axis at 1.6 years or the payback period of the computerized system is 1 year and 6 months.

Moreover, the payback period can be calculated by the formula as follows:

$$P = \frac{\text{Last year of negative Cash flow difference}}{\text{Cumulative different last negative year}} + \frac{\text{Absolute value of cumulative difference (last negative plus first year positive year)}}{\text{Cumulative different last negative year}}$$

Where P Payback Period

$$P = 1 + \{272,128.30 / (272,128.30 + 192,438.88)\}$$

$$= 1.6 \text{ years or 1 year and 6 months}$$

(4) Return-on-Investment Analysis (ROI)

Return-on-Investment Analysis technique compares the lifetime profitability of alternative solutions or projects. The ROI for a project is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. The ROI for a potential project is calculated by using the data from Table G.11. as follows:

$$\text{ROI} = \frac{(\text{Estimated lifetime benefits} - \text{Estimated lifetime costs})}{\text{Estimated lifetime costs}}$$

$$\begin{aligned}\text{ROI} &= ((7,924,178.61 - 5,873,002.28) / 5,873,002.28) \times 100 \\ &= 0.35 \times 100 \\ &= 35\%\end{aligned}$$

Therefore, the lifetime ROI is 35 percent.

G.5 Cost/Benefit Analysis for Candidate 3

(1) Cost of Candidate 3 Computerized System

Table G.12. Computerized System Cost for Candidate 3, Baht.

Cost items		Years				
		1	2	3	4	5
<u>Fixed Cost</u>						
Hardware Cost:						
Computer Server Cost	1 unit @ 52,000	10,400.00	10,400.00	10,400.00	10,400.00	10,400.00
Client Machine Cost	6 units @ 32,000	38,400.00	38,400.00	38,400.00	38,400.00	38,400.00
Laser Printer	4 units @ 15,000	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Dot Matrix Printer	1 unit @ 7,000	1,400.00	1,400.00	1,400.00	1,400.00	1,400.00
UPS 1000 VA	1 unit @ 5,900	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00
Total Hardware Cost		63,380.00	63,380.00	63,380.00	63,380.00	63,380.00
Software Cost:						
Windows 2000 Server	1 unit @ 30,000	6,000.00	6,000.00	6,000.00	6,000.00	6,000.00
Microsoft Windows 98	6 units @ 8,000	9,600.00	9,600.00	9,600.00	9,600.00	9,600.00
MS Office 2000	6 units @ 12,000	14,400.00	14,400.00	14,400.00	14,400.00	14,400.00
Network Cost		9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
Total Software Cost		39,000.00	39,000.00	39,000.00	39,000.00	39,000.00
Implementation Cost:						
Software Development Cost		94,000.00	-	-	-	-
Training Cost		50,000.00	-	-	-	-
Total implementation Cost		144,000.00	-	-	-	-
Maintenance Cost		-	20,000.00	22,000.00	24,200.00	26,620.00
Total Fixed Cost		246,380.00	122,380.00	124,380.00	126,580.00	129,000.00
<u>Operating Cost</u>						
Salary Cost:						
Inventory Manager	1 person @ 25,000	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Inventory Supervision	1 person @ 18,000	18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Inventory Officer	2 persons @ 15,000	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Total Monthly Salary Cost		73,000.00	80,300.00	88,330.00	97,163.00	106,879.30
Total Annual Salary Cost		876,000.00	963,600.00	1,059,960.00	1,165,956.00	1,282,551.60

Table G.12. Computerized System Cost for Candidate 3, Baht (Continued).

Cost items	Years				
	1	2	3	4	5
Office Supplies and Miscellaneous Cost:					
Stationary Per Annum	11,000.00	12,100.00	13,310.00	14,641.00	16,105.10
Paper Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Utility Per Annum	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Miscellaneous Per Annum	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Total Annual Office Supplies & Miscellaneous Cost	45,000.00	49,500.00	54,450.00	59,895.00	65,884.50
Total Operating Cost	921,000.00	1,013,100.00	1,114,410.00	1,225,851.00	1,348,436.10
Total Computerized System Cost	1,167,380.00	1,135,480.00	1,238,790.00	1,352,431.00	1,477,436.10

Table G.13. Five Years' Accumulated Cost for Candidate 3, Baht.

Year	Total Computerized System Cost	Accumulated Cost
1	1,167,380.00	1,167,380.00
2	1,135,480.00	2,302,860.00
3	1,238,790.00	3,541,650.00
4	1,352,431.00	4,894,081.00
5	1,477,436.10	6,371,517.10
Total	6,371,517.10	-

(2) Cost Comparison and Breakeven Analysis for Candidate 3.

Table G.14. The Comparison of the System Cost for Candidate 3, Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,081,980.00	1,167,380.00
2	2,271,160.00	2,302,860.00
3	3,578,260.00	3,541,650.00
4	5,015,072.00	4,894,081.00
5	6,594,567.20	6,371,517.10

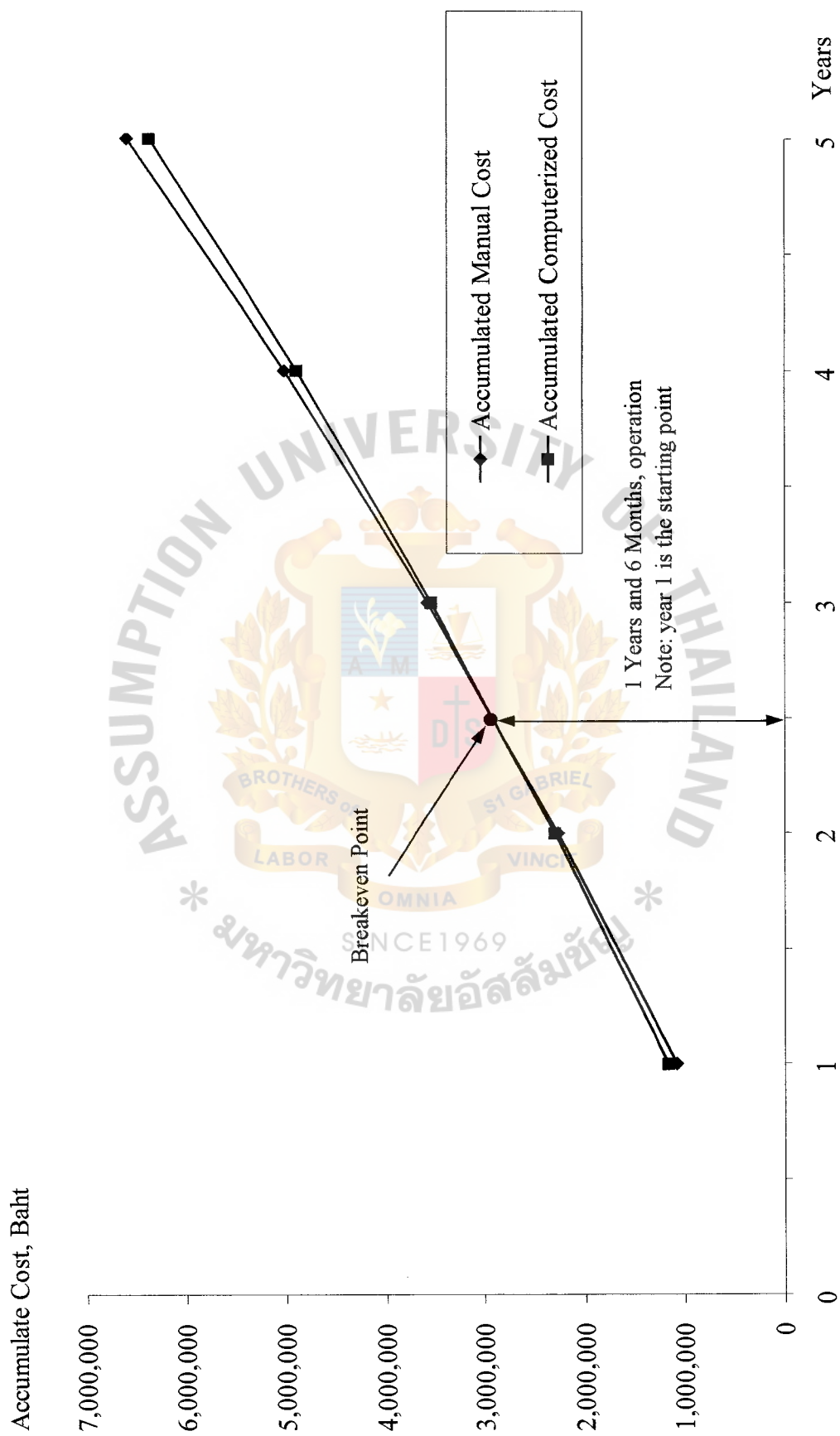


Figure G.5. Cost Comparison between the Manual and Proposed System for Candidate 3.

(3) Payback Analysis

The following cost items are required, as shown in Table G.11.

Investment Cost:

Hardware cost	316,900	Baht
Software cost	195,000	Baht
Software Development cost	94,000	Baht
Training cost	50,000	Baht
Total Investment Cost	655,900	Baht

Annual Operating Cost:

People-ware cost	876,000	Baht
Office Supplies & Miscellaneous cost	65,900	Baht
Total Annual Operating Cost	941,900	Baht

Annual Cost:

The formula of annual cost of the Computerized system is

$$\begin{aligned}\text{Annual Cost} &= (\text{Investment Cost/Estimated System Life}) + \\ &\quad \text{Annual Operating Cost} \\ &= (655,900/5) + 941,900 \\ &= 1,073,080 \text{ Baht}\end{aligned}$$

Saving:

Staff	144,000	Baht
Office Supplies & Miscellaneous	7,000	Baht
Opportunity cost & Intangible Benefit	1,302,200	Baht
Total Saving	1,453,200	Baht

Table G.15. Payback Analysis for Candidate 3, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development cost:	655,900.00						
Operation & Maintenance cost:		941,900.00	1,036,090.00	1,139,699.00	1,253,668.90	1,379,035.79	1,516,939.37
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted costs (adjusted to present value):	655,900.00	856,187.10	855,810.34	855,913.95	856,255.86	856,381.23	855,553.80
Cumulative time-adjusted costs over life time	655,900.00	1,512,087.10	2,367,897.44	3,223,811.39	4,080,067.25	4,936,448.47	5,792,002.28
Benefits derived from operation of new system:	0.00	1,453,200.00	1,598,520.00	1,758,372.00	1,934,209.20	2,127,630.12	2,340,393.13
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted benefits (adjusted to present value):	0.00	1,320,958.80	1,320,377.52	1,320,537.37	1,321,064.88	1,321,258.30	1,319,981.73
Cumulative time-adjusted benefits over life time:	0.00	1,320,958.80	2,641,336.32	3,961,873.69	5,282,938.58	6,604,196.88	7,924,178.61
Cumulative lifetime time-adjusted costs + benefits:	-655,900.00	-191,128.30	273,438.88	738,062.30	1,202,871.33	1,667,748.41	2,132,176.33

Then the Payback period is calculated to judge the profitability of the system as in Table G.15. and Figure G.6.

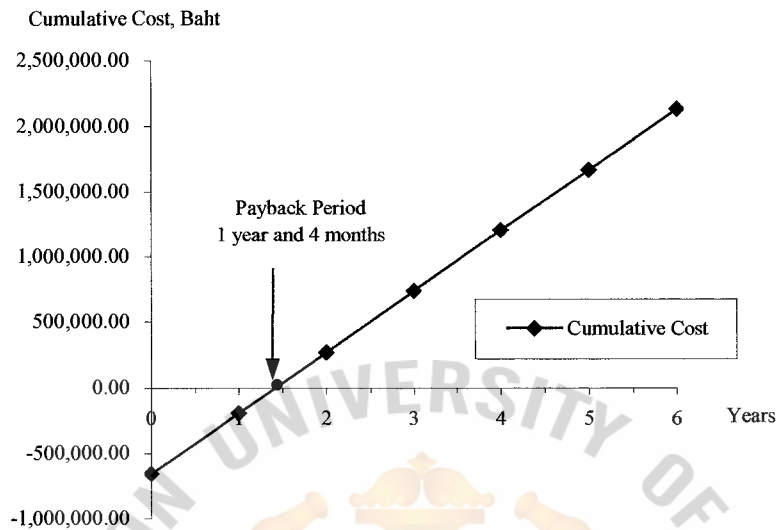


Figure G.6. Payback Period for Candidate 3.

As in Figure G.4. the graph of cumulative cost of computerized system crosses the x-axis at 1.4 years or the payback period of the computerized system is 1 year and 4 months.

Moreover, the payback period can be calculated by the formula as follows:

$$P = \frac{\text{Last year of negative Cash flow difference}}{\text{Cumulative different last negative year}} + \frac{\text{Absolute value of cumulative difference (last negative plus first year positive year)}}{\text{Cumulative different last negative year}}$$

Where P Payback Period

$$P = 1 + \{191,128.30 / (191,128.30 + 273,438.88)\}$$

$$= 1.4 \text{ years or 1 year and 4 months}$$

(4) Return-on-Investment Analysis (ROI)

Return-on-Investment Analysis technique compares the lifetime profitability of alternative solutions or projects. The ROI for a project is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. The ROI for a potential project is calculated by using the data from Table G.15. as follows:

$$\text{ROI} = \frac{(\text{Estimated lifetime benefits} - \text{Estimated lifetime costs})}{\text{Estimated lifetime costs}}$$

$$\begin{aligned}\text{ROI} &= ((7,924,178.61 - 5,792,002.28) / 5,792,002.28) \times 100 \\ &= 0.37 \times 100 \\ &= 37\%\end{aligned}$$

Therefore, the lifetime ROI is 37 percent.

BIBLIOGRAPHY

1. Date, C. J. An Introduction to Database System, 6th Edition. USA: Wesley Publishing Company, 1995.
2. Folk, Michael and Bill Zoellick. File Structure. New York: Addison Wesley Publishing Company, 1992.
3. Greene, James Harnsberger. Production and Inventory Control Handbook, 2nd Edition. NY: McGraw-Hill, 1987.
4. Kendall, Kenneth E. and Julie E. Kendall. System Analysis and Design, Third Edition. NJ: Prentice-Hall, 1995.
5. Laudon, Kenneth C. and Jane P Laudon. Management Information System: Organization and Technology, 4th Edition. USA: Prentice Hall, Inc., 1998.
6. Narasimhan, Seetharama L., Dennis W. McLeavey and Peter Billington. Production Planning and Inventory Control. NJ: Prentice-Hall, Inc., 1995.
7. Ozkarahan, Esen. Database Management: Concepts, Design and Practice. USA: Prentice Hall, Inc., 1990.
8. Page-Jones, Meilir. The Practical Guide to Structured System Design, Second Edition. Englewood Cliffs, NJ: Prentice Hall, 1988.
9. Pornprasertsakul, Ampai. System Analysis and Design. Bangkok: Nation Electronics and Computer Technology Center, 1994.
10. Senn, James A. Analysis and Design of Information Systems, Second Edition. NY: McGraw-Hill, 1989.
11. Stallings, William. Data and Computer Communications, 5th Edition. NJ: Prentice-Hall, Inc., 1997.
12. Tanenbaum, Andrew S. Computer Networks, 3rd Edition. NJ: Prentice-Hall, Inc., 1996.
13. Waters, C. D. J. Inventory Control and Management. Chichester: John Wiley & Sons Ltd., 1999.
14. Whitten, Jeffrey L. and Lonnie D. Bentley. Systems Analysis and Design Methods, Fourth Edition. Taipei: McGraw-Hill, 1998.