Spare-part Inventory Management Information System of Siam Motors Industries Co., Ltd.

by

Mr. Charnchai Romfahthai

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

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer Information Systems
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Academic Year	November 2003

The Graduate School of Assumption University has approved this final report of the three-credit course, CS 6998 System Development Project, Submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.

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ABSTRACT

This system development project presents the analysis, design and implementation of the Spare-part Management Information System of Siam Motors Industries Co., Ltd., with the purpose of improving the business operations of the company. This project involves development of an effective information system to facilitate the business process of the company.

The existing spare-part inventory control process is based on some manual as well as some computerized systems. Almost data are inputted and stored on paper while some are kept in software rented from Siam Motors Co., Ltd. It is time consuming to search for and retrieve the required information. The existing system has not support for decision making in purchasing management. Moreover, it has high costs for mainframe and software rental.

The new proposed information system is developed to replace the existing system. All data are kept in the database server, Microsoft SQL Server 2000, and are accessed through Visual Basic Runtime. It is developed to capture the data and transactions concerning spare-part inventory control, sales requisition and purchasing in order to support decision making of management level.

The project includes modeling architectures that include Data Flow Diagrams (DFDs), Database architecture, Network architecture, User Interface and Report Design, candidate matrix of 3 candidates and feasibility matrix that is used to find out the most suitable candidate, cost benefit analysis that shows the comparison between the cost of the existing and proposed system, and the benefit of this proposed system that reduces the number of operation staff, and solve the problems of the existing system.

ACKNOWLEDGEMENTS

This system development project is completed through the assistance of numerous people. The writer would like to acknowledge their efforts and thank them for their contributions.

He would like to acknowledge indebtedness to Dr. Settapong Malisuwan, the project advisor, for his valuable guidance, advice and comments throughout the whole project. And gratitude also goes to all the members of the MS (CIS) committee members who have imparted their knowledge to him.

He extends his sincere thanks to Mr. Thavee Fongkasira, Managing Director, Mr. Siam Kongpakdeesuk, his bosses and General Manager of Finance and Accounting Department of Siam Motors Industries for permission to use some company information, Ms. Onuma Arayacheeppreecha, his friend for her timely assistance and moral support, and Mr. Lujisak Romfahthai, his younger brother for imparting his knowledge about the Visual Basic.NET program.

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I. INTRODUCTION

1.1 Background of the Project

Siam Motors Industries Co., Ltd. is a distributor of optimum quality Nissan forklift, pallet and stacker and automotive service equipment from recognizable brand worldwide. In addition, the company is the sole distributor for Nissan spare-parts whose inventory represents a large portion of business investment and must be well managed in order to maximize profits. Unless inventories are controlled, they are unreliable, inefficient, and costly.

Currently, the existing system of inventory control for Siam Motors Industries Co., Ltd. is almost manual inventory control system; it uses card records, inventory tags, and accounting data to keep the information necessary to establish economic order quantities, order points, and other parameters for effective inventory control. However as the number of items, suppliers and general importance of inventory increase, the manual inventory control system may give inaccurate and carelessly recorded inventory data. I t is often desirable to consider use of a computerized system of inventory control.

1.2 Objectives of the Project

The main objective of the project is to develop a computerized system for inventory tracking and suggestion order of Siam Motors Industries Co., Ltd. The reason is the number of products (spare parts) is high volume while most of the processes are done manually. So it takes a long time to keep track of the inventory and choose the products for ordering.

To develop the computerized system, the company has to define the problems as well as user requirements and solve the problems of this project. The following are the objectives of the project:

(1) To study the existing system of inventory (spare parts) system of Siam Motors Industries Co., Ltd.

(2) To identify problems and user requirement of the project.

(3) To analyze the current processes and procedures of the existing system.

(4) To design an effective computerized information system for Siam Motors Industries Co., Ltd.

(5) To keep track of inventory level of Siam Motors Industries Co., Ltd.

(6) To minimize stock levels and reduce the cost of operation in order to prepare order planning by using the suggested order.

(7) Provide management report for review and oversight.

1.3 Scope of the Project

(1) To keep data concerning customers, products (spare parts), purchase order, sale order, and suppliers.

(2) To provide decision support for spare part order.

(3) To provide excellent reports to assist management in making the right decisions.

(4) To eliminate problems in different sections. All departments can share and use the same information.

1.4 Deliverables

The deliverables of the project on inventory and sales information system are as follows:

(1) Project Introduction (Background of the project, Objectives, and Scopes)

(2) Data Modeling (ER Diagram)

(3) Process Modeling (Context Diagram, Data Flow Diagram)

(4) System Specification (Hardware and Software specification)

(5) System Design (Input and Output Designs)

(6) Security and Control

(7) Cost Benefit Analysis (Payback Period, Net Present Value)

(8) Application software (such as VB.net, Visible Analyst 7.5, Visio 2000 Enterprise Edition, and Rational Rose 2000 Enterprise Edition)

(9) Project Implementation(Overview ,Source Code, Test Plan, and Conversion)

(10) Conclusion and Recommendations

1.5 Project Plan

The project plan of "Spare-part Inventory Management Information System" is shown in Figure 1.1. The project plan of "Spare-part Inventory Management Information System" composes of three phases, as follows:

(1) System Analysis Phase

(a) Define the objective and scope of the project.

(b) Study the existing system in the form of Context Diagram, Data Flow Diagram.

(c) Identify problems in the existing system.

(d) Study and analyze the business requirements and priorities of a new proposed system.

(e) Generate the proposed system in the form of Entity Relationship Diagrams, and Data Flow Diagrams.

(f) Analyze cost and benefit between the existing system and the proposed system.

(2) System Design Phase

(a) Evaluation of alternative solutions and specifications of a computer-based solution.

(b) Study how the system will reach the requirements identified during system analysis.

(3) System Implementation Phase

(a) Implementation includes all the activities that take place to convert from the existing system to the proposed system.

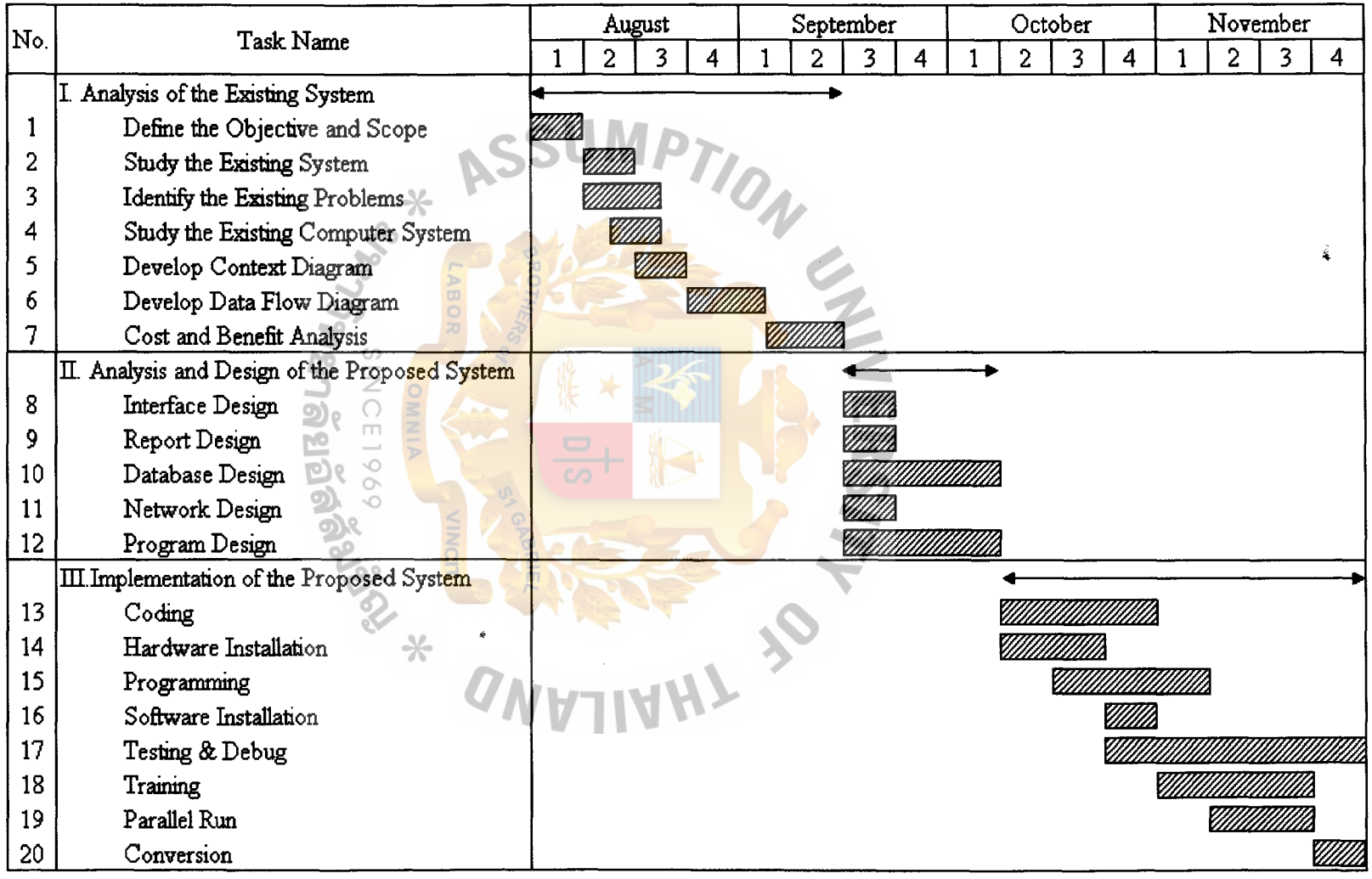


Figure 1.1. Project Plan of Spare-part Inventory Management System.

II. THE EXISTING SYSTEM

2.1 Background of the Company

Siam Motors Industries Co., Ltd. started as a small "Nissan Special Products Division"; it was under the administration of Nissan Sales Department of Siam Motors Co., Ltd. At that time Nissan Forklift market was very narrow and did not receive much attention as it was. Over the last decade, the economy of Thailand had developed more and more, and there was requirement for more advanced technology and equipment Therefore, Siam Motors Industries Co., Ltd. was established independently, departing from the division, as a subsidiary of Siam Motors Co., Ltd.

Siam Motors Industries Co., Ltd. aimed at expanding its production to serve customers' ever-growing demand for the finest industrial and automotive service equipments. At present, Siam Motors Industries Co., Ltd. offers the market two major categories of products; Nissan Forklift / Genuine Spare-Part and Automotive Service Equipment from international leading brands worldwide.

2.2 The Existing Computer System

At present, Siam Motor Industries uses computer only in some parts of the inventory control system, such as product issue, invoice, etc., while most parts of the system are still manually operated. For example, the ordering process is sill manually operated. As there are various and high volume of stock, manual ordering process has become inefficient. Clerical and data entry errors can be a significant source of costs and related problems, so the ordering point may be inaccurate. Thus, the existing system produces much paperwork, and requires many staffs to operate. The results are redundant processes, inefficient operation, inflexibility, non scalability, and so on.

Moreover, there is a monthly leasing cost of mainframe, which is leased from Siam Motors Co., Ltd. It is about 240,000 Baht per year. This mainframe is linked

through a modem; therefore, if the modem is out-of-order, the mainframe will not be able to operate.

The current business processes of Siam Motors Industries Co., Ltd. are described as follows:

(1) When customers inquire about the products or want to buy the products, the product department will check the quantities of remaining products, whether there is enough for the order. If there are enough products, sale request will be issued by identifying name, address, the item of products to be sold, quantities, and price. Then the order will be sent to the accounting department in order to issue the invoice.

(2) When accounting department receives the sale request, the invoice will be issued by identifying customer's address, and product items. Then the stock will be updated.

(3) Then invoice and other documents are returned to product department for further operations.

(4) At the end of the month, purchasing section will keep the invoice and PO that they sell within that month and check the stock quantity available by using the existing system and manually calculating purchasing reorder point.

(5) When the purchasing point has been calculated, the purchasing order will be manually operated and sent to suppliers

(6) Then the suppliers deliver the items that are purchased with supplier invoices. After that, the delivered items are checked and supplier invoices are signed by the store controller staff or chief and sent to the manager.

(7) Then inventory manager will send the supplier invoices to accounting department to continue stock updating.

2.3 Current Problems and Areas for Improvement

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

(1) Stored data is redundant and inconsistence in multiple files from many departments. Daily transactions that are transferred to another department must be rewritten and recorded in the document files. Therefore, every transaction occurring in a day takes a lot of time and makes the staff do routine jobs.

(2) A lot of documents: The existing system is a manual system and it is generated by using a lot of paper work. This problem is the result of redundant processes. The organization has to spend on the cost of office supplies. Moreover, something recorded on paper cannot be kept for a long time for reference in the future and data is not secure from accident or unauthorized persons.

(3) Lack of inventory control system: The exiting system does not have decision making support for purchasing products. At present, there is no supporting system to control purchasing order; therefore, there are some effects in dealing with stock. For example, the products, which are not regularly sold, are often ordered, so there is overstock. It represents money tied up until the inventory leaves the factory as a purchased product. On the other hand, if the products which are regularly sold are not kept track of, the company may have products, that are out of stock, which makes the company lose the opportunity to sell those products.

(4) A lot of errors: In the existing system, there are a lot of errors. At the end of each year, the accounting department faces many problems about inaccuracy

of quantities of products, when they check the stock. It is a result from some operation process, which is still manually operated. This manual operating process inefficiently checks and controls the quantities of products; therefore, some products may be lost and some selling products are not recorded in accounting transaction.

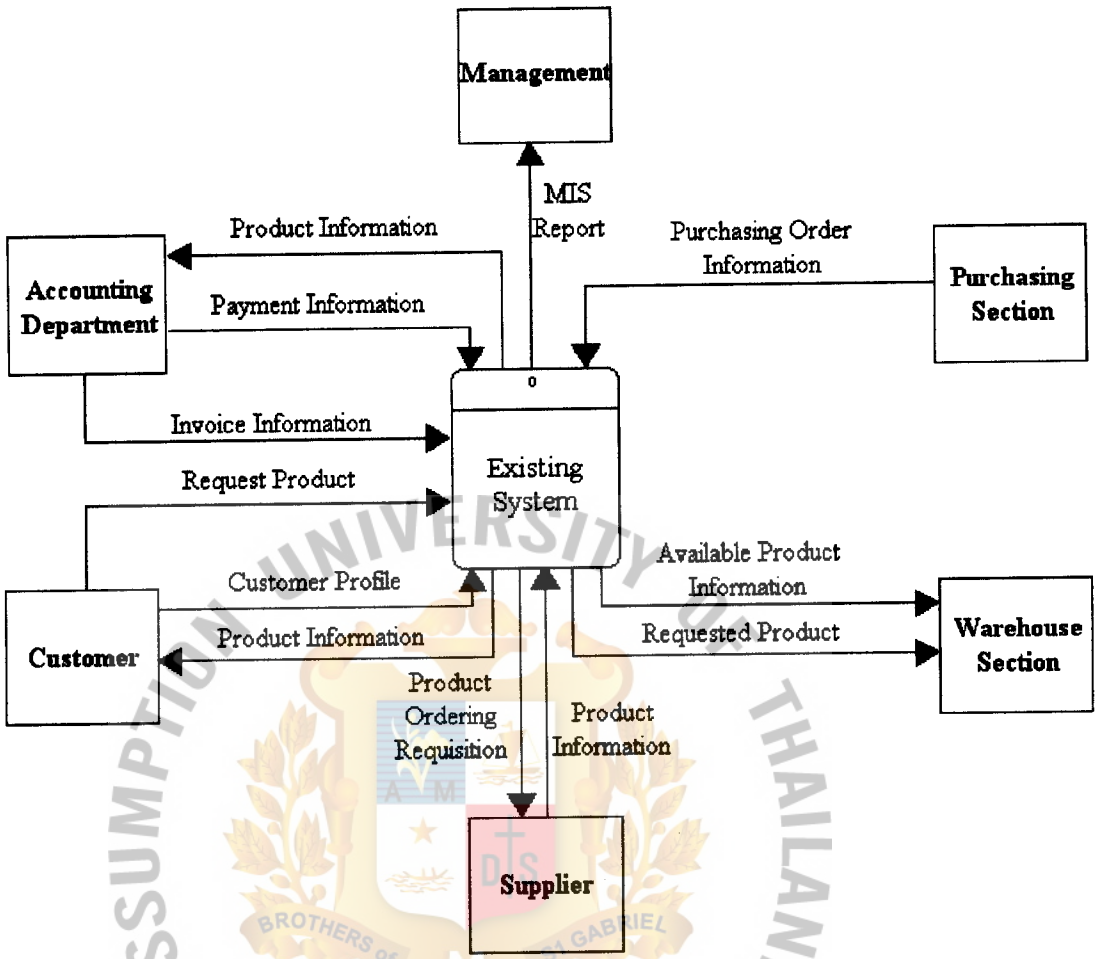


Figure 2.1. Context level Data Flow Diagram of Existing System.

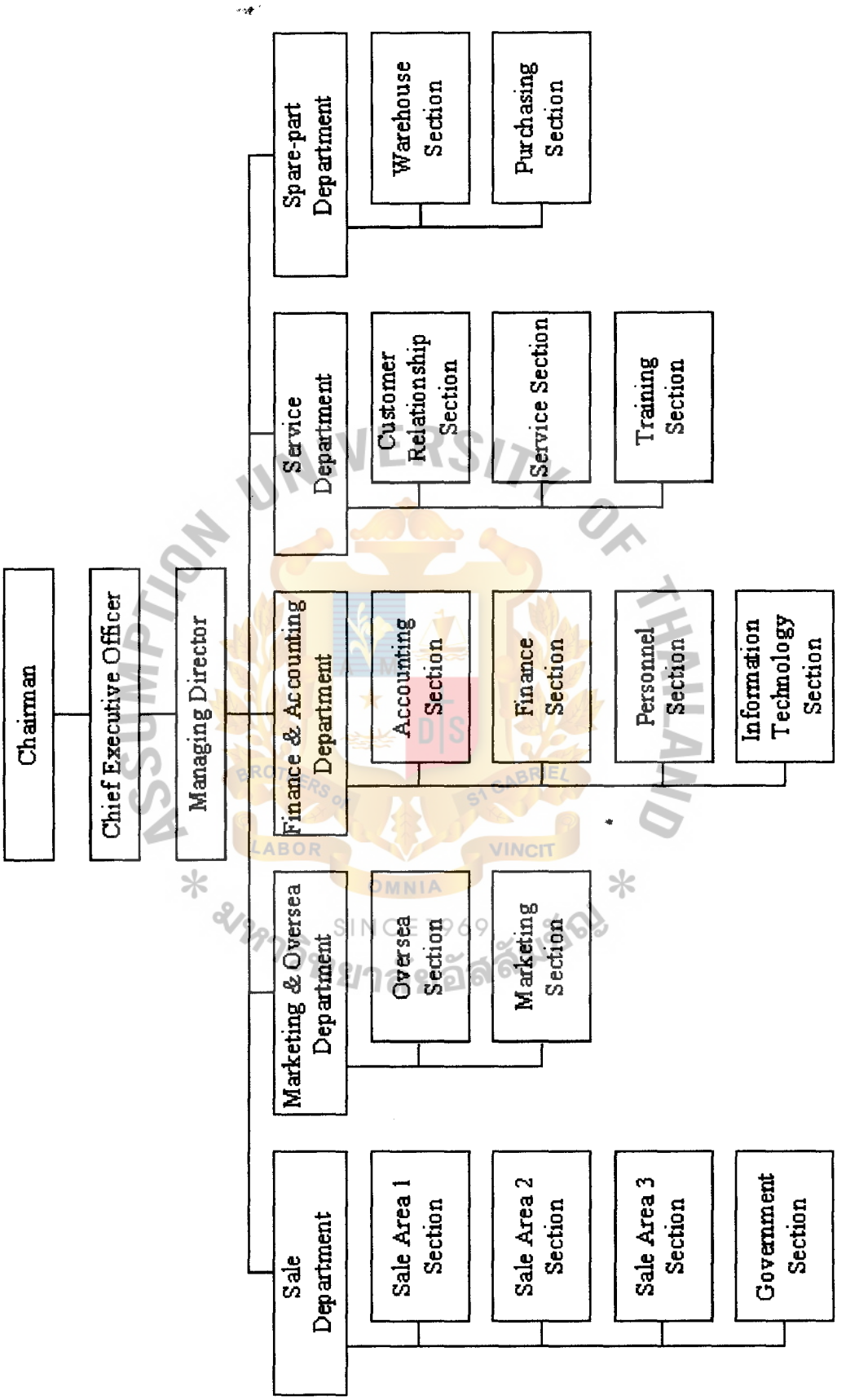


Figure 2.2. Organization Chart of Siam Motors Industries Co., Ltd.

III. THE PROPOSED SYSTEM

3.1 System Specification

As mentioned in the previous chapter, Siam Motors Industries now requires a new effective inventory control system, which can facilitate various processes, day-to-day operations, solve the problems occurring from the existing system and set up on information base for management instead of the existing manual system.

The proposed system will serve all user requirements, solve the problems, and increase effectiveness in purchasing section.

3.1.1 User Requirement Analysis

The requirement analysis defines the business requirements for a new system without consideration of technology. The user requirements are obtained from the user themselves and the existing system evaluation. Actually, the existing system can serve some user requirements, but users still need further development for more system functions as well as improvement within the existing system's operation scope.

The user requirements are concluded as follows:

(1) Input Requirements

(a) The system should have an authorized system for accessing to the system.

(b) The user should take less time to enter the required information.

(c) The system should verify the correct data type that is entered into the database for avoiding Database Inconsistency.

(d) The users should be able to take less time to input data such as customer detail, supplier detail, etc.

(e) The system must have an easy input screen.

(2) Process Requirements

(a) The system should calculate the total amount of each sale request, invoice, receipt, purchasing order and product receiving.

(b) The system should provide data sharing at the point of time.

(c) The system should calculate suggested product ordering.

(d) The users should be able to search the required information.

(e) The system should be able to add, update and delete the information in the database.

(f) The system should have correct processes about inventory control.

(3) Output Requirements

(a) The store controller must be able to view the current stock level of each product from the computer screen at any time.

(b) The purchasing section must be able to view the suggested order of each product from the computer screen at any time.

(c) The system should generate reports for each requirement.

3.1.2 Process Modeling

Process modeling is a technique for organizing and documenting the structure and flow of data through the system's processes. The data flow diagram (DFD) shows the relation between the process and data.

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

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

Figure 3.3 shows the completed Data Flow Diagram of the Proposed System that will show the major functions of the proposed system.

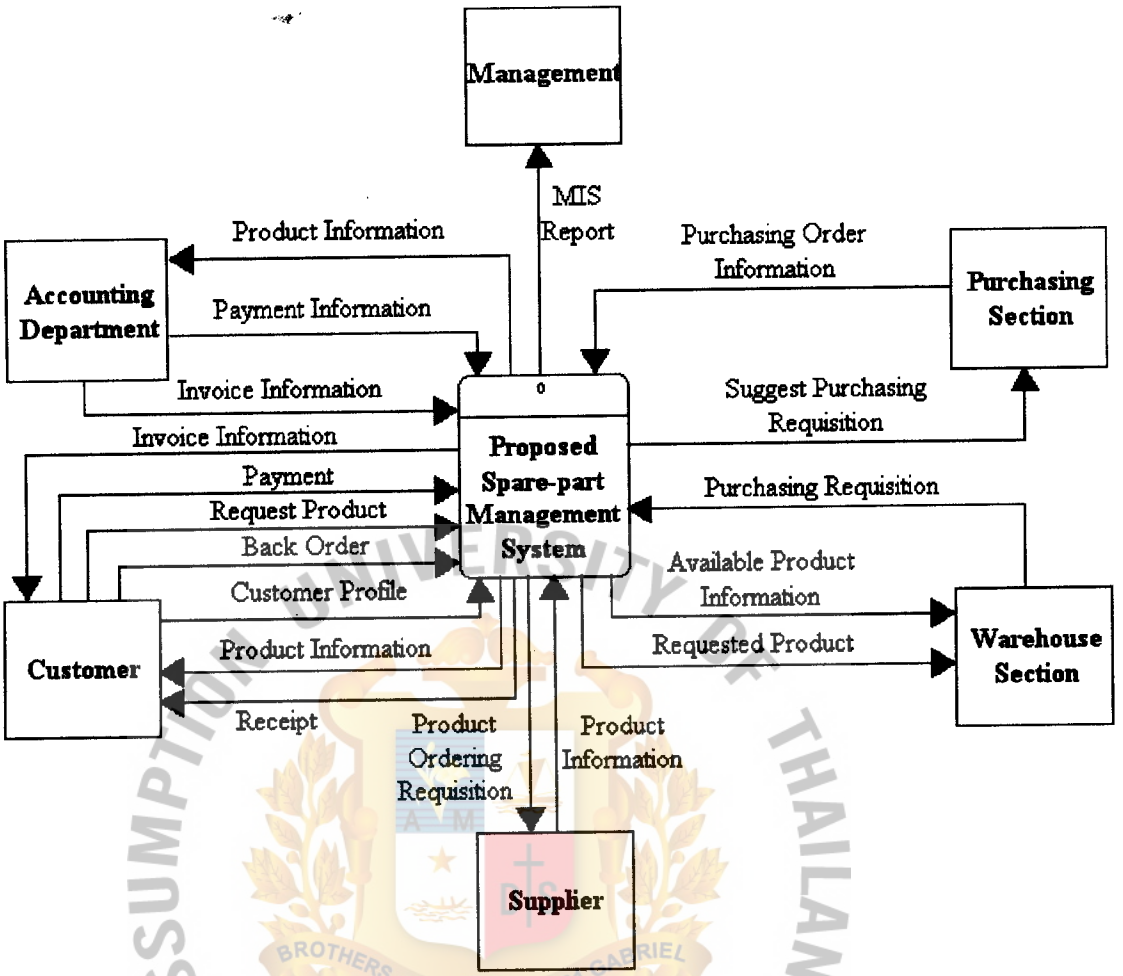


Figure 3.1. Context level Data Flow Diagram of Proposed System.

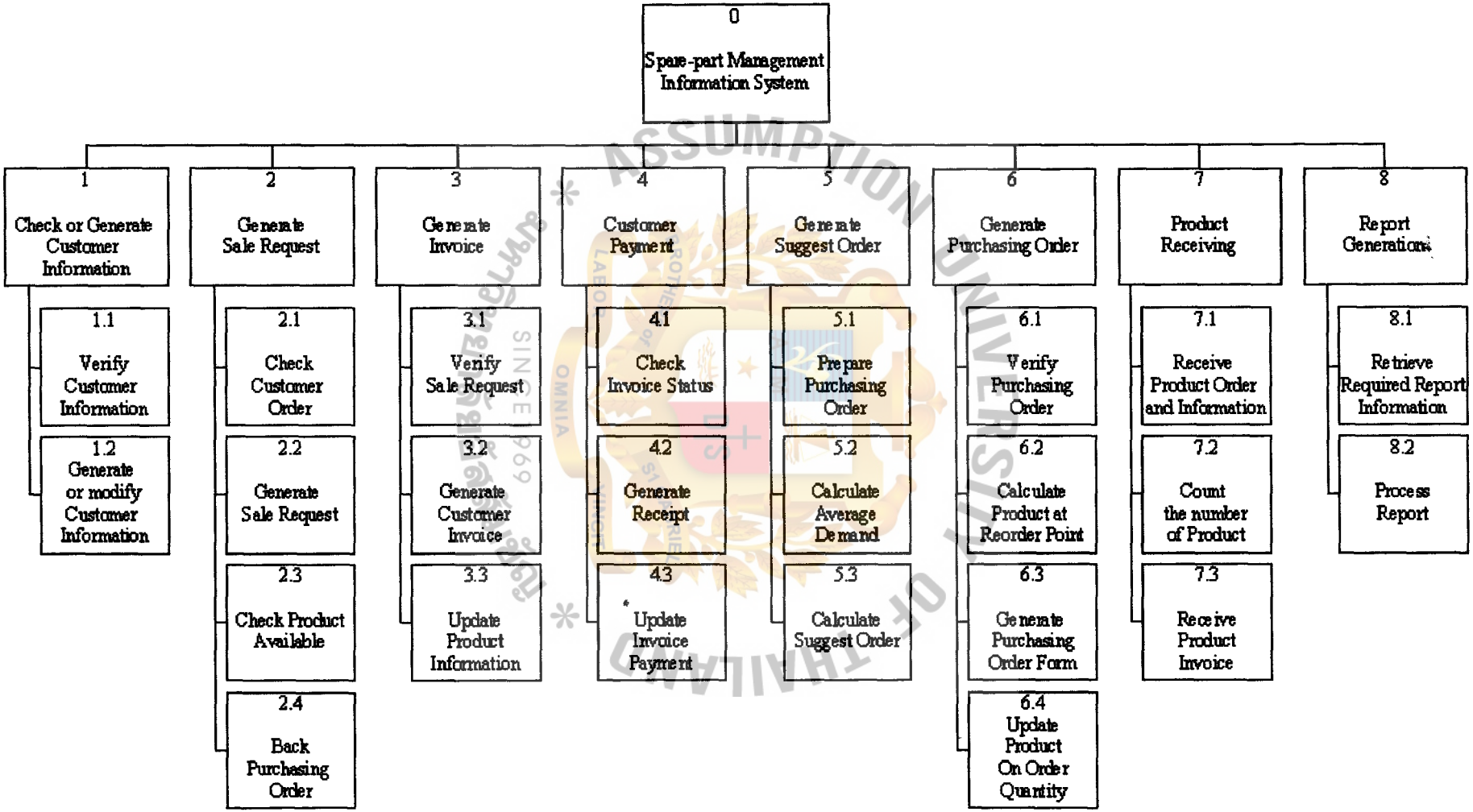


Figure 3.2. Functional Decomposition Diagram of Proposed System.

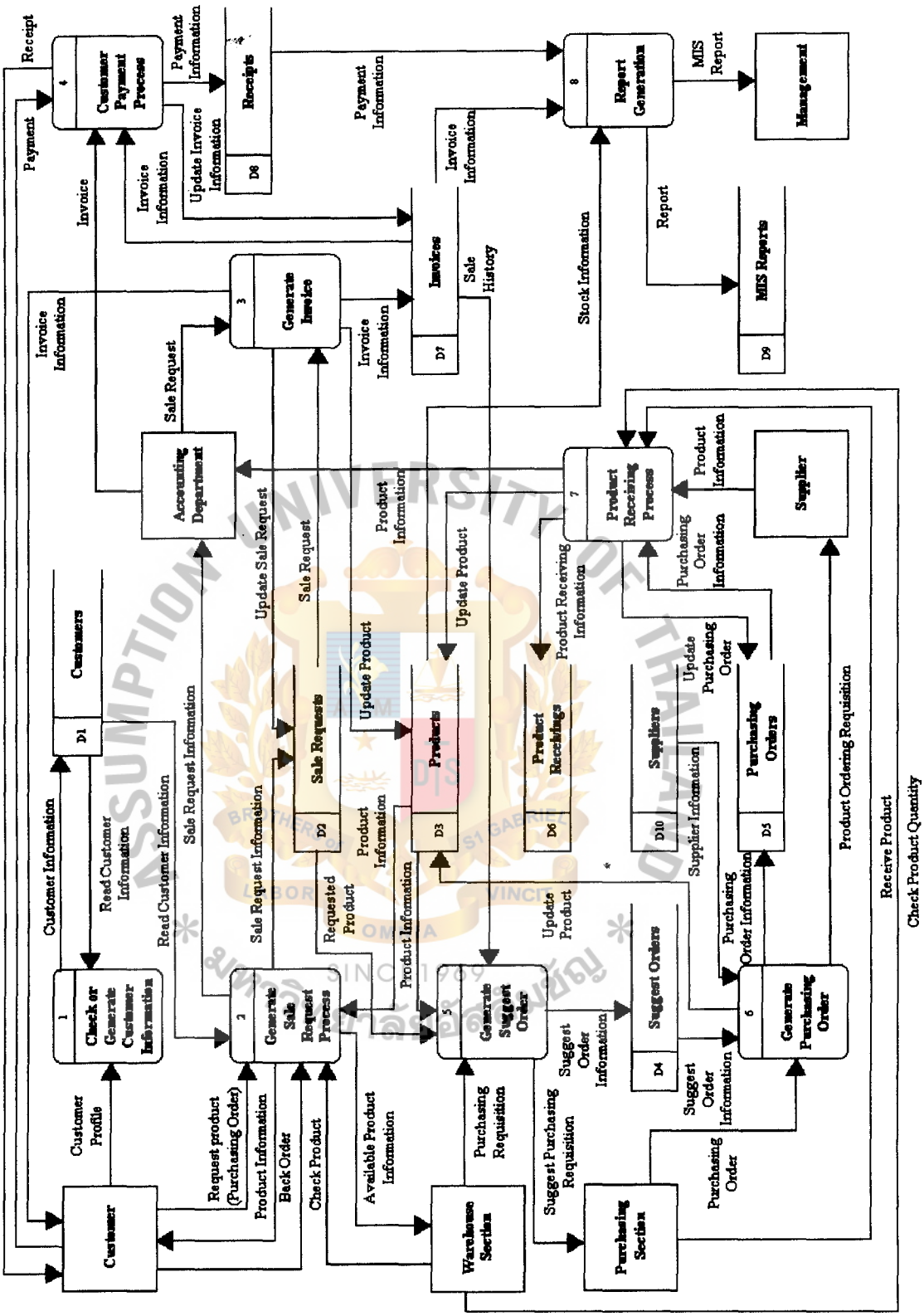


Figure 3.3. Data Flow Diagram of Proposed System.

3.1.3 Decision Analysis

During system selection, the system analyst identifies candidate system solutions and analyzes those solutions for feasibility. The feasibility analysis uses the Candidate System Matrix and Feasibility Analysis Matrix for presenting candidates and recommendations to the management.

(1) Candidate System Matrix

To find out the solution that can support business requirements, three candidate solutions are proposed as shown in Table 3.1. This table shows the characteristics of each candidate for the system designer and user to make a comparison.

(a) Candidate 1: The Package inventory software of Crystal Software Group would be purchased for support. This solution can be implemented quickly because it is a purchased package software solution, but it cannot support all user requirements. This Package Software runs on Microsoft Windows 2000 Server on the Server and the clients use Microsoft Windows XP. This software uses Visual FoxPro software that is Database Management system. Input devices are keyboard and mouse. Output devices are Monitor and Laser printers on the network. The storage devices are 38.4 GB. and Tape Device.

(b) Candidate 2: This candidate is custom solution developed by Microsoft Visual Basic.NET. It can support user required business process for organization. This solution uses Windows 2000 Server on the server and Microsoft Windows XP on the clients. Database Management System uses Microsoft SQL Server. Input devices are keyboard and

mouse. Output devices are Monitor, Dot-Matrix and Laser printers on the network. The storage devices are 38.4 GB. and Tape Device.

(c) Candidate 3: This candidate is custom solution. It can support user required business process for organization. This solution is used to follow the concept of two tier client/server computer. It represents Developer 2000 and Oracle Database Standard Edition that can support the multi-user environment and relational database technology. But Oracle is extremely complex, and difficult to understand for users. So this solution must include a training course that will guide users in developing the new application with powerful database server.

Table 3.1. Candidate System Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Portion of System Computerized Brief description of that portion of the system that would be computerized in this candidate.	Support almost user requirements and multi-user supports.	Fully support all relevant units that are involved spare-part inventory management information system.	Same as Candidate 2
Benefits Brief description of the business benefits that would be realized for this candidate.	This solution can be implemented quickly because it's purchased solution	Better control and provide high efficiency and improved productivity through quicker access to information resources.	Provide high efficiency, powerful DBMS and application that perform more efficiently.
Servers and Workstations A description of the servers and workstations needed to support this candidate.	Server: Intel Pentium Xeon 2.0 GHz PC : Intel Pentium IV 2.0 GHz	Same as Candidate 1	Same as Candidate 1
Software Tools Needed Software tools needed to design and build the candidate (e. g., database management system, emulators, operating systems, languages, etc.). Not generally applicable if applications software packages are to be purchased.	Not needed.	Windows 2000 Server Microsoft SQL Server 2000 Microsoft Visual Basic.NET Windows XP	Windows 2000 Server Developer 2000 Oracle Database Standard Edition Windows XP
Application Software A description of the software to be purchased, built, accessed, or some combination of these techniques.	Package Solution	Custom Solution	Same as Candidate 2
Method of Data Processing Generally some combination of: on-line, batch, deferred batch, remote batch, and real-time.	Database stored on server and processed on workstation	Database stored and processed on server. GUI stored on workstation	Oracle uses a two-tier Client / Server Architecture.
Output Devices and Implications A description of output devices that would be used, special output requirements, (e.g. network, preprinted forms, etc.), and output considerations (e.g., timing constraints).	Display Monitor Dot-matrix printer Laser printer	Same as Candidate 1	Same as Candidate 1
Input Devices and Implications A description of Input methods to be used, input devices (e.g., keyboard, mouse, etc.), special input requirements, (e.g. new or revised forms from which data would be input), and input considerations (e.g., timing of actual inputs).	Keyboard and mouse	Keyboard, mouse and barcode reader	Same as Candidate 2
Storage Devices and Implications Brief description of what data would be stored, what data would be accessed from existing stores, what storage media would be used, how much storage capacity would be needed, and how data would be organized.	38.4 GB storage capacity and tape backup.	Microsoft SQL Server DBMS with 38.4 GB storage capacity and tape backup.	Oracle DBMS with 38.4 GB storage capacity and tape backup.

(2) Feasibility Analysis Matrix

The feasibility of alternative solution is described by Feasibility Analysis Matrix table that is shown in Table 3.2.

The full details of cost-benefit calculation (Economic Feasibility) are shown in Appendix C which are all candidate cost tables, payback analysis tables and graphs, and net present value (NPV) of each candidate.

Table 3.2. Feasibility Analysis Matrix.

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3
Operational Feasibility **Functionality**. A description of to what degree the candidate would benefit the organization and how well the system would work. **Political**. A description of how well received this solution would be from user management, user, and organization perspective.	30%	Support most user requirements and multi-user supports. Score: 75	Fully support the user requirements in term of functionality. Score: 100	Same as Candidate 2 Score: 100
Technical Feasibility **Technology**. An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate. **Expertise**. An assessment of the technical expertise needed to develop, operate, and maintain the candidate system.	30%	Package solution is the simple way to develop. But it is suitable for a small system. It does not provide good performance when it is used to run across a network. Score: 90	MS.SQL Server is full database server whose engines are superior in term of speed and multi-user capabilities. MS Visual Basic.NET is a generally accepted technology in developing application. Score: 95	Oracle is database management system software that provides high efficiency. It is an extremely complex and more powerful software solution; however it requires a lot of expense for user developing and training. Score: 90
Economic Feasibility • Cost to develop (Baht) • Payback period • Net present Value(Baht) • Detail Calculation	30%	816,740.00 Baht 1 Year 3 Months 2,505,956.78 Baht See Appendix C Score: 100	1,138,990.00 Baht 1 Year 6 Months 2,798,557.29 Baht See Appendix C Score: 100	1,925,740.00 Baht 2 Year 6 Months 2,011,807.29 Baht See Appendix C Score: 80
Schedule Feasibility An assessment of how long the solution will take to design and implement.	10%	Approximately 3 months Score:100	Approximately 4-6 months Score:90	Approximately 10 months Score:70
Ranking	100%	89.5	97.5	88.0

From Candidate System Matrix and Feasibility Analysis Matrix, Candidate 2 is the best solution that is selected for further design phase. Because Candidate 2 fully supports the user requirements and has the most total score of ranking in Feasibility Analysis Matrix. However, the development schedule takes more time to develop and implement than Candidate 1.

3.2 System Design

System design focuses on the technical or implementation concerns of the system. Thus the purpose of the design phase is to transform the business requirement statement from the requirement analysis phase into design specifications for construction. The detail of each design can be explained as follows:

(1) Structure Design

Structure Design is a technique that breaks up a large program into an hierarchy of modules. The primary tool that is used in structure design is the Structure Chart. Structure Design requires Data Flow Diagrams because the processes appearing on Data Flow Diagrams will represent modules on a structure chart. Structure charts are illustrated in Appendix D. and Data Flow Diagrams are represented in Appendix G.

(2) Process Specification

The purpose of a process specification is to define what the system does to transform inputs into outputs. It provides the details of system process in table format, which is easier to understand than a diagram. All specified tables, which are the processes from the logical data flow diagram, are shown in Appendix H.

(3) Database Design

Database Design is shown in Entity Relationship Diagram (ERD) form.

In database analysis, a normalization technique is used to transform all data in ERD into applicable database. The result of database design is illustrated in Appendix F.

(4) Data Dictionary

Data Dictionary provides a list of terms and definition for all data items and data stored within the developed system. The data dictionary for both entity relationship diagram and data flow diagram is shown in Appendix I.

(5) User Interface Design

The User Interface Designs are the designs of the entire interface screens for the proposed system. The user interface design is represented in Appendix A.

(6) Report Design

The Report Designs are reports that are generated by the proposed system. The report designs are represented in Appendix B.

3.3 Hardware and Software Requirement

3.3.1 Hardware Requirement

The existing operation system uses stand alone PCs, which do not connect to any server. To implement the proposed system, it requires the new hardware and network configuration to be Database Server, which is a computer whose primary function is to offer computing services, keep the data and information, and manage system resources for client PCs requesting for those services.

The proposed system requires the following hardware components.

(1) Server 1 Set

(2) PC or Workstation 5 Sets

(3) Network Printer 3 Units

(4) Switching hub 1 Unit

(5) UPS 6 Units

The hardware specification is shown in the following tables.

Table 3.3. Hardware Specification for Database Server.

Device	Specification
CPU	Intel Pentium Xeon 2.0 GHz
Cache	512 KB
Memory	SDRAM 512 MB 133 MHz
Hard Disk	36.4 GB HDD U3
CD-Rom Drive	48X
Floppy Drive	3.5" 1.44 MB
Network Adapter	NIC Gigabit Auto Switching Network 10/100/1000

Device	Specification
Display Adapter	Graphics 8 MB video Memory
Display Monitor	Compaq SVGA 15"
UPS	APC Smart 1000 with Power-Chute Management

Table 3.4. Hardware Specification for Client Computer.

Device	Specification
CPU	Intel Pentium IV 2.0 GHz FSB 133 MHz
Cache	512 KB
Memory	SDRAM 512 MB 133 MHz
Hard Disk	36.4 GB HDD U3
CD-Rom Drive	48X
Floppy Drive	3.5" 1.44 MB
Network Adapter	NIC Gigabit Auto Switching Network 10/100/1000
Display Adapter	Graphics 8 MB video Memory
Display Monitor	Compaq SVGA 15"

The Network Configuration of the proposed system is designed to use Star Topology that uses hub or switching to be the center of the connecting workstations

The objectives of network connection are sharing resources such as data and printers. Multiple users can access to the system at the same time, and controlling or using the system at different places in the organization. The connection between Database server and Client PCs can be established through the LAN.

Table 3.5. Hardware Specification for Network configuration and other devices.

Device	Specification
Switching	3COM SuperStack III Baseline 10/100 Auto-sensing
Printer	HP LaserJet 4200n and Epson LQ2180i
UPS	APC Smart-UPS 1000 VA, LEONICS Astra 500 VA

The Network Configuration of the proposed system is shown in Figure 3.4.

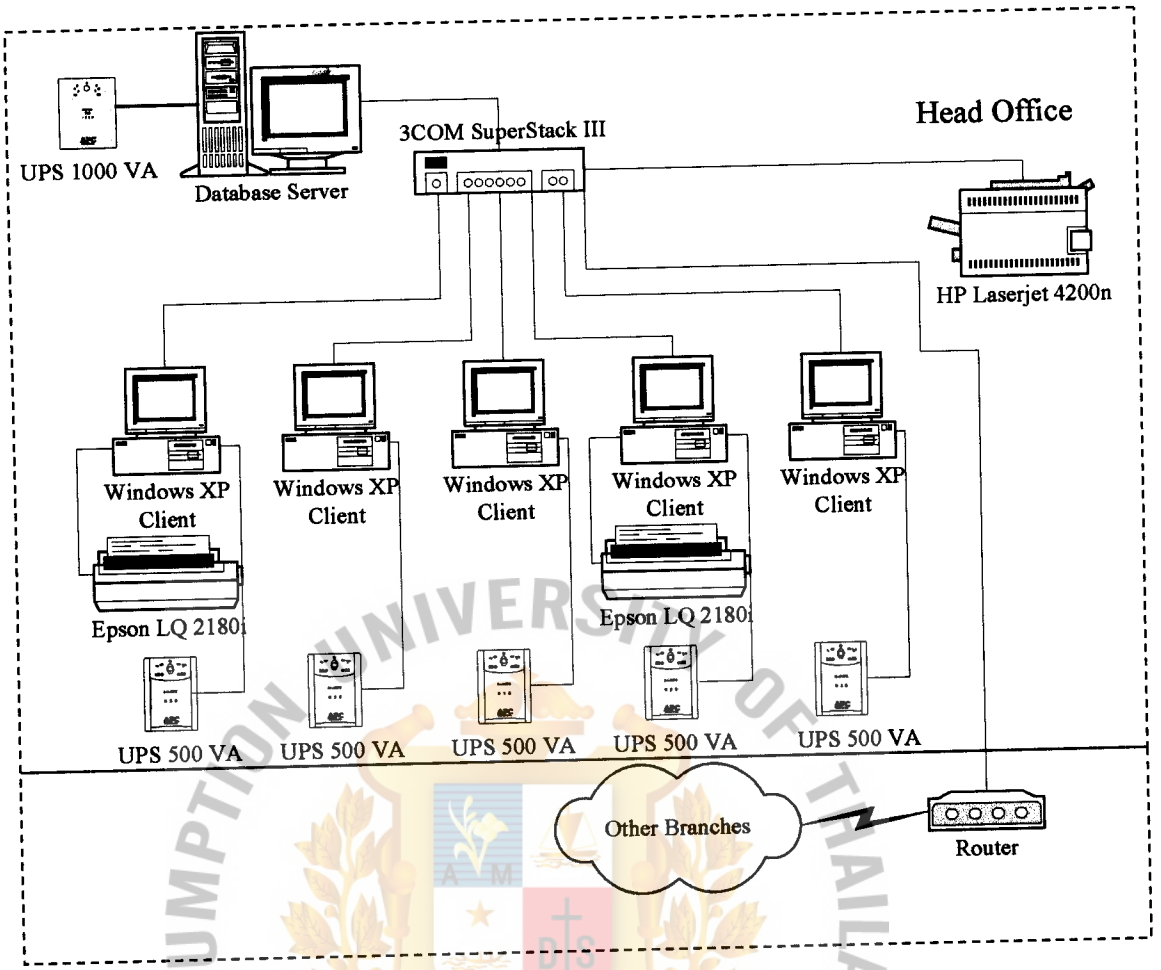


Figure 3.4. Network Configuration of the proposed system.

3.3.2 Software Requirement

The software specification for server and client software are shown in Table 3.6. and Table 3.7.

Table 3.6. Software Specification for Database Server.

Software	Specification
Operating System	Microsoft Windows 2000 Professional
Database Server Software	Microsoft SQL Server 2000
Application Software	Microsoft Visual Basic.Net

Table 3.7. Software Specification for Client Computer.

Software	Specification
Operating System	Microsoft Windows XP
Application Software	Microsoft Visual Basic.Net, Microsoft Office XP

3.4 Security and Control

One of the most important considerations in the development of system operation is security. The proposed system tries to be a user-friendly program that anyone can access to and use it easily. Therefore, to keep the accuracy of the data and information, management team needs to be extremely careful at this point. This program needs a permission level access for control and security. The security strategies are listed below.

(1) Identification

The User Identification (User ID) and password are assigned only to

the permitted persons. When users sign in to the system, they require inputting not only their user ID, but also their password.

(2) Authorization

Authorization is concerned with ensuring that only properly authorized users are able to access particular network resources or corporate information resources. Authorization blocks the users that have low level of authorization to access the program such as deletion, insertion, and updating.

(3) Physical Security

The failure of main electricity supply causes interruption to the function of the computer facility or telecommunication network. The UPS (Uninterruptible Power Supply) is used to supply power in case main electricity supply is out - of - order to avoid the data loss.

(4) Backup and Recovery

All data are backed up in backup tape at the end of the day and kept in a secure place.

(5) Other Security

The system must provide message or solution to the users when error occurs. An error should be solved and corrected immediately after it is discovered on the report. And the system must have virus-checking program for avoiding viruses.

3.5 Cost and Benefit Analysis

The economic feasibility has been defined as a cost-benefit analysis. The details of both cost and benefit of the new system compared with the existing system must be

defined. There are costs associated with developing the system, and there are costs associated with operating the system.

3.5.1 Cost Analysis

(1) Cost of Existing System

In the existing system, some parts are operated manually and some parts are computerized and it incurs both fixed costs and annual operating costs. The fixed costs consist of hardware and software costs.

The hardware costs include personal computers, dot-matrix printers, typewriters, modem for connecting to the mainframe at Siam Motors Co., Ltd., and calculators. The software costs include Microsoft Windows 98, and Microsoft Office 97.

The annual operating costs include salary cost, office supplies and miscellaneous cost, and the cost of mainframe rental.

The details of the existing system cost are summarized in Table 3.8 and 3.9.

Table 3.8. Cost of Existing System, Baht.

Cost items		Year				
		1	2	3	4	5
Fixed Cost						
Hardware Cost:						
Personal Computer	2 units @ 20,000	8,000.00	8,000.00	8,000.00	8,000.00	8,000.00
Dot matrix Printer	2 units @ 28,000	11,200.00	11,200.00	11,200.00	11,200.00	11,200.00
Calculator	4 units @ 2,000	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00
Modem	1 unit @ 15,000	3,000.00	3,000.00	3,000.00	3,000.00	3,000.00
Typewriter	2 units @ 8,500	3,400.00	3,400.00	3,400.00	3,400.00	3,400.00
Total Hardware Cost		27,200.00	27,200.00	27,200.00	27,200.00	27,200.00
Software Cost:						
Microsoft Windows 98	2 units @ 8,500	3,400.00	3,400.00	3,400.00	3,400.00	3,400.00
Microsoft Office 97	2 units @ 10,000	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
Total Software Cost		7,400.00	7,400.00	7,400.00	7,400.00	7,400.00
Total Fixed Cost		34,600.00	34,600.00	34,600.00	34,600.00	34,600.00
Operating Cost						
Salary Cost:						
Inventory Manager	1 person@ 30,000	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Staff:						
Purchasing Chief	1 person@ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Store Controller Chief	1 person@ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Purchasing Clerk	2 persons@10,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Store Controller Officer	4 persons@ 8,000	32,000.00	35,200.00	38,720.00	42,592.00	46,851.20
Accounting Department						
Accounting Officer	2 persons@12,000	24,000.00	26,400.00	29,040.00	31,944.00	35,138.40
Total Monthly Salary Cost		146,000.00	160,600.00	176,660.00	194,326.00	213,758.60
Total Annual Salary Cost		1,752,000.00	1,927,200.00	2,119,920.00	2,331,912.00	2,565,103.20
Office Supplies & Miscellaneous						
Mainframe Rental	20,000 Per Month	240,000.00	264,000.00	290,400.00	319,440.00	351,384.00
Stationary	Per Annual	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Paper	Per Annual	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Utility	Per Annual	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Miscellaneous	Per Annual	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Total Annual Office Supplies & Miscellaneous Cost		335,000.00	368,500.00	405,350.00	445,885.00	490,473.50
Total Annual Operating Cost		2,087,000.00	2,295,700.00	2,525,270.00	2,777,797.00	3,055,576.70
Total Existing System Cost		2,121,600.00	2,330,300.00	2,559,870.00	2,812,397.00	3,090,176.70

Table 3.9. Five Years Accumulated Existing System Cost, Baht.

Year	Total Existing System Cost	Accumulated Cost
1	2,121,600.00	2,121,600.00
2	2,330,300.00	4,451,900.00
3	2,559,870.00	7,011,770.00
4	2,812,397.00	9,824,167.00
5	3,090,176.70	12,914,343.70
Total	12,914,343.70	-

(2) Costs of Proposed System

The proposed system costs are also classified into fixed costs and annual operating costs.

The fixed costs include the hardware costs, that are 1 database server, 5 client computers, 2 dot-matrix printers, 1 laser printer, 6 UPS, and networking cost, and the software costs, Microsoft SQL Server - Client, Windows 2000 Server – Client, Microsoft Windows XP, Visual Basic.NET, and Microsoft Office XP. And the fixed costs that will occur in the proposed system are implementation costs that consist of people-ware cost, training cost, installing cost, system integration cost, and miscellaneous cost.

The annual operating costs include salary cost, office supplies and miscellaneous cost.

The proposed system or computerized system requires some investment in computer hardware and software. Therefore, the maintenance cost for new hardware will occur after expiry-of-warranty. In the first year, the proposed system has the cost of implementation that includes people-ware cost, training cost, installing cost, system integration cost, and miscellaneous cost.

Table 3.10. Estimated Cost of Proposed System, Baht.

Cost items		Year 1	2	3	4	5
Fixed Cost						
Hardware Cost:						
Computer Server	1 unit @ 89,100	17,820.00	17,820.00	17,820.00	17,820.00	17,820.00
Workstation	5 units @ 20,000	20,000.00	20,000.00	20,000.00	20,000.00	20,000.00
Dot matrix Printer	2 units @ 28,000	11,200.00	11,200.00	11,200.00	11,200.00	11,200.00
Laser Printer	1 unit @ 67,000	13,400.00	13,400.00	13,400.00	13,400.00	13,400.00
Network Cost		7,000.00	7,000.00	7,000.00	7,000.00	7,000.00
UPS 1KVA	1 unit @ 17,700	3,540.00	3,540.00	3,540.00	3,540.00	3,540.00
UPS 500 VA	5 units @ 2,500	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
Total Hardware Cost		75,460.00	75,460.00	75,460.00	75,460.00	75,460.00
Software Cost:						
Microsoft SQL Server	1 unit @ 33,500	6,700.00	6,700.00	6,700.00	6,700.00	6,700.00
Microsoft SQL Client	5 units @ 5,550	5,550.00	5,550.00	5,550.00	5,550.00	5,550.00
Windows 2000 Server	1 unit @ 24,780	4,956.00	4,956.00	4,956.00	4,956.00	4,956.00
Windows 2000 Client	5 units @ 1,232	1,232.00	1,232.00	1,232.00	1,232.00	1,232.00
Microsoft Windows XP	5 units @ 7,500	7,500.00	7,500.00	7,500.00	7,500.00	7,500.00
Visual Basic.NET	1 unit @ 50,000	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Microsoft Office XP	5 units @ 10,000	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Total Software Cost		45,938.00	45,938.00	45,938.00	45,938.00	45,938.00
Maintenance Cost:						
Hardware Maintenance Cost		-	-	-	22,638.00	22,638.00
Network Maintenance Cost		-	-	-	2,100.00	2,100.00
Total Maintenance Cost		-	-	-	24,738.00	24,738.00
Implementation Cost:						
1 System Analyst	6 Months@ 25,000	150,000.00	-	-	-	-
2 Programmers	2 Months@ 20,000	80,000.00	-	-	-	-
2 Network Specialist	1 Month @ 18,000	36,000.00	-	-	-	-
1 Database Specialist	2 Months@ 18,000	36,000.00	-	-	-	-
Training Cost		100,000.00	-	-	-	-
Installing Cost		50,000.00	-	-	-	-
System Integration		30,000.00	-	-	-	-
Miscellaneous Cost		50,000.00	-	-	-	-
Total Implementation Cost		532,000.00	-	-	-	-
Total Fixed Cost		653,398.00	121,398.00	121,398.00	146,136.00	146,136.00

Table 3.10. Estimated Cost of Proposed System, Baht (Continued).

Cost items		Year				
		1	2	3	4	5
Operating Cost						
People-Ware Cost:						
Inventory Manager	1 person @ 30,000	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Staff:						
Purchasing Chief	1 person @ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Store Controller Chief	1 person @ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Purchasing Clerk	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Store Controller Officer	3 persons @ 8,000	24,000.00	26,400.00	29,040.00	31,944.00	35,138.40
Accounting Department						
Accounting Officer	2 persons@12,000	24,000.00	26,400.00	29,040.00	31,944.00	35,138.40
Total Monthly Salary Cost		128,000.00	140,800.00	154,880.00	170,368.00	187,404.80
Total Annual Salary Cost		1,536,000.00	1,689,600.00	1,858,560.00	2,044,416.00	2,248,857.60
Office Supplies & Miscellaneous						
Stationary	Per Annual	18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Paper	Per Annual	27,000.00	29,700.00	32,670.00	35,937.00	39,530.70
Utility	Per Annual	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Miscellaneous	Per Annual	18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Total Annual Office Supplies & Miscellaneous Cost		88,000.00	96,800.00	106,480.00	117,128.00	128,840.80
Total Annual Operating Cost		1,624,000.00	1,786,400.00	1,965,040.00	2,161,544.00	2,377,698.40
Total Proposed System Cost		2,277,398.00	1,907,798.00	2,086,438.00	2,307,680.00	2,523,834.40

Table 3.11. Five Years Accumulated Proposed System Cost, Baht.

Year	Total Proposed System Cost	Accumulated Cost
1	2,277,398.00	2,277,398.00
2	1,907,798.00	4,185,196.00
3	2,086,438.00	6,271,634.00
4	2,307,680.00	8,579,314.00
5	2,523,834.40	11,103,148.40
Total	11,103,148.40	-

(3) Comparison of system cost

After both the existing system cost and proposed system cost are identified, the comparison table is constructed to compare the accumulated manual cost and accumulated proposed cost in order to analyze break-even analysis, and reveal the cost saving after implementing the proposed system. The comparison of Accumulated Existing System cost and Proposed System cost is summarized in Table 3.12.

Table 3.12 Comparison of Accumulated Existing System Cost and Proposed System Cost, Baht.

Year	Accumulated Existing Cost	Accumulated Proposed Cost
1	2,121,600.00	2,277,398.00
2	4,451,900.00	4,185,196.00
3	7,011,770.00	6,271,634.00
4	9,824,167.00	8,579,314.00
5	12,914,343.70	11,103,148.40

From Table 3.12, the accumulated proposed system cost will save a cost of 1,811,195.30 Baht in five years.

3.5.2 Benefit Analysis

The benefit of the proposed system can be classified into tangible and intangible benefits. Tangible benefits are usually measured in terms of monthly or annual savings. Tangible benefits are decreased response time, elimination of working steps, reduced expenses, etc. Intangible benefits are benefits that are difficult or impossible to quantify, such as better decision making, and better service to community.

(1) Tangible benefits

Tangible benefits are those that can be easily quantified. They are measured in terms of annual cost savings (salary cost, office supplies cost and miscellaneous) when comparing proposed system with existing system. Tangible benefits of the proposed system are shown in Table 3.13.

Table 3.13. Tangible Benefits of the Proposed System, Baht.

Benefit		Price
Cost Savings		
Salary Cost:		
Purchasing Clerk	1 person @ 10,000 per month	120,000.00
Store Controller Officer	1 person @ 8,000 per month	96,000.00
Total Annual Salary Cost Saving		216,000.00
Office Supplies & Miscellaneous		
Mainframe Rental	20,000 per month	240,000.00
Stationary	10% decrease	18,000.00
Paper	10% decrease	27,000.00
Miscellaneous	10% decrease	18,000.00
Total Annual Office Supplies & Miscellaneous Cost Saving		303,000.00
Total Tangible Benefits per Annum		519,000.00

(2) Intangible Benefits

Intangible costs in the company include all the problems occurring in the existing system being solved. The major intangible benefits that will be obtained in proposed system, are summarized as follows:

(a) Providing faster order processing time.

(b) Increasing Inventory control of operation

(c) Better Decision Making

(d) Reducing redundant processes and data.

(e) Improving security and control

3.5.3 Breakeven Analysis

Breakeven Analysis is the regular form of cost comparison. It is comparing the cost of the existing system and the proposed system to determine the point where the costs of both systems become equal. Normally, the cost of the proposed system will be highest in the first year because of installation of new hardware and software. But, for the long term, the proposed system can reduce the annual operating cost especially salary cost and office supplies cost.

Figure 3.5 shows the break-even point which occurs approximately 4 months after the system has been operated. This result indicates that the proposed system is satisfactory for investing and implementing because it will incur less operating cost than the existing system in the long run operation.

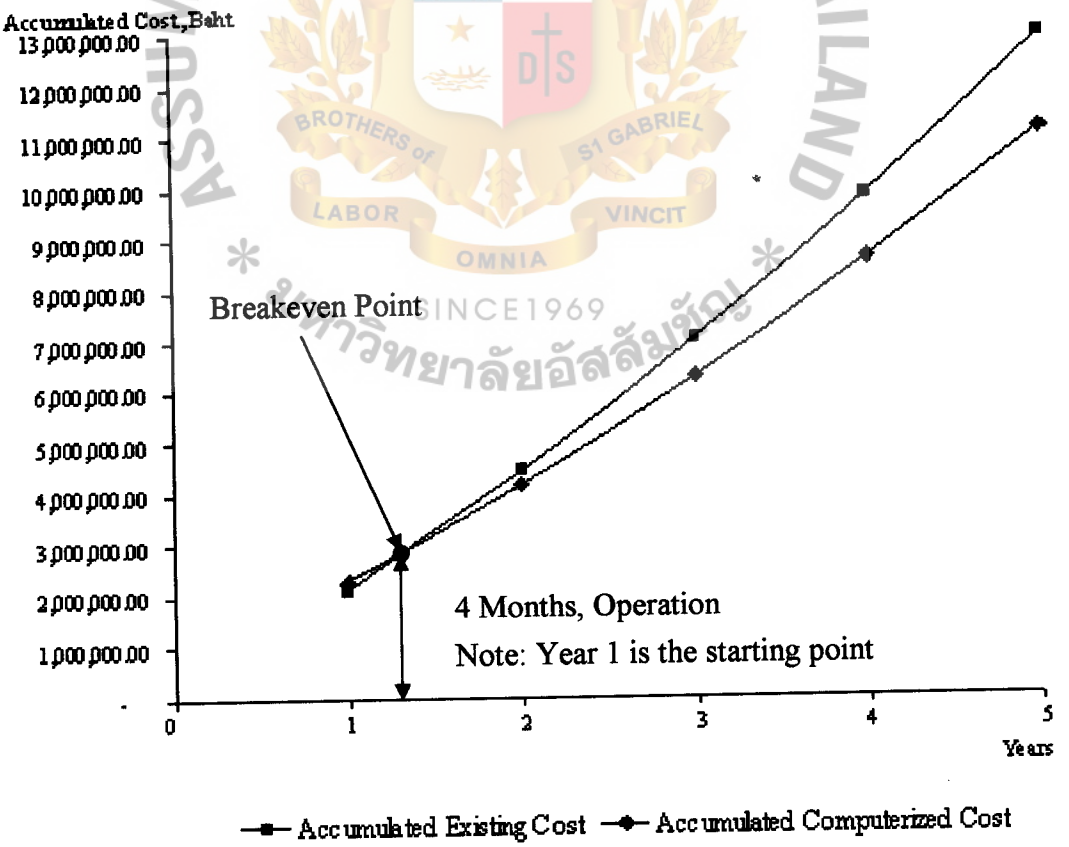


Figure 3.5. Cost Comparison between Existing and Proposed System.

3.5.4 Payback Analysis

The payback period analysis is a type of "break-even" measurement; it is a simple and popular methodology to measure the performance of the benefit which accumulates earnings sufficient to cover the investment. Payback period is defined as the point in time when initial investment costs are recovered completely and the proposed system's saving begin.

The discounted payback period must consist of the time value of money to adjust future money to be the current value and that is called "present value". The formula for present value is shown below:

$$PV_n = \frac{1}{(1+I)^n}$$

Where PV_n = Present value at year n

I = Discount rate (%)

n = Required year

Minimum Loan Rate (MLR), that is 5.75%, is used for discount rate in this project.

Table 3.14. Minimum Loan Rate in October, 2003.

Bank	MLR (%)
Bangkok Bank	5.75
Krung Thai Bank	5.75
Krungsri Ayudhya Bank	5.75
Siam Commercial Bank	5.75

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

The payback period can be calculated by the formula as follows:

$$P = \text{Last year of negative cash flow difference} + \frac{\text{Cumulative Difference last negative year}}{\text{Absolute value of cumulative difference}}$$

Where P = Payback period

$$P = 1 + \frac{405,183.85}{405,183.85 + 358,113.32}$$

$$P = 1.531 \text{ years}$$

The details of payback period is shown in Appendix C.

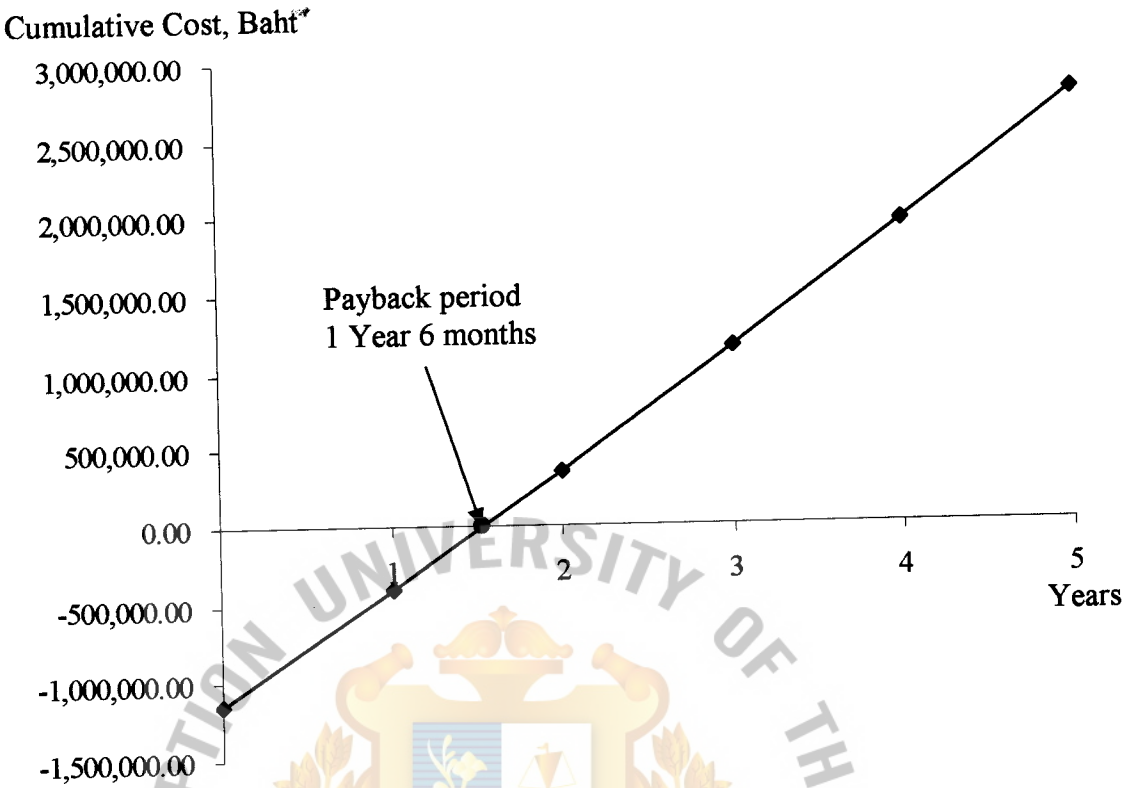


Figure 3.6. Payback Period Analysis of Proposed System.

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

Implementation includes those activities that take place to convert from the old system to the new system. Implementation is essential to provide a reliable system to solve business requirements. There are two main stages that are classified for implementing the proposed system, which are detailed as follows:

(1) Construction Stage

The construction stage is to develop and test a functional system that fulfills business requirements and to implement the interfaces between the proposed system and existing system. This stage includes the process of installation and acquisition of new hardware, software and testing in order to ensure that it would operate properly.

(2) Delivery Stage

The objective of the delivery stage is for a conversion plan that is prepared to provide a smooth transition to the new system. Conversion is the process of changing from the old system to the new system. It also includes networking configuration and training the staff. After the new system starts operation, system evaluation is conducted to discover any trouble in operation.

4.2 Construction Phase

(1) Hardware and Software Acquisition and Installation

The proposed system needs to acquire new hardware and software. Hardware for the proposed system needs one server, five client PCs, UPSs, and network. The factors that are used to define the hardware for the proposed system are as follows:

(a) Determining size and capacity requirements

The starting point in the equipment decision process is the size and capacity requirements because one particular system may be appropriate for one workload and inappropriate for another. The features, that are used to consider, include internal memory size, cycle, characteristics of display, etc.

(b) Financial factor

Purchasing new computer hardware is the factor that the new system selects because of the least cost in the long run, and distinct tax advantages.

For software acquisition, the proposed system needs new software that is server software, DBMS and development software. Flexibility of software system includes the ability to meet changing requirement and varying user needs. The areas where, flexibility is wanted are data storage, reporting and options, definition of parameters, and data input.

(2) Building and testing networks

For system implementation, the first activity is building and testing the network for the proposed system requires the network to share data, printers and communication. The network uses star topology for making client-server.

(3) Building and testing database

This task must immediately precede other programming activities because database is the resource shared by the computer programs to be written. Physical database will be created at the server. The database will be built depending on the structure of the database design requirement during the system design; it is shown in Appendix E.

After building database structure, the next step is testing sample data with database to add, modify, delete and retrieve data. Furthermore, database performance, data security, backup and recovery will be tested in this task.

(4) Writing and testing new program

The proposed system is the in-house program, and the system owner and system users are not involved in this step. The program will be split into small units. Every unit will be written and tested and then the units will be integrated into the final program. The final program will be tested again, and if an error occurs, the system designer can find the point where error occurs and solve it.

4.3 Delivery Phase

(1) Conducting system test

The purpose of this activity is to test all software, in the proposed program to ensure they can work together. This activity is concerned with system testing, and identification of program-specific problems may necessitate a return to previous activities and subsequent stub and unit level testing. The system owner and users are involved in this activity.

(2) Training system users

User training is an important part of implementation because it shows the system will succeed or fail when the user operates it. User training describes how to use the proposed system in their workplace. It enables the users to use and do some basic configurations and control their daily operations.

User training must also instruct individuals in troubleshooting the system, determining a problem arising caused by equipment or software or by something that they have done in using the system.

(3) Preparing conversion plan

This activity begins by preparing to place the new system into operation. This plan uses parallel conversion technique that uses both old and new system running together for some period of time until the new system solves all the problems and the program is free of error.

(4) Converting to new system

After that, the parallel run will stop and the existing system will be cancelled and the new one will convert the data and run the program.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The purpose of this system development project is to analyze, design, and implement the system to support the spare-part inventory management information system for Spare-part Department of Siam Motors Industries Co., Ltd. Most parts of the existing system are manually managed, especially product procurement, which causes many problems, lots of human errors, complex and time-consuming in gathering the information, and is too slow because it uses the telephone line to link to the Mainframe of Siam Motors Co., Ltd. The proposed system is then developed in order to improve business requirements.

The proposed system uses the Client/Server architecture. Specifications of the servers and clients are shown in Table 3.4, 3.5, 3.6 in the previous chapter. The proposed system uses Microsoft Windows 2000 Server, Microsoft SQL 2000, Microsoft XP, Microsoft Visual Basic .NET to develop the system.

The benefit of saving cost and time is proved by the work performed as is shown in the previous chapter "The cost and benefit analysis". Based on the cost and benefit analysis section, breakeven point will occur within four months of the first year after using the proposed system. The proposed system will reduce cost of the mainframe rental and people-ware cost. Table 5.1 shows the time performed on each process and the benefit of the proposed system compared with the existing system.

Table 5.1. Degree of Achievement.

Process	Existing System	Proposed System
Sale Product Process	20 minutes	5 minutes
Check Product In Stock	1 minutes	1 second
Generate Invoice Process	20 minutes	2 minutes
Customer Payment Process	20 minutes	5 minutes
Calculate Suggest Order Process	5 days	1 minutes
Prepare to Order Process	5 days	2 days
Product Receiving Process	10 minutes	10 minutes
Input data (insert, modify data)	10 minutes	5 minutes
Output Data (Report and Query)	60 minutes	1 minute
Total	10 days and 141minutes	2 days, 30 minutes and 1 second

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

(1) Sale Product Process:

The existing system spends 20 minutes to input customer information, and part information in paper sheet (Sale Request) by searching the part number from the PC. In contrast, the proposed system provides the Graphic User Interface to make the direct input process easy; the officer can check the customer by using the Customer ID, search the part number immediately and then print out the sale request by spending 5 minutes only.

(2) Check Product In Stock:

The proposed system provides the product information. The store controller can check the products immediately. On the other hand, the existing system spends 5 minutes for uploading to the mainframe at Siam Motors Co., Ltd. and then downloading the product information.

(3) Generate Invoice Process:

When the accountant receives the sale request, it takes time to input the data to the existing system for generating invoice and updating the product information. But in the proposed system, this process is almost complete from the sale request that inputs the information. The accountant just only inputs the sale request number and checks the information.

(4) Customer Payment Process:

The proposed system provides the user to check the invoice and customer payment. When the customer pays the money, the process of generate receipt just takes 5 minutes because the proposed system can download the invoice information that is not payment yet.

(5) Calculate Suggest Order Process:

Because there are more than 10,000 items of spare parts, the existing system takes a time to calculate suggested order manually. But the proposed system can provide this process by using the machine.

(6) Prepare to Order Process:

This process is the same as calculate suggested order process. When the existing system calculates the suggested order, the purchasing section takes time to look at the suggested order for making the purchasing order. In contrast, the proposed system can calculate the suggested order immediately and compare it to the actual order in the Purchasing Order Input Screen.

(7) Product Receiving Process:

The proposed system cannot improve this process because this process must still have manual activity that is the counting of the products.

(8) Input data (insert, modify data):

The proposed system uses Graphic User Interface that is designed to be user friendly. The input screens are easy to understand and to input the data. The existing system is in the DOS mode that is hard for the users.

(9) Output Data (Report and Query):

The proposed system creates reports and queries by using the scope of the desired key to generate. Since all data are kept in the database, it is easy to collect the data to generate the report. On the other hand, the existing system is linked to the mainframe of Siam Motors Co., Ltd.; so, the reports will be generated at Siam Motors Co., Ltd. and they will be sent to the company.

5.2 Recommendations

Inventory is one of the most expensive and important assets in many companies. Because of this, how a company manages its inventory has significant effects on cash flow as well as profitability. Inventory Management deserves separate mention beyond other phases of accounting due to its importance to operations, especially for the inventory of spare-parts, which are various. Each spare-part has its degree of importance and essential to be closely examined.

This project is presented to show how to efficiently manage the spare-parts. If the inventory of spare-parts is efficiently managed, customer service is improved through fast shipment of customers' orders, and by doing so certain costs are reduced.

The proposed system of spare-part inventory management information system is designed in the form of Client/Server computing. This project brings the use of computer system to control inventory instead of manual system. By the use of computer, it is convenient to control the inventory, and reduce repetition and error. It also reduces

time-consumption in each process. Moreover, the computerized inventory control system will be a decision making support system, which helps in making decisions about product procurement. By using Suggested Order System, which is explained in Appendix J, the order quantities will be suitable, not too much, or too low.

The system in this project can be an application of inventory control for other companies such as book stores, stationary stores, or drug stores. The main point of the system is Part Moving Code, which helps in understanding the basic of inventory. It helps to efficiently manage the stock. With suggested order, ordering quantities are compatible to demand.

For Part Moving Code and Suggested order, it is seen that Part Moving Code defines the policy of products procurement; therefore, the importance of categories, including policies should be arranged in suitable order. If they are arranged unsystematically, the efficiency of inventory management will be reduced. Concerning with Suggested order, it is seen that the disadvantage of suggested order is that it is well applied for the products which have steady demand. If the products do not have steady demand, the order should be considered more by using Suggested Order.

Whether the system in this project is efficiently used or not, the important thing to remember is that inventory management by using computer is not always good. The users should have a clear idea about the policies, which are related to using the computer system. Although the system is quite complete, if the use of policies is not compatible with the organization, the system will not be efficient.

APPENDIX A

USER INTERFACE DESIGN

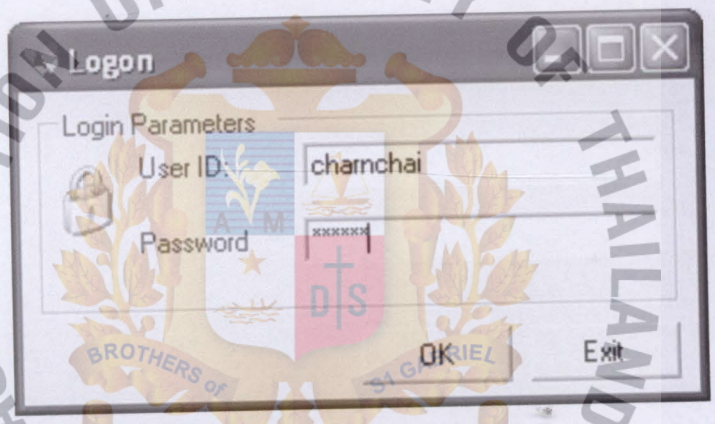


Figure A.1. Login Menu of Spare-part Inventory Management Information System.

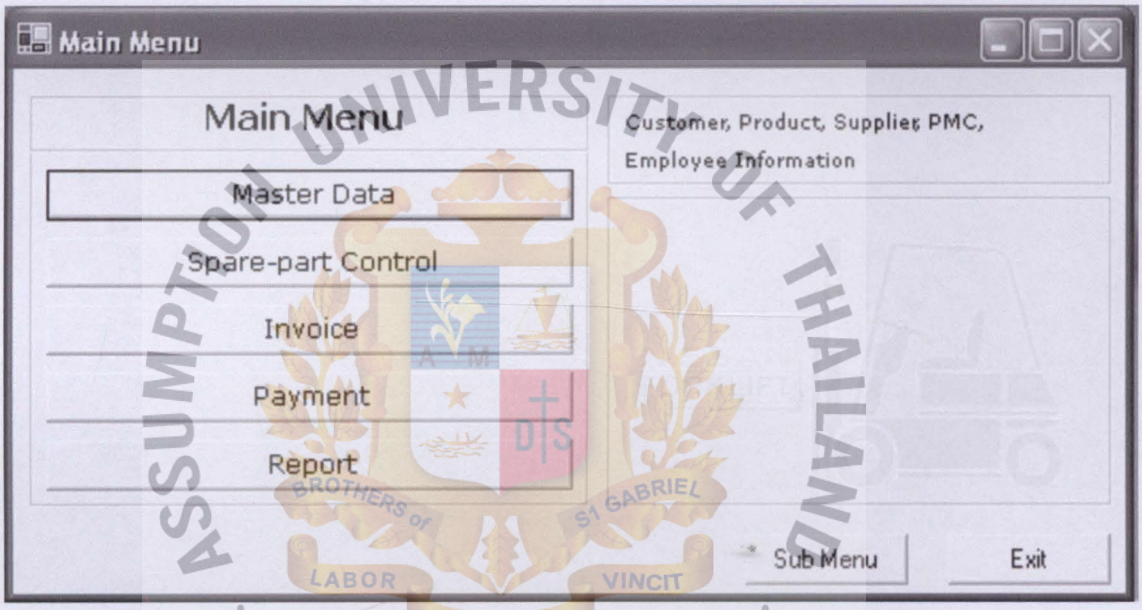


Figure A.2. Main Menu of Spare-part Inventory Management Information System.

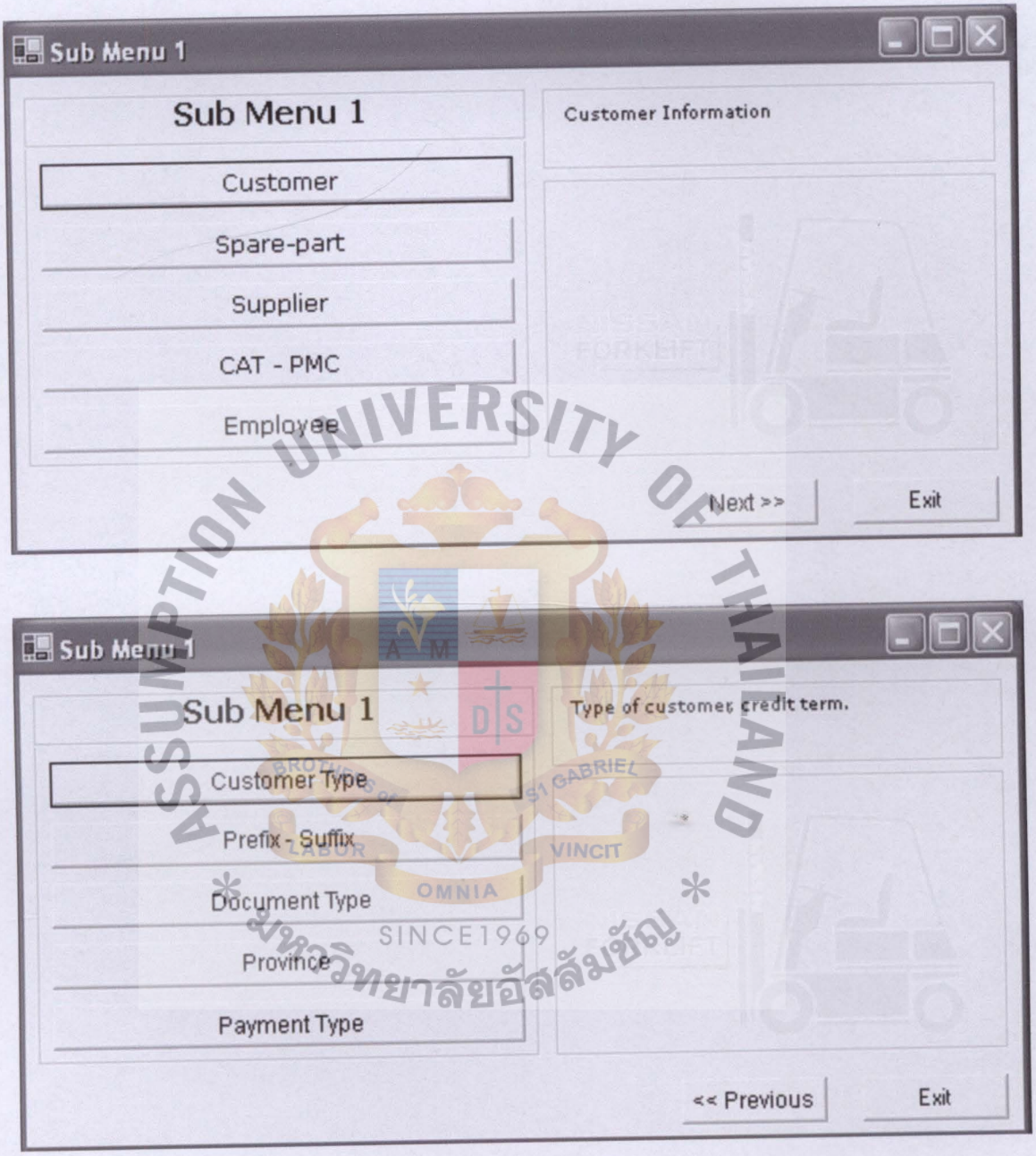


Figure A.3. Sub Menu 1 of Master Data.

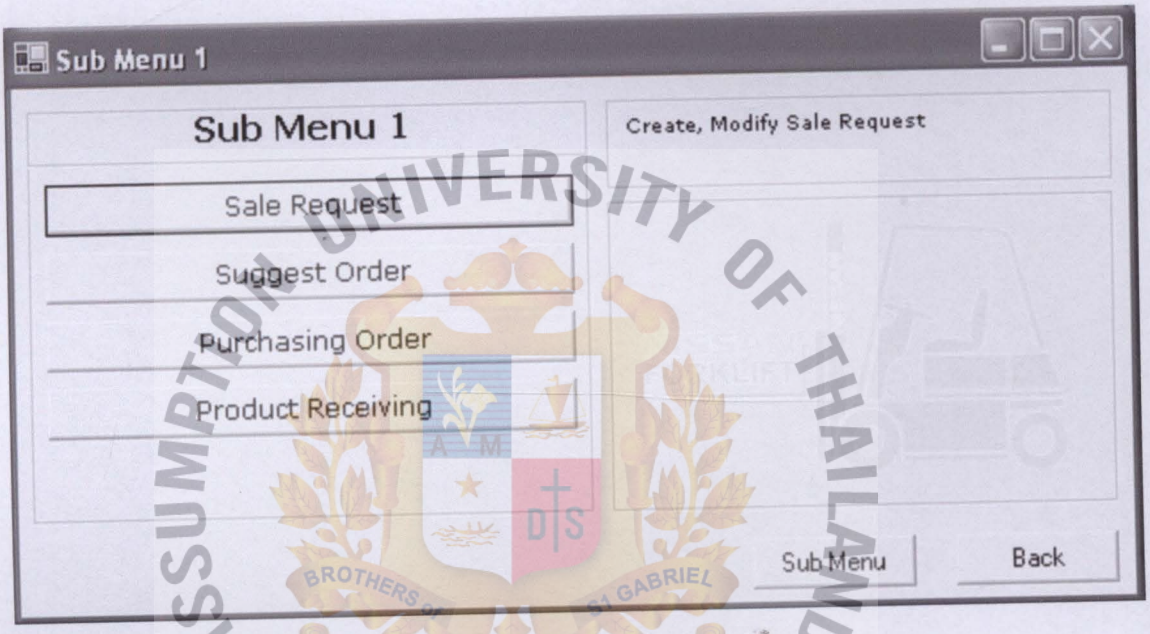


Figure A.4. Sub Menu 1 of Spare-part Control.

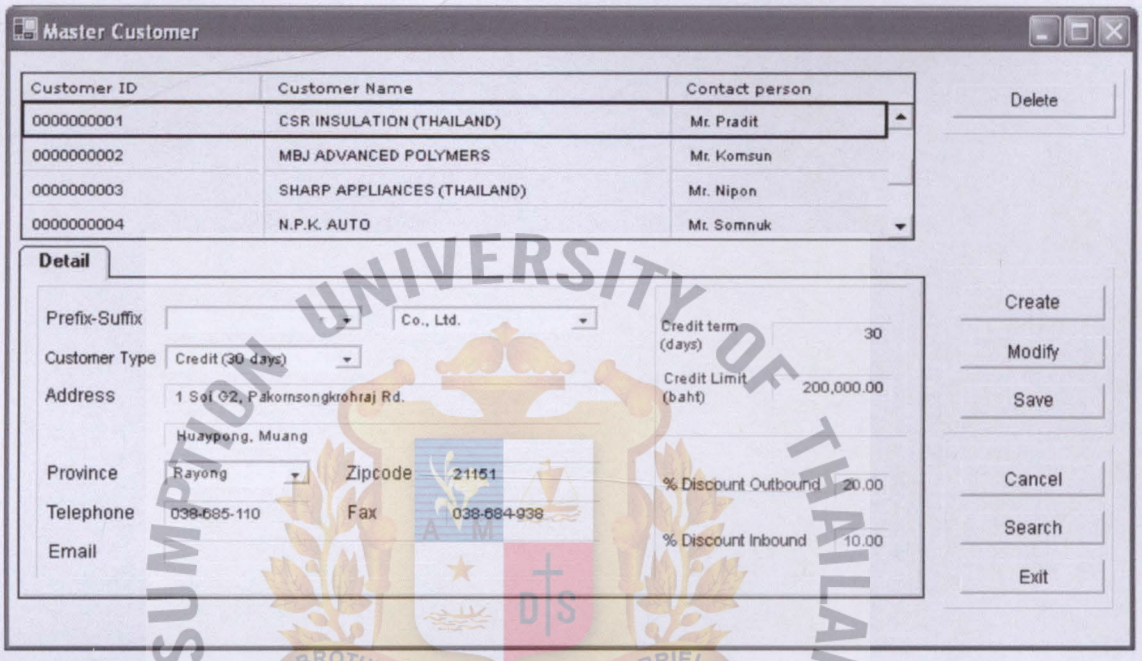


Figure A.5. Customer Information Screen.

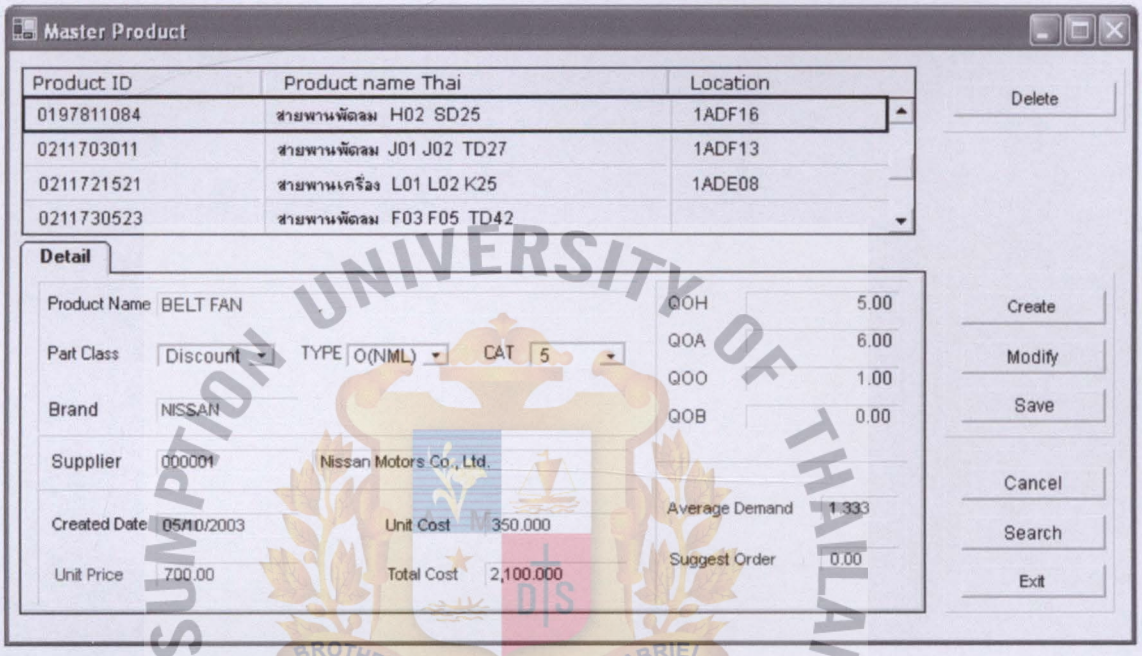


Figure A.6. Spare-Part Information Screen.

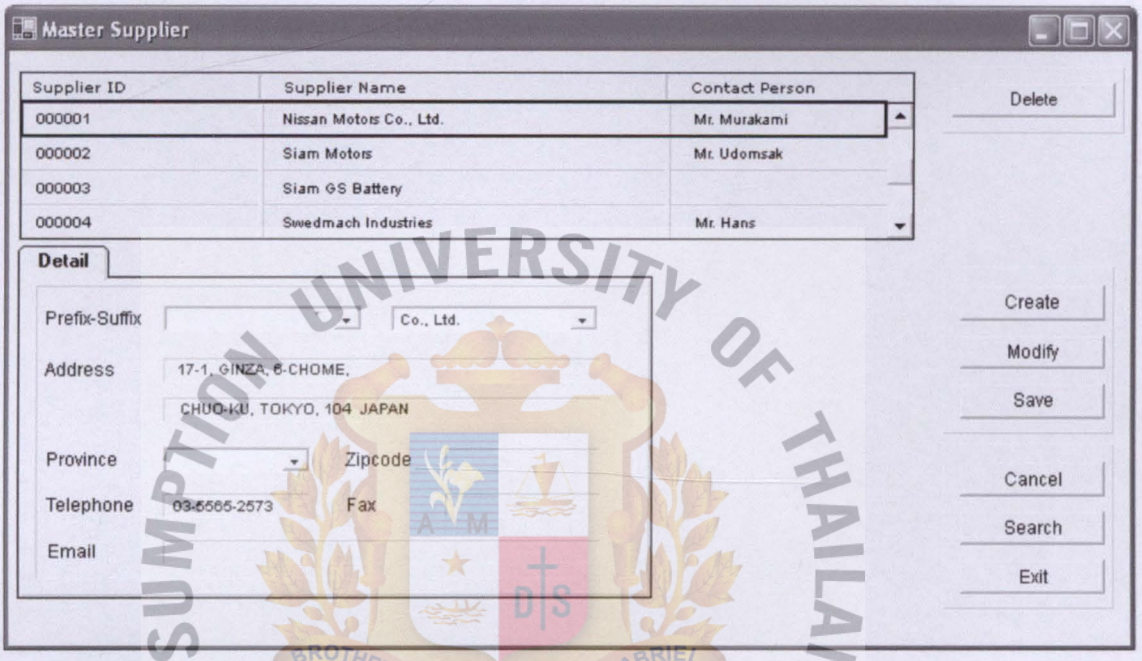


Figure A.7. Supplier Information Screen.

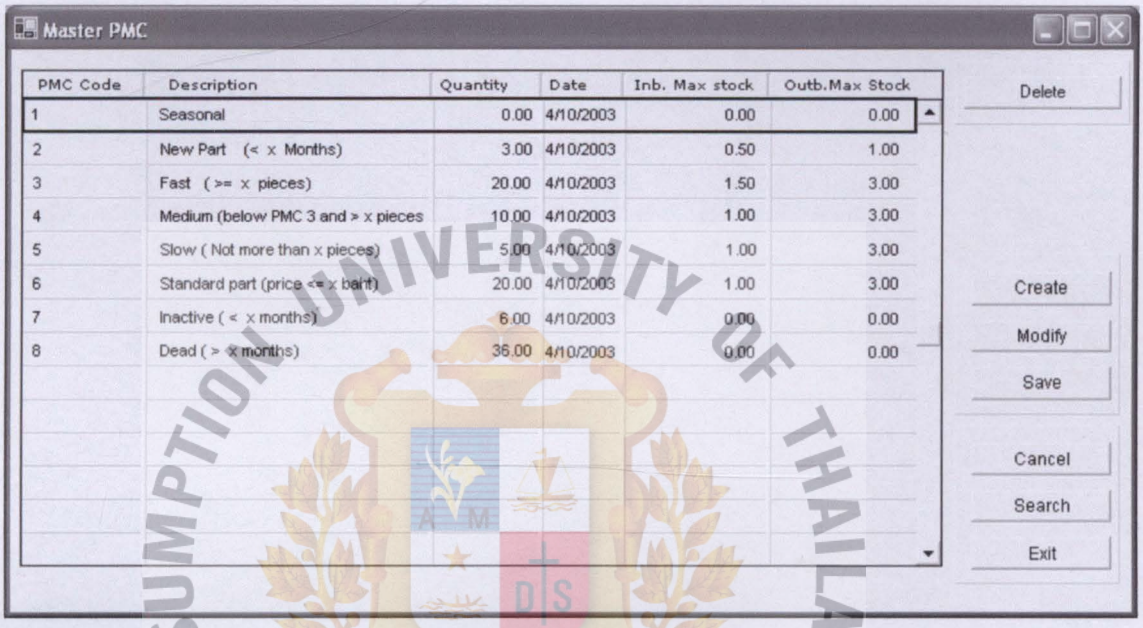


Figure A.8. CAT-PMC Information Screen.

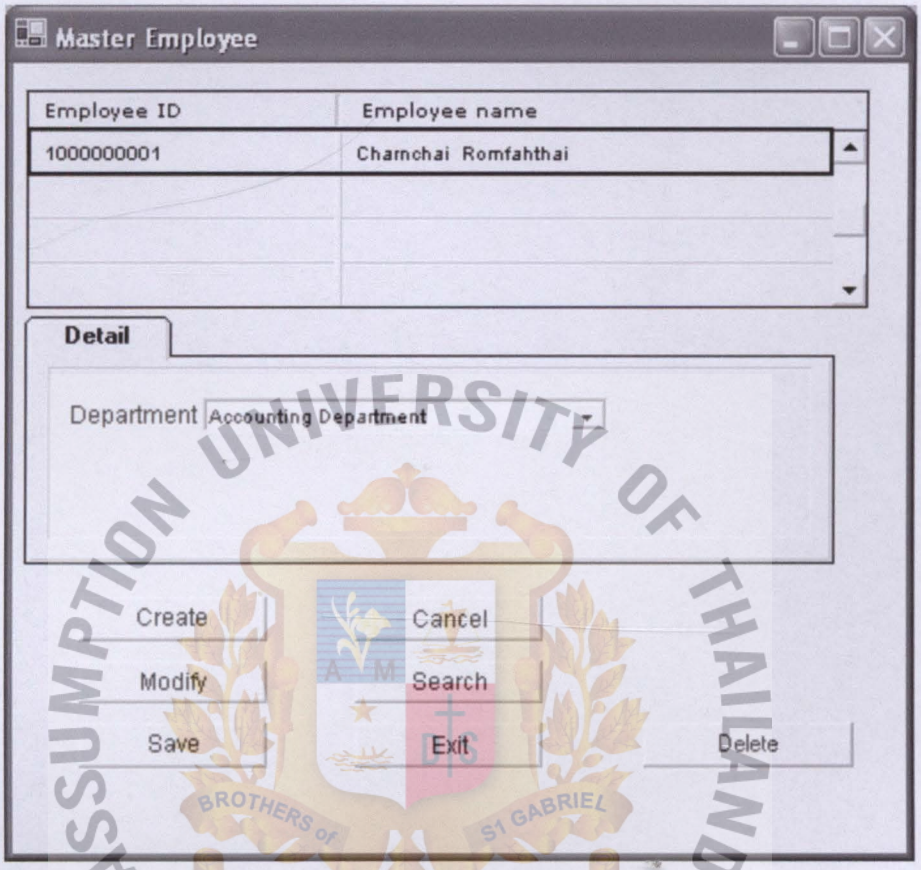


Figure A.9. Employee Information Screen.

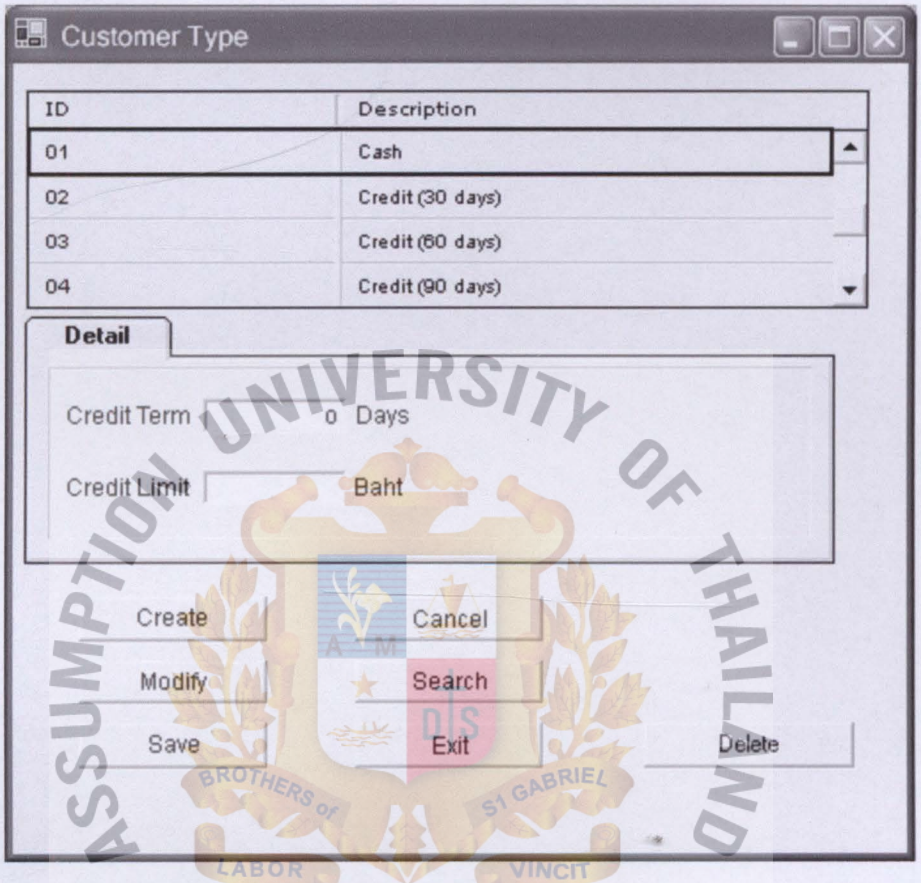


Figure A.10. Customer Type Screen.

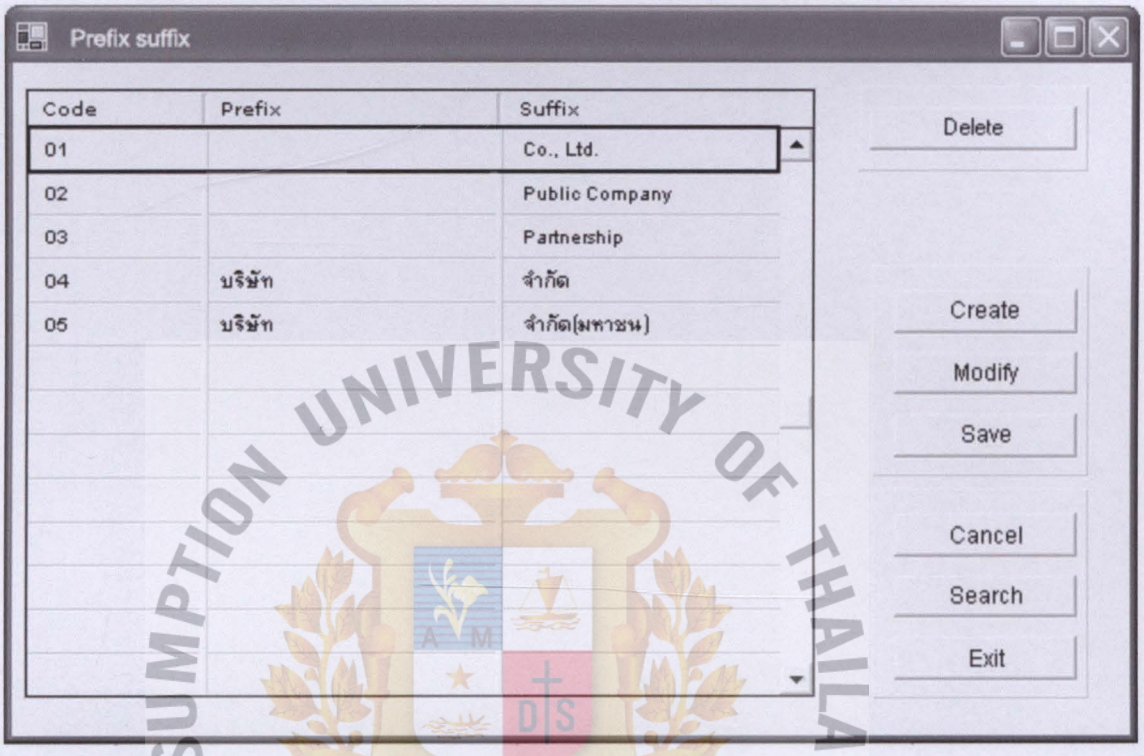


Figure A.11. Prefix Suffix Screen.

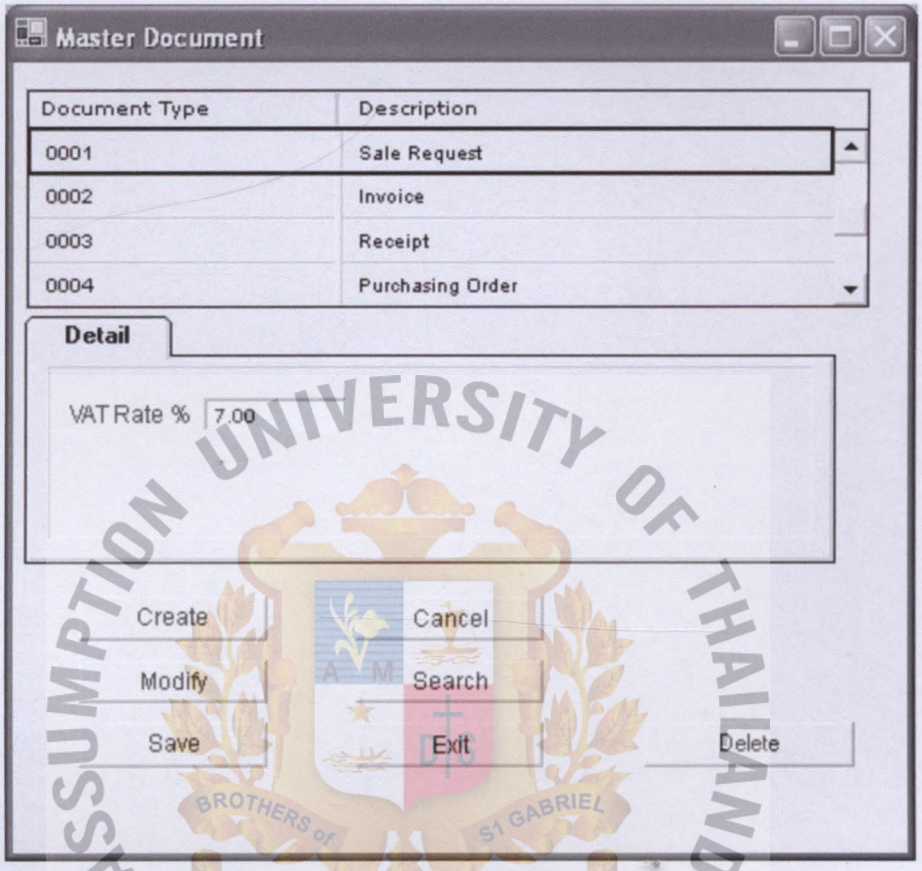


Figure A.12. Document Type Screen.

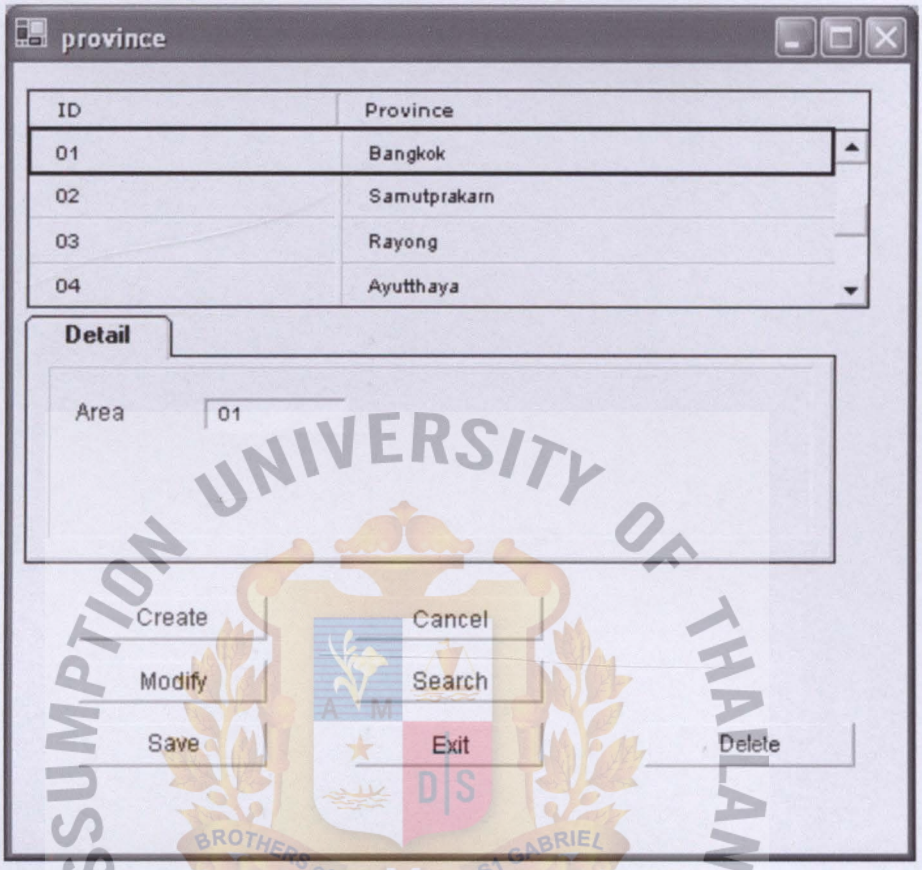


Figure A.13. Province Screen.

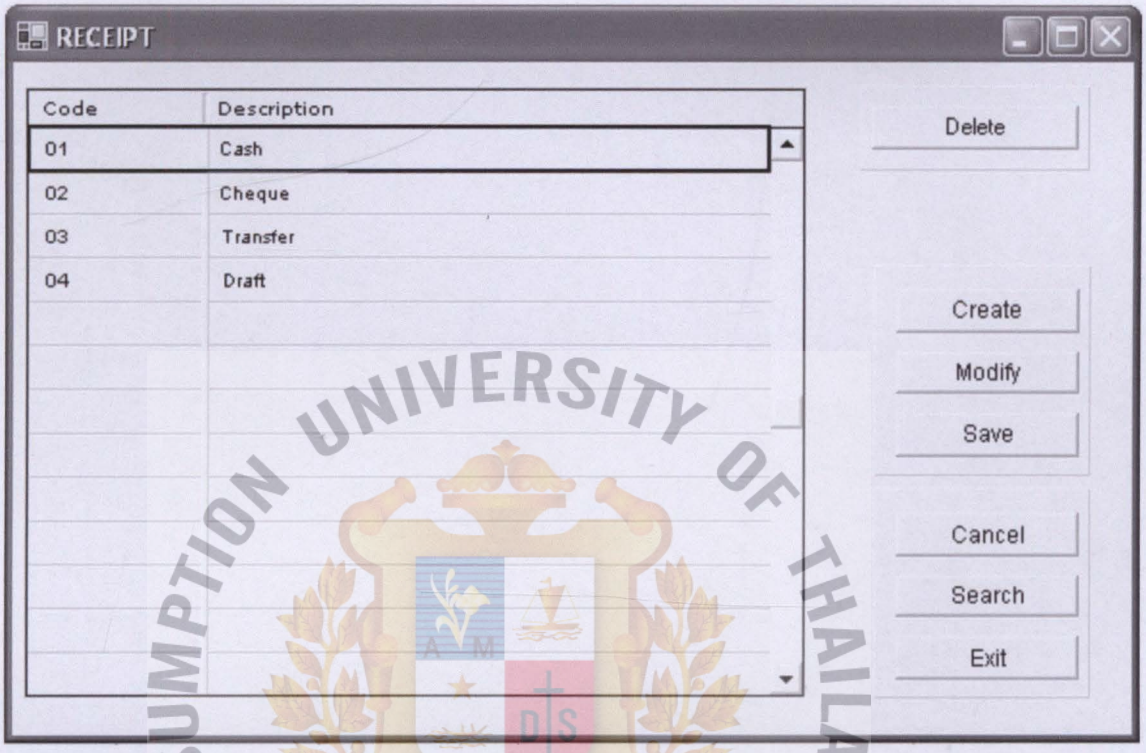


Figure A.14. Payment Type Screen.

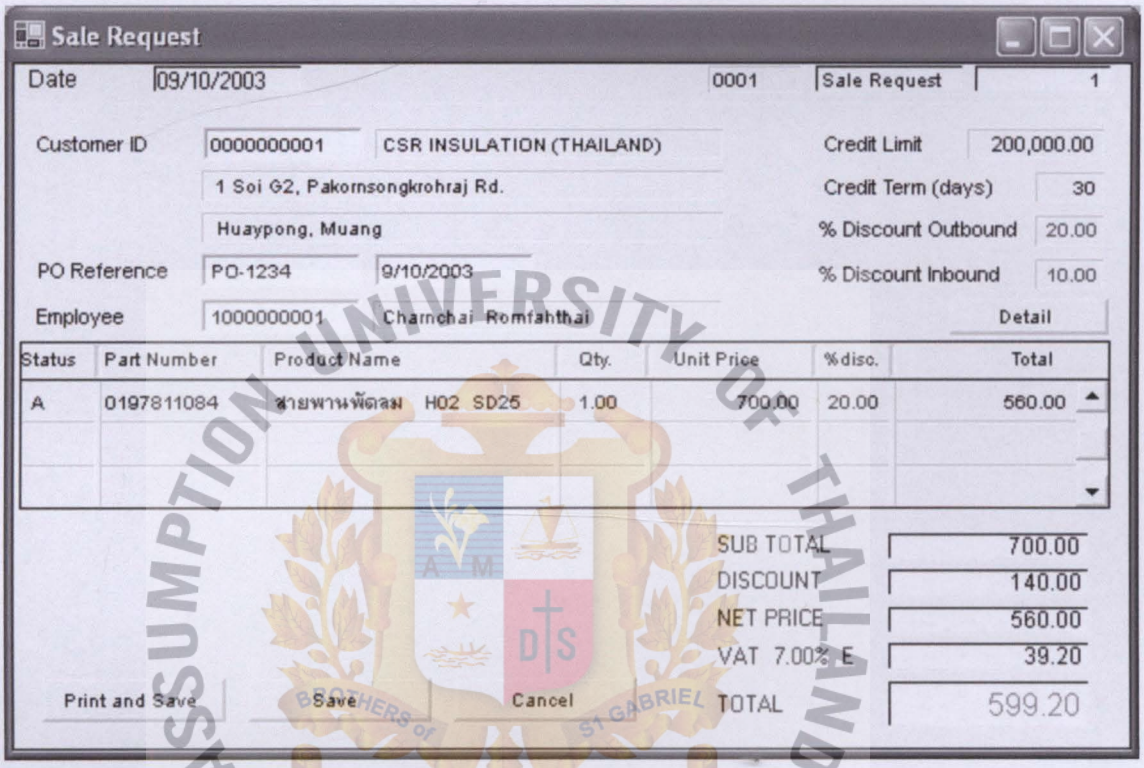


Figure A.15. Sale Request Screen.

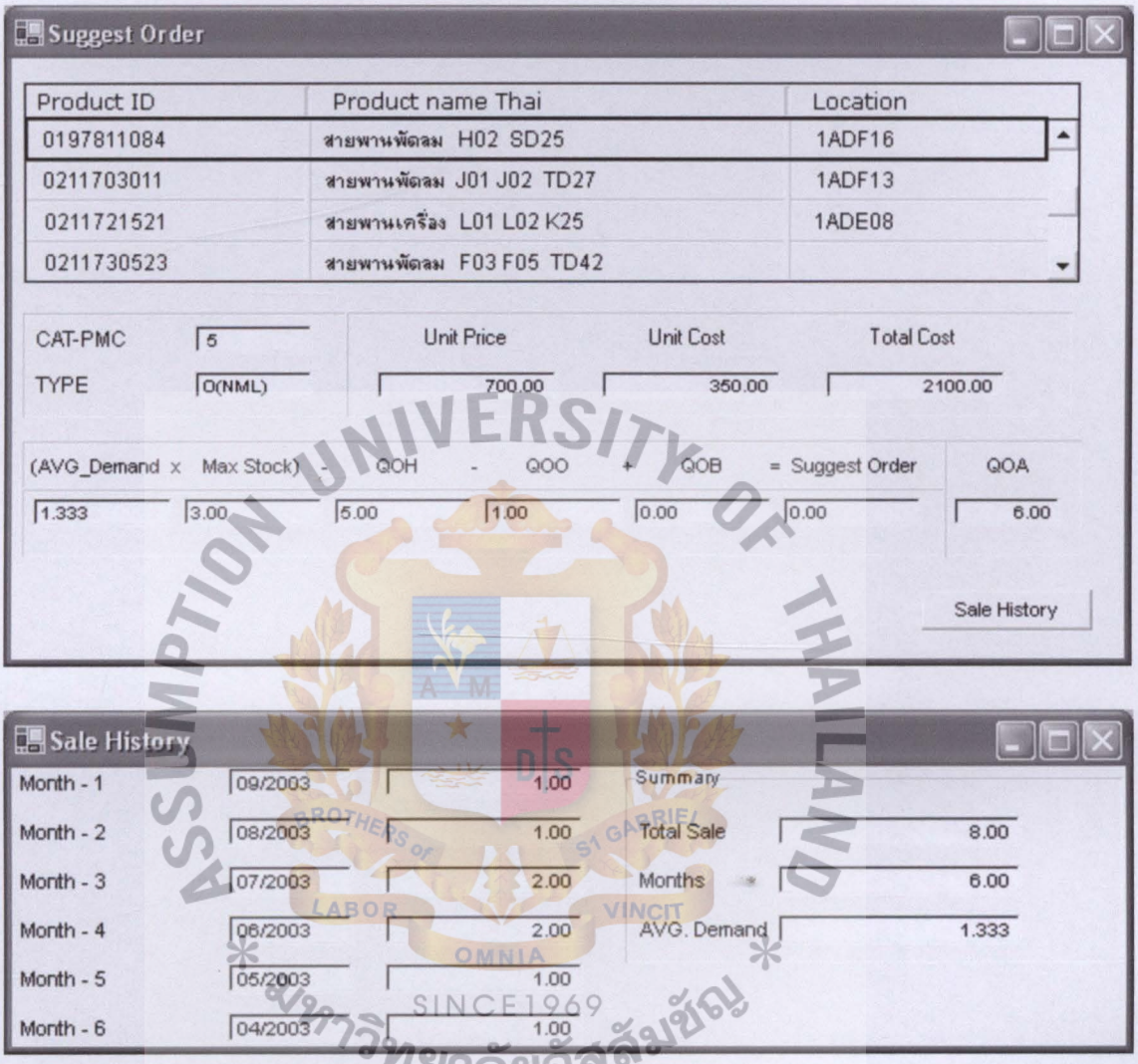


Figure A.16. Suggested Order Screen.

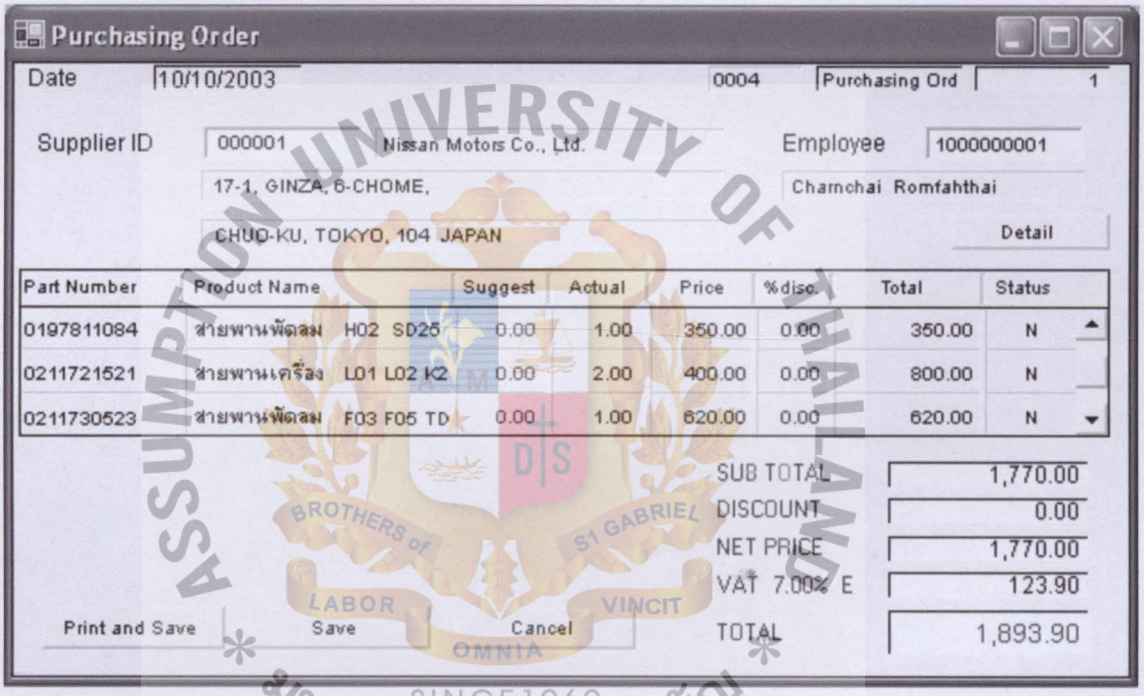


Figure A.17. Purchasing Order Screen.

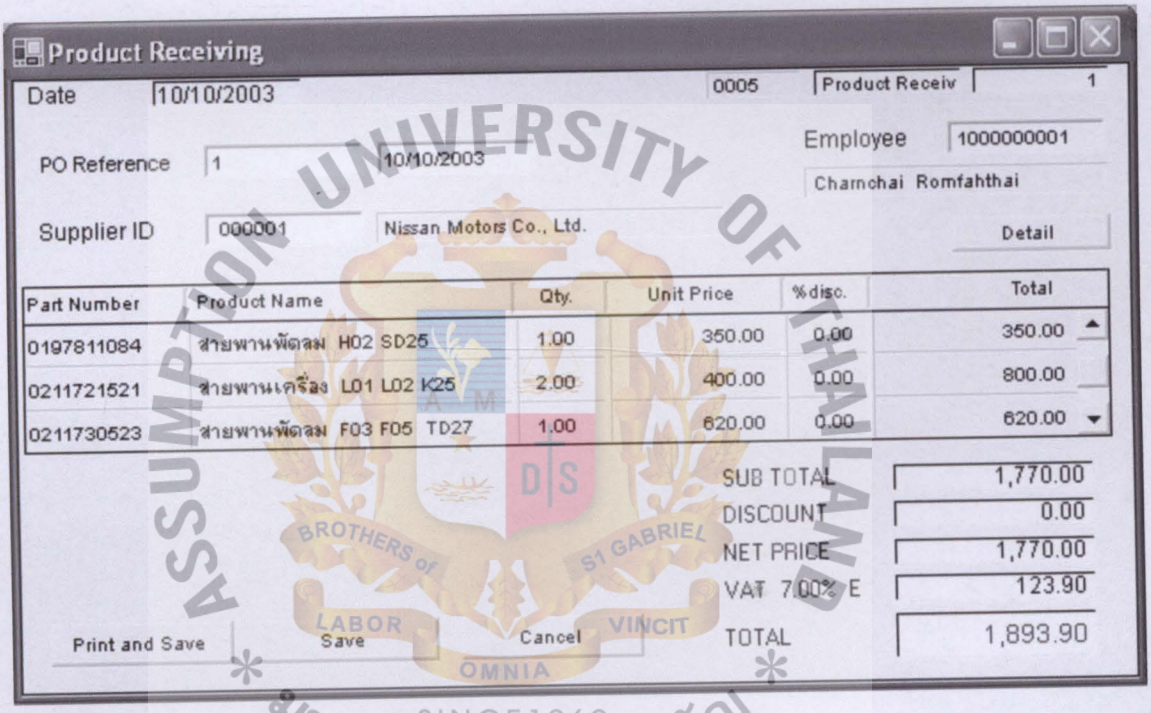


Figure A.18. Product Receiving Screen.

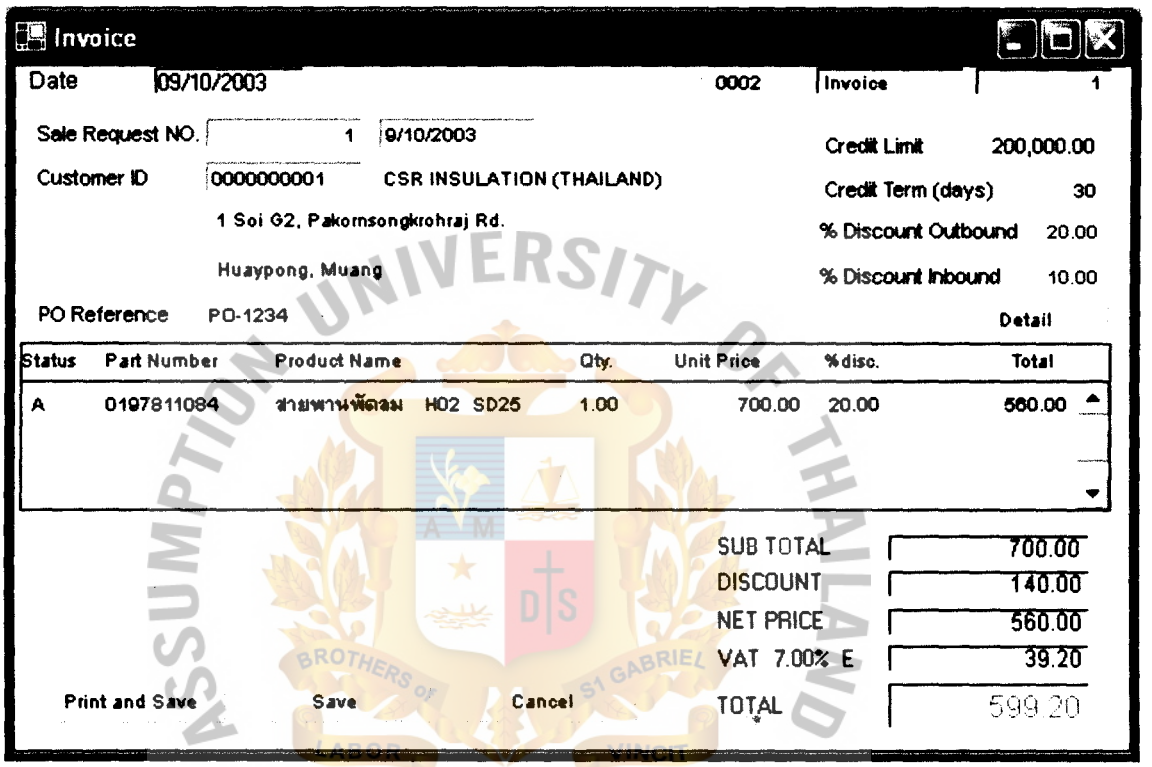


Figure A.19. Invoice Screen.

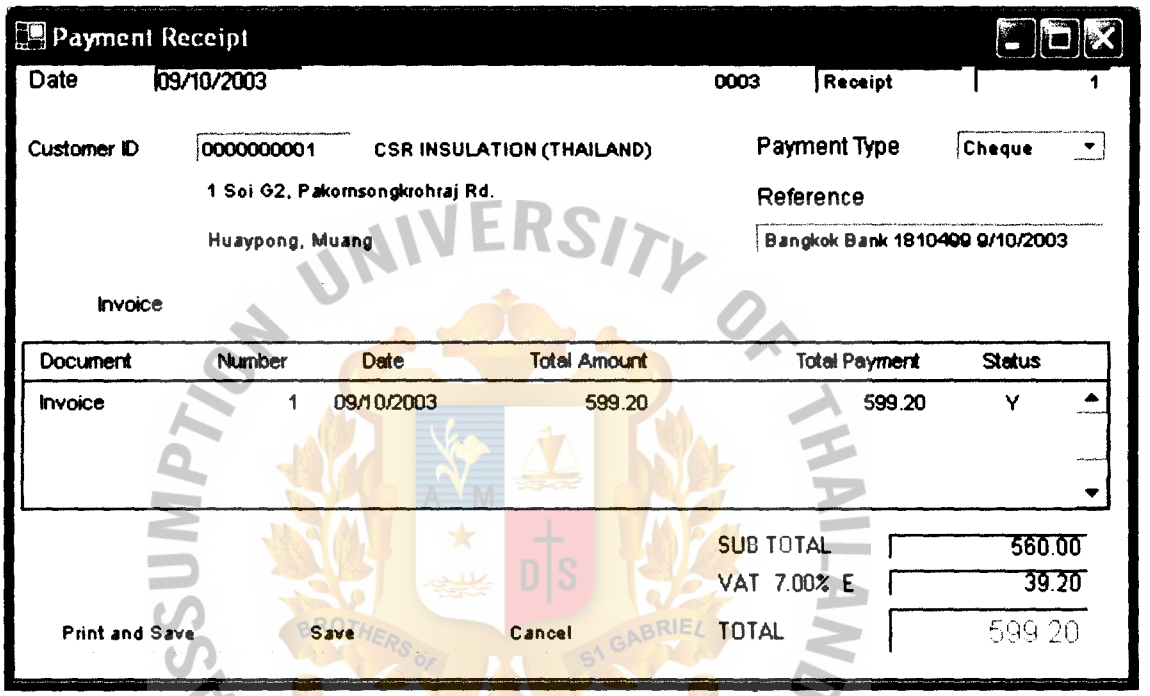


Figure A.20. Payment Screen.

APPENDIX B

REPORT DESIGN

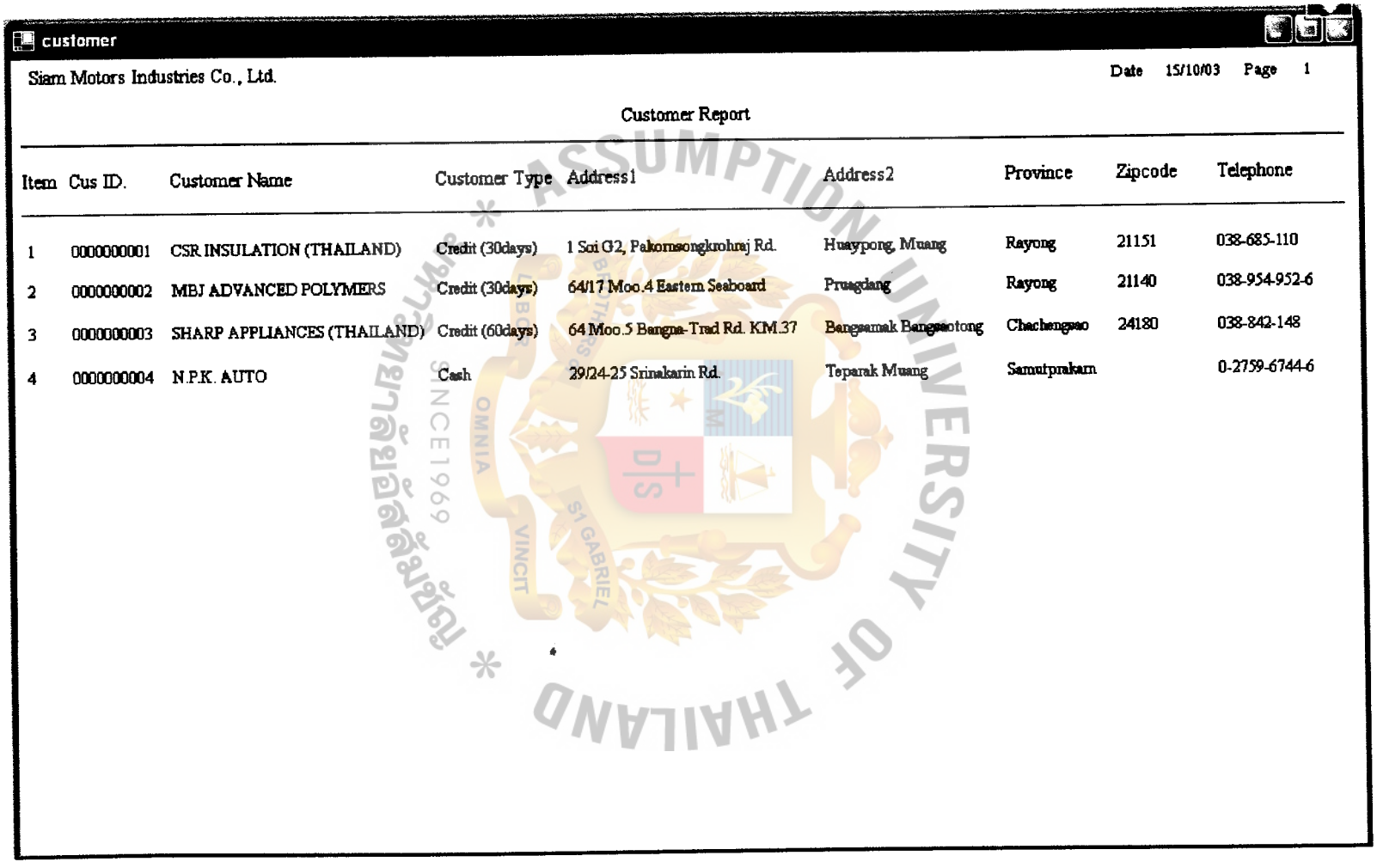
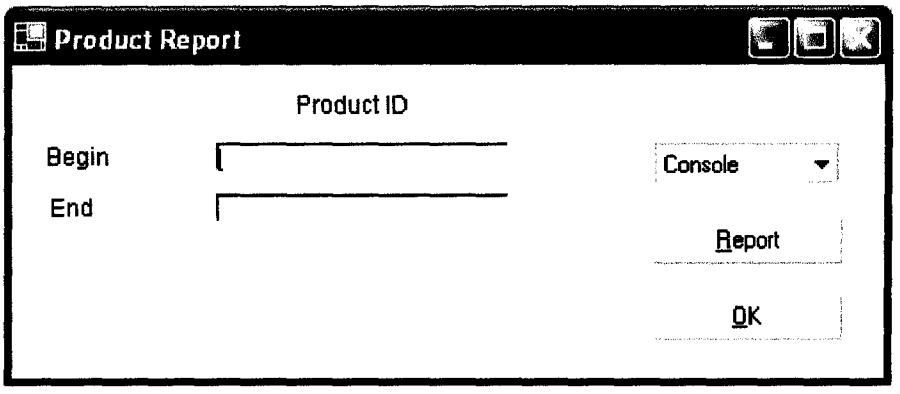
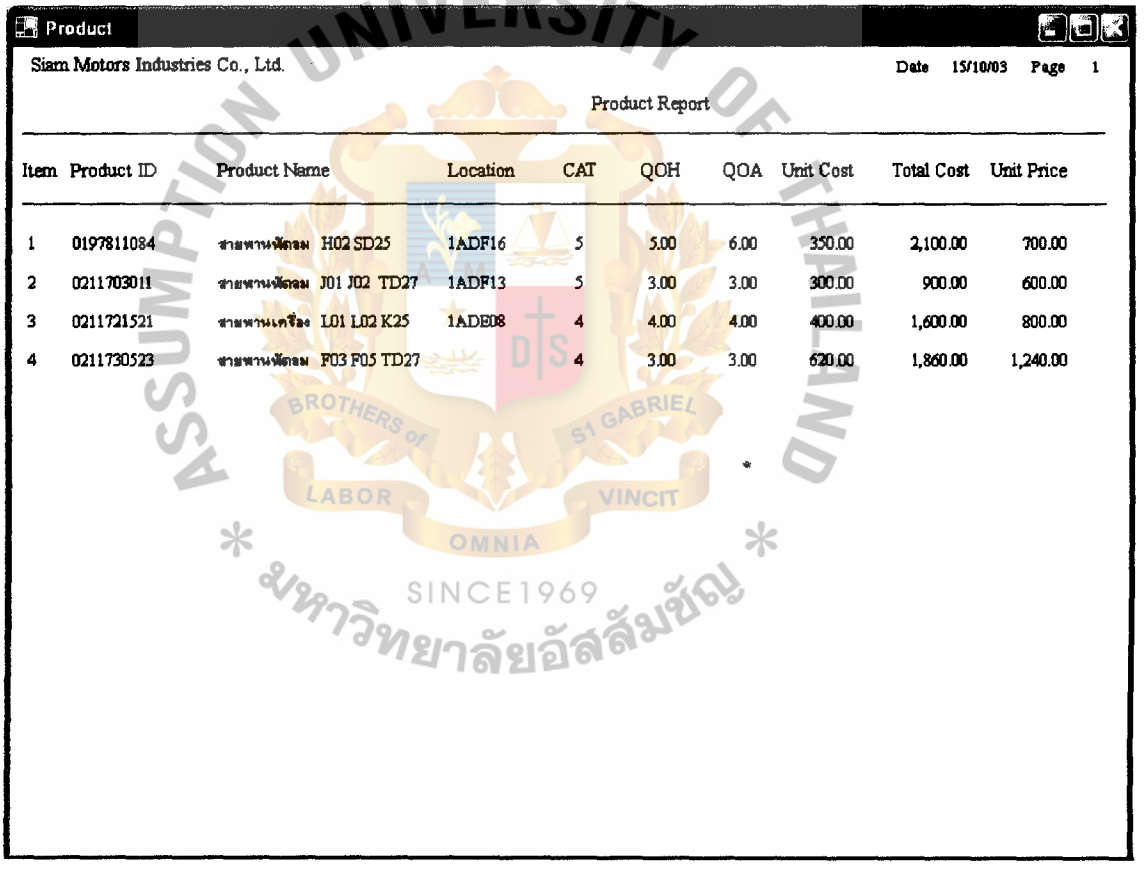


Figure B.1. Customer Report.





Item	Product ID	Product Name	Location	CAT	QOH	QOA	Unit Cost	Total Cost	Unit Price
1	0197811084	ชายพานพัดลม H02 SD25	1ADF16	5	5.00	6.00	350.00	2,100.00	700.00
2	0211703011	ชายพานพัดลม J01 J02 TD27	1ADF13	5	3.00	3.00	300.00	900.00	600.00
3	0211721521	ชายพานเครื่อง L01 L02 K25	1ADE08	4	4.00	4.00	400.00	1,600.00	800.00
4	0211730523	ชายพานพัดลม F03 F05 TD27		4	3.00	3.00	620.00	1,860.00	1,240.00

Figure B.2. Product Report.

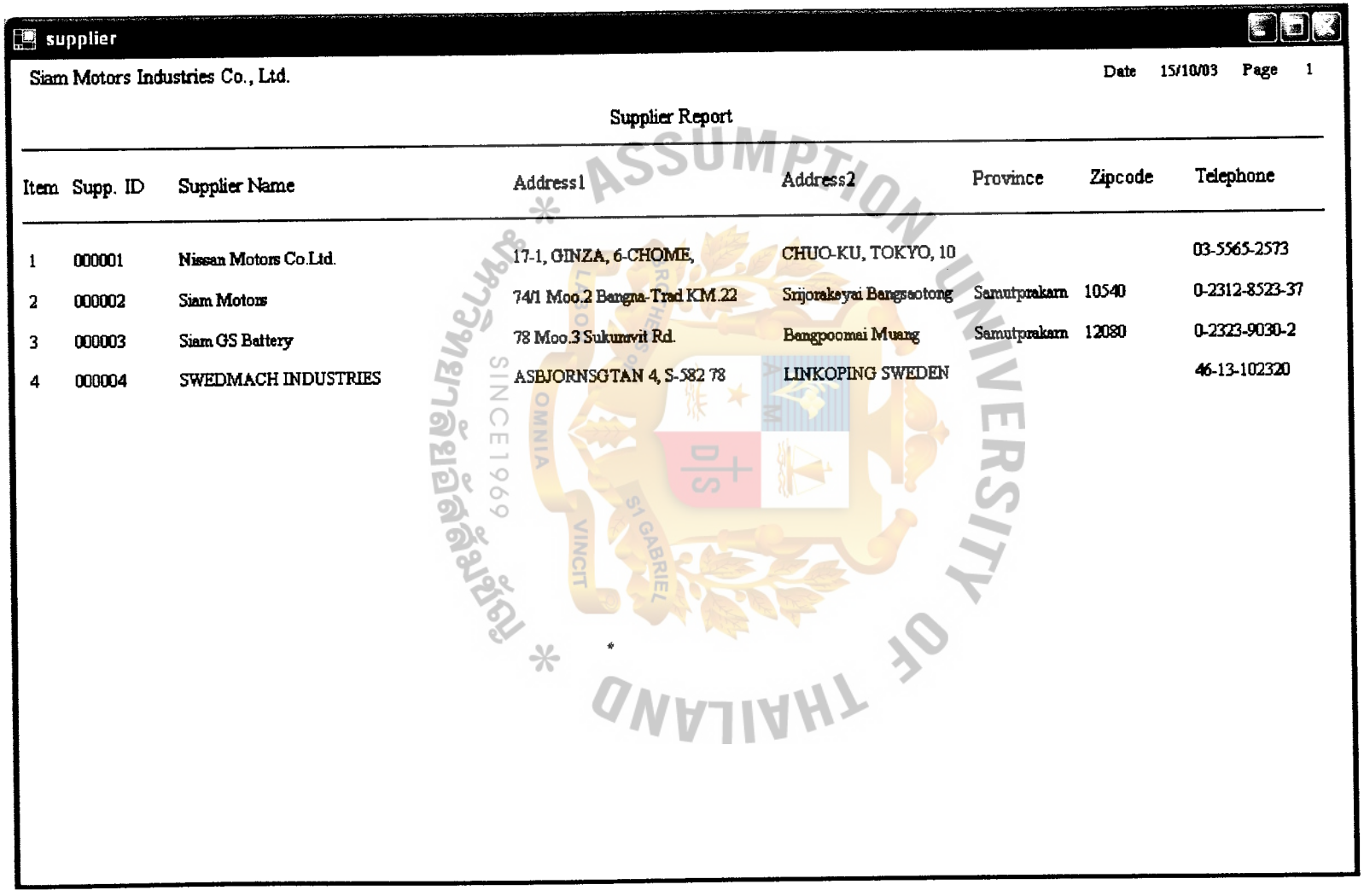
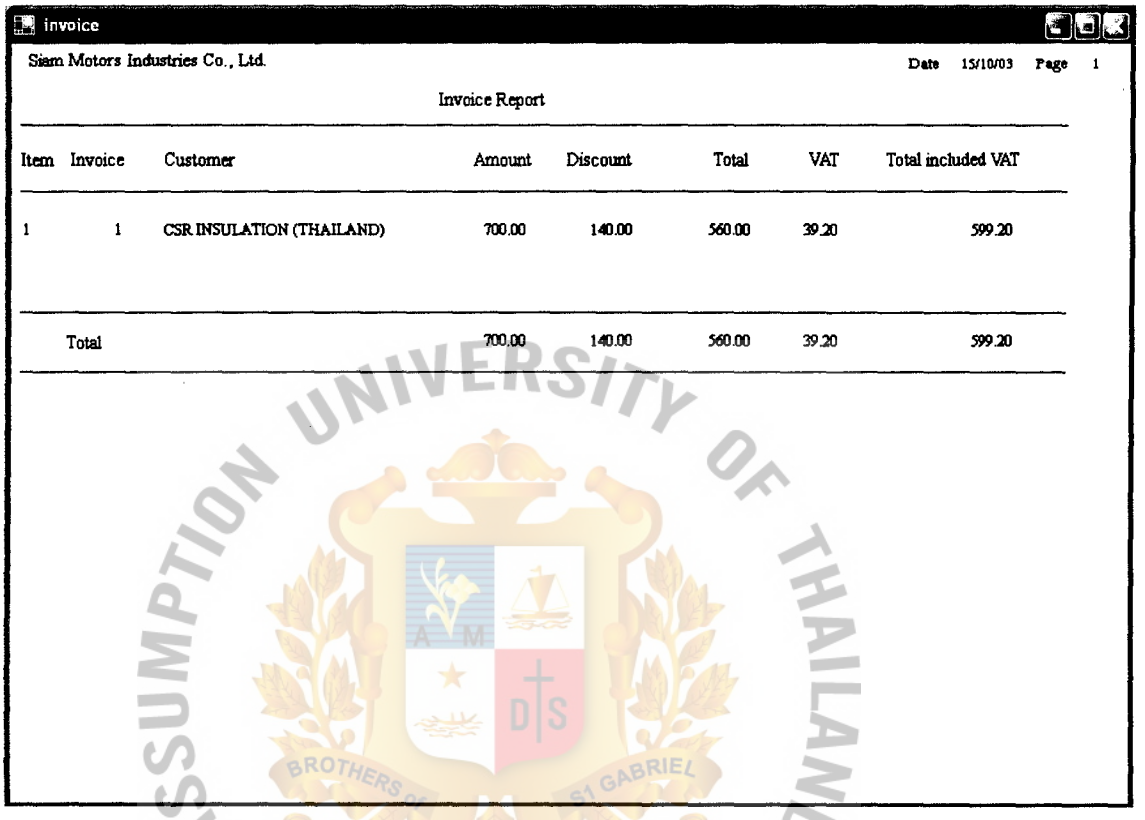


Figure B.3. Supplier Report.



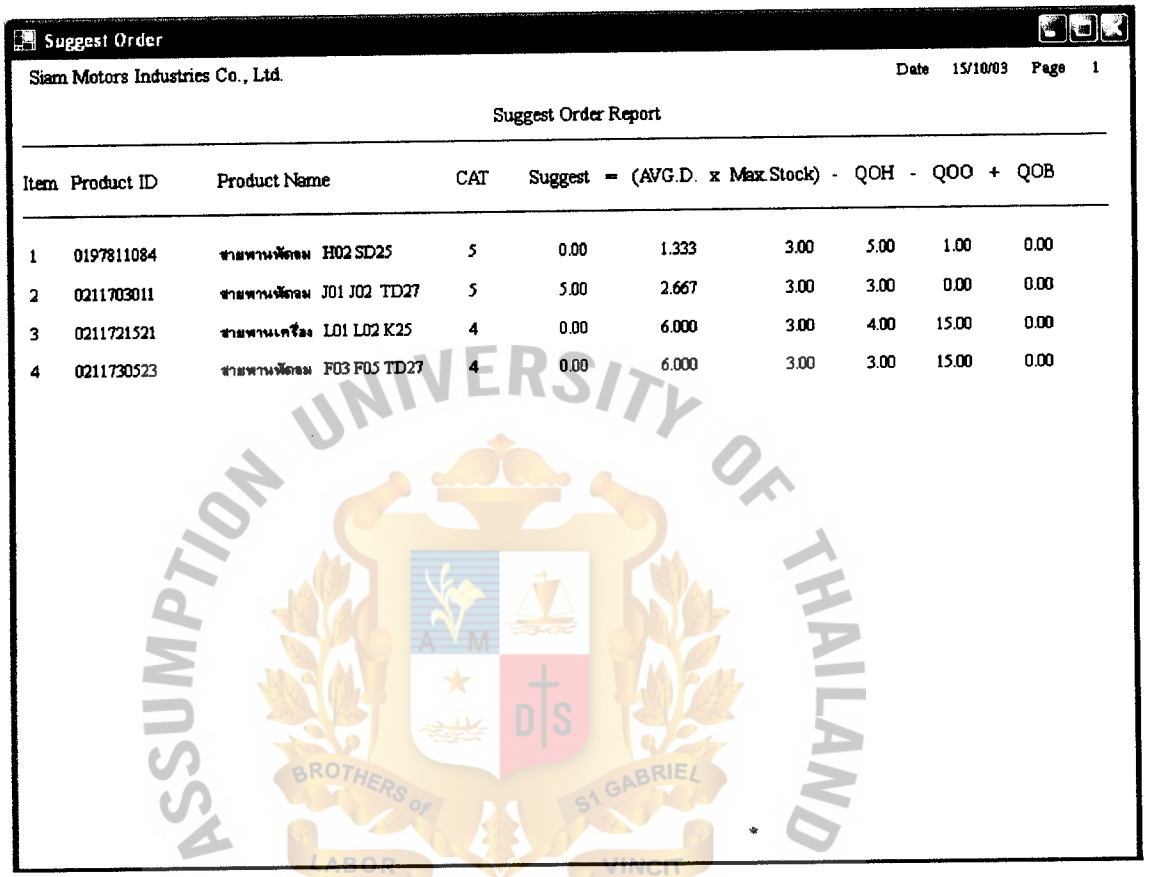
invoice

Siam Motors Industries Co., Ltd. Date 15/10/03 Page 1

Invoice Report

Item	Invoice	Customer	Amount	Discount	Total	VAT	Total included VAT
1	1	CSR INSULATION (THAILAND)	700.00	140.00	560.00	39.20	599.20
	Total		700.00	140.00	560.00	39.20	599.20

Figure B.4. Invoice Report.



Suggest Order

Siam Motors Industries Co., Ltd. Date 15/10/03 Page 1

Suggest Order Report

Item	Product ID	Product Name	CAT	Suggest = (AVG.D. x Max.Stock) - QOH - QOO + QOB					
1	0197811084	ชายพานพัดลม H02 SD25	5	0.00	1.333	3.00	5.00	1.00	0.00
2	0211703011	ชายพานพัดลม J01 J02 TD27	5	5.00	2.667	3.00	3.00	0.00	0.00
3	0211721521	ชายพานแอร์ L01 L02 K25	4	0.00	6.000	3.00	4.00	15.00	0.00
4	0211730523	ชายพานพัดลม F03 F05 TD27	4	0.00	6.000	3.00	3.00	15.00	0.00

Figure B.5. Suggested Order Report.

APPENDIX C

FEASIBILITY ANALYSIS

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

Cost Items		Price
Development Costs		
People-ware Cost:		
1 System Analyst	(3 Months @ 25,000)	75,000.00
2 Network Specialists	(1 Month @ 18,000)	36,000.00
Total People-ware Cost		111,000.00
Hardware Costs:		
Computer Server	(1 unit @ 89,100)	89,100.00
Workstation	(5 units @ 20,000)	100,000.00
Dot matrix Printer	(2 units @ 28,000)	56,000.00
Laser Printer	(1 unit @ 67,000)	67,000.00
Network Cost		35,000.00
UPS 1KVA	(1 unit @ 17,700)	17,700.00
UPS 500 VA	(5 units @ 2,500)	12,500.00
Total Hardware Costs		377,300.00
Software Costs:		
Windows 2000 Server	(1 unit @ 24,780)	24,780.00
Windows 2000 Client	(5 units @ 1,232)	6,160.00
Microsoft Windows XP	(5 units @ 7,500)	37,500.00
Visual Foxpro	(1 unit @ 20,000)	20,000.00
Inventory Control Software Package		50,000.00
Microsoft Office XP	(5 units @ 10,000)	50,000.00
Total Software Costs		218,440.00
Implementation Costs:		
Training Cost		20,000.00
Installing Cost		20,000.00
System Integration		30,000.00
System Modified		20,000.00
Miscellaneous Cost		50,000.00
Total Implementation Cost		140,000.00
Total Development Costs		816,740.00

Table C.1. Estimated Cost of Candidate 1, Baht. (Continued.)

Cost Items		Year 1	Year 2	Year 3	Year 4	Year 5
Annual Operating Costs						
People-ware Cost:						
Inventory Manager	(1 person @ 30,000 per month)	360,000.00	396,000.00	435,600.00	479,160.00	527,076.00
Purchasing Chief	(1 persons @ 20,000 per month)	240,000.00	264,000.00	290,400.00	319,440.00	351,384.00
Store Controller Chief	(1 person @ 20,000 per month)	240,000.00	264,000.00	290,400.00	319,440.00	351,384.00
Purchasing Clerk	(2 person @ 10,000 per month)	240,000.00	264,000.00	290,400.00	319,440.00	351,384.00
Store Controller Officer	(3 persons @ 8,000 per month)	288,000.00	316,800.00	348,480.00	383,328.00	421,660.80
Accounting Officer	(2 persons @ 12,000 per month)	288,000.00	316,800.00	348,480.00	383,328.00	421,660.80
Total People-ware Cost		1,656,000.00	1,821,600.00	2,003,760.00	2,204,136.00	2,424,549.60
Office Supplies & Miscellaneous Costs:						
Stationary		18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Paper		27,000.00	29,700.00	32,670.00	35,937.00	39,530.70
Utility		25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Miscellaneous		18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Total Office Supplies & Miscellaneous Costs		88,000.00	96,800.00	106,480.00	117,128.00	128,840.80
Maintenance Costs:						
Hardware Maintenance		-	-	-	22,638.00	22,638.00
Network Maintenance		-	-	-	2,100.00	2,100.00
Total Maintenance Costs		-	-	-	24,738.00	24,738.00
Total Annual Operating Costs:		1,744,000.00	1,918,400.00	2,110,240.00	2,346,002.00	2,578,128.40
Total Computerized System Cost		2,560,740.00	4,479,140.00	6,589,380.00	8,935,382.00	11,513,510.40

Table C.2. Estimated Cost of Candidate 2, Baht.

Cost Items		Price
Development Costs		
People-ware Cost:		
1 System Analyst	(6 Months @ 25,000)	150,000.00
2 Programmers	(2 Months @ 20,000)	80,000.00
2 Network Specialists	(1 Month @ 18,000)	36,000.00
1 Database Specialist	(2 Month @ 18,000)	36,000.00
Total People-ware Cost		302,000.00
Hardware Costs:		
Computer Server	(1 unit @ 89,100)	89,100.00
Workstation	(5 units @ 20,000)	100,000.00
Dot matrix Printer	(2 units @ 28,000)	56,000.00
Laser Printer	(1 unit @ 67,000)	67,000.00
Network Cost		35,000.00
UPS 1KVA	(1 unit @ 17,700)	17,700.00
UPS 500 VA	(5 units @ 2,500)	12,500.00
Total Hardware Costs		377,300.00
Software Costs:		
Microsoft SQL Server	(1 unit @ 33,500)	33,500.00
Microsoft SQL Client	(5 units @ 5,550)	27,750.00
Windows 2000 Server	(1 unit @ 24,780)	24,780.00
Windows 2000 Client	(5 units @ 1,232)	6,160.00
Microsoft Windows XP	(5 units @ 7,500)	37,500.00
Visual Basic.NET	(1 unit @ 50,000)	50,000.00
Microsoft Office XP	(5 units @ 10,000)	50,000.00
Total Software Costs		229,690.00
Implementation Costs:		
Training Cost		100,000.00
Installing Cost		50,000.00
System Integration		30,000.00
Miscellaneous Cost		50,000.00
Total Implementation Cost		230,000.00
Total Development Costs		1,138,990.00

Table C.2. Estimated Cost of Candidate 2, Baht. (Continued.)

Cost Items		Year 1	Year 2	Year 3	Year 4	Year 5
Annual Operating Costs						
People-ware Cost:						
Inventory Manager	(1 person @ 30,000 per month)	360,000.00	396,000.00	435,600.00	479,160.00	527,076.00
Purchasing Chief	(1 person @ 20,000 per month)	240,000.00	264,000.00	290,400.00	319,440.00	351,384.00
Store Controller Chief	(1 person @ 20,000 per month)	240,000.00	264,000.00	290,400.00	319,440.00	351,384.00
Purchasing Clerk	(1 person @ 10,000 per month)	120,000.00	132,000.00	145,200.00	159,720.00	175,692.00
Store Controller Officer	(3 persons @ 8,000 per month)	288,000.00	316,800.00	348,480.00	383,328.00	421,660.80
Accounting Officer	(2 persons @ 12,000 per month)	288,000.00	316,800.00	348,480.00	383,328.00	421,660.80
Total People-ware Cost		1,536,000.00	1,689,600.00	1,858,560.00	2,044,416.00	2,248,857.60
Office Supplies & Miscellaneous Costs:						
Stationary		18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Paper		27,000.00	29,700.00	32,670.00	35,937.00	39,530.70
Utility		25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Miscellaneous		18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Total Office Supplies & Miscellaneous Costs		88,000.00	96,800.00	106,480.00	117,128.00	128,840.80
Maintenance Costs:						
Hardware Maintenance		-	-	-	22,638.00	22,638.00
Network Maintenance		-	-	-	2,100.00	2,100.00
Total Maintenance Costs		-	-	-	24,738.00	24,738.00
Total Annual Operating Costs:		1,624,000.00	1,786,400.00	1,965,040.00	2,186,282.00	2,402,436.40
Total Computerized System Cost		2,762,990.00	4,549,390.00	6,514,430.00	8,700,712.00	11,103,148.40

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

Cost Items		Price
Development Costs		
People-ware Cost:		
People-ware Cost:		
1 System Analyst	(10 Months @ 25,000)	250,000.00
2 Programmers	(6 Months @ 20,000)	240,000.00
2 Network Specialists	(1 Month @ 18,000)	36,000.00
1 Database Specialist	(3 Month @ 18,000)	54,000.00
Total People-ware Cost		580,000.00
Hardware Costs:		
Computer Server	(1 unit @ 89,100)	89,100.00
Workstation	(5 units @ 20,000)	100,000.00
Dot matrix Printer	(2 units @ 28,000)	56,000.00
Laser Printer	(1 unit @ 67,000)	67,000.00
Network Cost		35,000.00
UPS 1KVA	(1 unit @ 17,700)	17,700.00
UPS 500 VA	(5 units @ 2,500)	12,500.00
Total Hardware Costs		377,300.00
Software Costs:		
Windows 2000 Server	(1 unit @ 24,780)	24,780.00
Windows 2000 Client	(5 units @ 1,232)	6,160.00
Microsoft Windows XP	(5 units @ 7,500)	37,500.00
Oracle Database Standard Edition & Developer 2000 (15,000 US)		600,000.00
Microsoft Office XP	(5 units @ 10,000)	50,000.00
Total Software Costs		718,440.00
Implementation Costs:		
Training Cost		150,000.00
Installing Cost		50,000.00
Miscellaneous Cost		50,000.00
Total Implementation Cost		250,000.00
Total Development Costs		1,925,740.00

Table C.3. Estimated Cost of Candidate 3, Baht. (Continued.)

Cost Items		Year 1	Year 2	Year 3	Year 4	Year 5
Annual Operating Costs						
People-ware Cost:						
Inventory Manager	(1 person @ 30,000 per month)	360,000.00	396,000.00	435,600.00	479,160.00	527,076.00
Purchasing Chief	(1 person @ 20,000 per month)	240,000.00	264,000.00	290,400.00	319,440.00	351,384.00
Store Controller Chief	(1 person @ 20,000 per month)	240,000.00	264,000.00	290,400.00	319,440.00	351,384.00
Purchasing Clerk	(1 person @ 10,000 per month)	120,000.00	132,000.00	145,200.00	159,720.00	175,692.00
Store Controller Officer	(3 persons @ 8,000 per month)	288,000.00	316,800.00	348,480.00	383,328.00	421,660.80
Accounting Officer	(2 persons @ 12,000 per month)	288,000.00	316,800.00	348,480.00	383,328.00	421,660.80
Total People-ware Cost		1,536,000.00	1,689,600.00	1,858,560.00	2,044,416.00	2,248,857.60
Office Supplies & Miscellaneous Costs:						
Stationary		18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Paper		27,000.00	29,700.00	32,670.00	35,937.00	39,530.70
Utility		25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Miscellaneous		18,000.00	19,800.00	21,780.00	23,958.00	26,353.80
Total Office Supplies & Miscellaneous Costs		88,000.00	96,800.00	106,480.00	117,128.00	128,840.80
Maintenance Costs:						
Hardware Maintenance		-	-	-	22,638.00	22,638.00
Network Maintenance		-	-	-	2,100.00	2,100.00
Total Maintenance Costs		-	-	-	24,738.00	24,738.00
Total Annual Operating Costs:		1,624,000.00	1,786,400.00	1,965,040.00	2,186,282.00	2,402,436.40
Total Computerized System Cost		3,549,740.00	5,336,140.00	7,301,180.00	9,487,462.00	11,889,898.40

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

Cost items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	- 816,740.00	-	-	-	-	-
Operating and Maintenance Cost		- 1,744,000.00	- 1,918,400.00	- 2,110,240.00	- 2,346,002.00	- 2,578,128.40
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Costs (Adjust to present value)	- 816,740.00	- 1,649,172.58	- 1,715,451.38	- 1,784,393.87	- 1,875,887.86	- 1,949,407.64
Cumulative Time-Adjusted Costs over life time	- 816,740.00	- 2,465,912.58	- 4,181,363.96	- 5,965,757.83	- 7,841,645.69	- 9,791,053.33
Benefit derived from operation of the new system	-	2,400,000.00	2,640,000.00	2,904,000.00	3,194,400.00	3,513,840.00
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Benefits (Adjust to present value)	-	2,269,503.55	2,360,712.91	2,455,587.90	2,554,275.82	2,656,929.94
Cumulative Time-Adjusted Benefits over life time	-	2,269,503.55	4,630,216.45	7,085,804.35	9,640,080.17	12,297,010.11
Cumulative Lifetime Time-Adjusted Cost + Benefit	- 816,740.00	- 196,409.03	448,852.50	1,120,046.52	1,798,434.48	2,505,956.78

Table C.5. Payback Period for Candidate 2, Baht.

Cost items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	- 1,138,990.00	-	-	-	-	-
Operating and Maintenance Cost		- 1,624,000.00	- 1,786,400.00	- 1,965,040.00	- 2,186,282.00	- 2,402,436.40
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Costs (Adjust to present value)	- 1,138,990.00	- 1,535,697.40	- 1,597,415.73	- 1,661,614.48	- 1,748,174.07	- 1,816,561.14
Cumulative Time-Adjusted Costs over life time	- 1,138,990.00	- 2,674,687.40	- 4,272,103.13	- 5,933,717.61	- 7,681,891.68	- 9,498,452.82
Benefit derived from operation of the new system	-	2,400,000.00	2,640,000.00	2,904,000.00	3,194,400.00	3,513,840.00
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Benefits (Adjust to present value)	-	2,269,503.55	2,360,712.91	2,455,587.90	2,554,275.82	2,656,929.94
Cumulative Time-Adjusted Benefits over life time	-	2,269,503.55	4,630,216.45	7,085,804.35	9,640,080.17	12,297,010.11
Cumulative Lifetime Time-Adjusted Cost + Benefit	- 1,138,990.00	- 405,183.85	358,113.32	1,152,086.74	1,958,188.49	2,798,557.29

Table C.6. Payback Period for Candidate 3, Baht.

Cost items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	- 1,925,740.00	-	-	-	-	-
Operating and Maintenance Cost		- 1,624,000.00	- 1,786,400.00	- 1,965,040.00	- 2,186,282.00	- 2,402,436.40
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Costs (Adjust to present value)	- 1,925,740.00	- 1,535,697.40	- 1,597,415.73	- 1,661,614.48	- 1,748,174.07	- 1,816,561.14
Cumulative Time-Adjusted Costs over life time	- 1,925,740.00	- 3,461,437.40	- 5,058,853.13	- 6,720,467.61	- 8,468,641.68	-10,285,202.82
Benefit derived from operation of the new system	-	2,400,000.00	2,640,000.00	2,904,000.00	3,194,400.00	3,513,840.00
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Benefits (Adjust to present value)	-	2,269,503.55	2,360,712.91	2,455,587.90	2,554,275.82	2,656,929.94
Cumulative Time-Adjusted Benefits over life time	-	2,269,503.55	4,630,216.45	7,085,804.35	9,640,080.17	12,297,010.11
Cumulative Lifetime Time-Adjusted Cost + Benefit	- 1,925,740.00	- 1,191,933.85	- 428,636.68	365,336.74	1,171,438.49	2,011,807.29

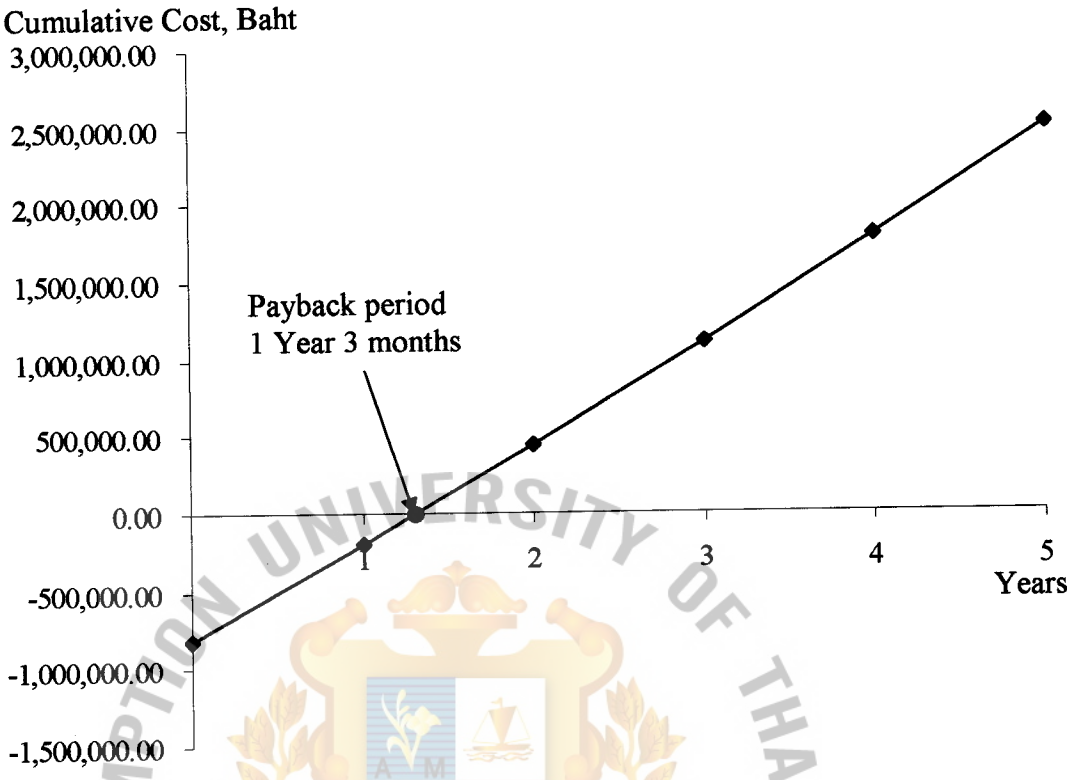


Figure C.1. Payback Period for Candidate 1.

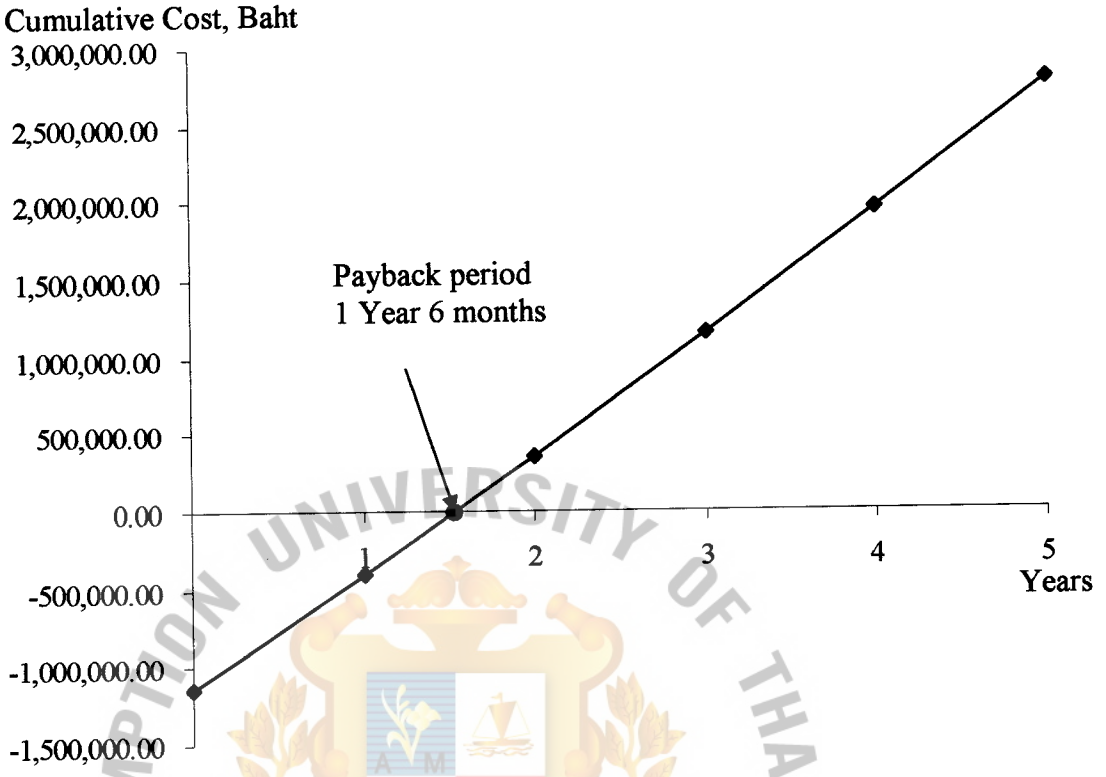


Figure C.2. Payback Period for Candidate 2.

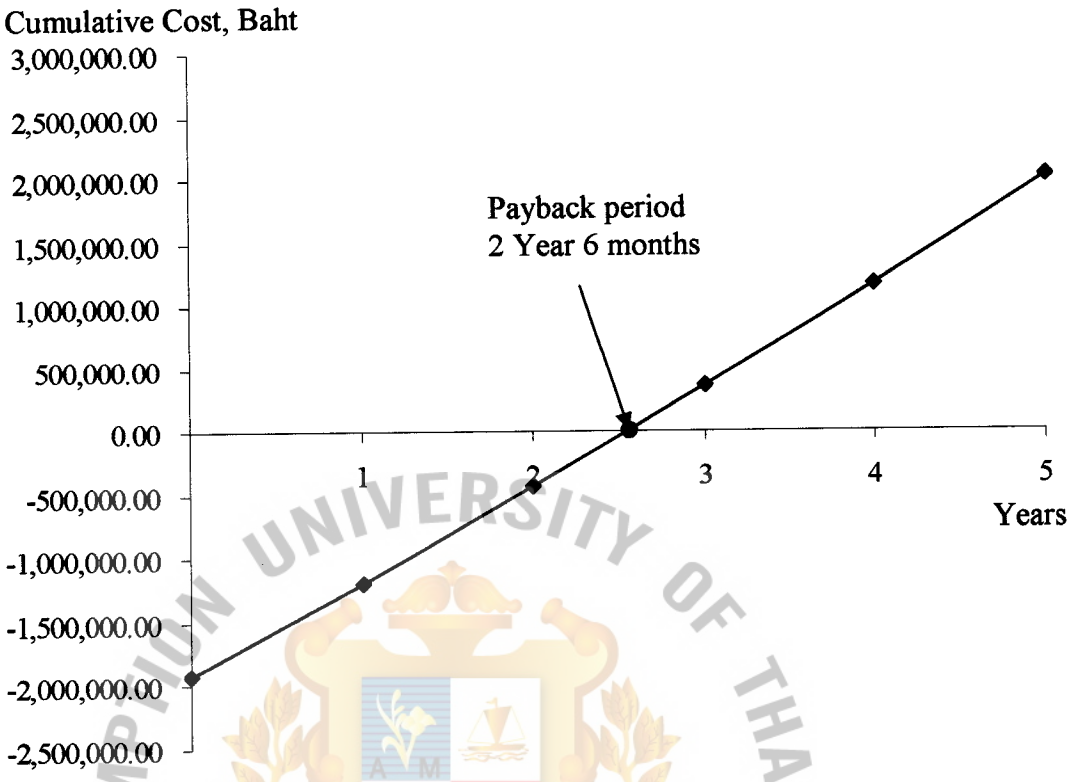


Figure C.3. Payback Period for Candidate 3.

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

Cost items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	- 816,740.00	-	-	-	-	-
Operating and Maintenance Cost	-	- 1,744,000.00	- 1,918,400.00	- 2,110,240.00	- 2,346,002.00	- 2,578,128.40
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Costs (Adjust to present value)	- 816,740.00	- 1,649,172.58	- 1,715,451.38	- 1,784,393.87	- 1,875,887.86	- 1,949,407.64
Cumulative Time-Adjusted Costs over life time						- 9,791,053.33
Benefit derived from operation of the new system	-	2,400,000.00	2,640,000.00	2,904,000.00	3,194,400.00	3,513,840.00
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Benefits (Adjust to present value)	-	2,269,503.55	2,360,712.91	2,455,587.90	2,554,275.82	2,656,929.94
Cumulative Time-Adjusted Benefits over life time						12,297,010.11
Cumulative Lifetime Time-Adjusted Cost + Benefit						2,505,956.78

Table C.8. Net Present Value for Candidate 2, Baht.

Cost items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	- 1,138,990.00	-	-	-	-	-
Operating and Maintenance Cost	-	- 1,624,000.00	- 1,786,400.00	- 1,965,040.00	- 2,186,282.00	- 2,402,436.40
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Costs (Adjust to present value)	- 1,138,990.00	- 1,535,697.40	- 1,597,415.73	- 1,661,614.48	- 1,748,174.07	- 1,816,561.14
Cumulative Time-Adjusted Costs over life time						- 9,498,452.82
Benefit derived from operation of the new system	-	2,400,000.00	2,640,000.00	2,904,000.00	3,194,400.00	3,513,840.00
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Benefits (Adjust to present value)	-	2,269,503.55	2,360,712.91	2,455,587.90	2,554,275.82	2,656,929.94
Cumulative Time-Adjusted Benefits over life time						12,297,010.11
Cumulative Lifetime Time-Adjusted Cost + Benefit						2,798,557.29

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

Cost items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	- 1,925,740.00	-	-	-	-	-
Operating and Maintenance Cost	-	- 1,624,000.00	- 1,786,400.00	- 1,965,040.00	- 2,186,282.00	- 2,402,436.40
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Costs (Adjust to present value)	- 1,925,740.00	- 1,535,697.40	- 1,597,415.73	- 1,661,614.48	- 1,748,174.07	- 1,816,561.14
Cumulative Time-Adjusted Costs over life time						-10,285,202.82
Benefit derived from operation of the new system	-	2,400,000.00	2,640,000.00	2,904,000.00	3,194,400.00	3,513,840.00
Discount Factors for 5.75% (MLR)	1.0000	0.9456	0.8942	0.8456	0.7996	0.7561
Time-Adjusted Benefits (Adjust to present value)	-	2,269,503.55	2,360,712.91	2,455,587.90	2,554,275.82	2,656,929.94
Cumulative Time-Adjusted Benefits over life time						12,297,010.11
Cumulative Lifetime Time-Adjusted Cost + Benefit						2,011,807.29

APPENDIX D

STRUCTURE CHART

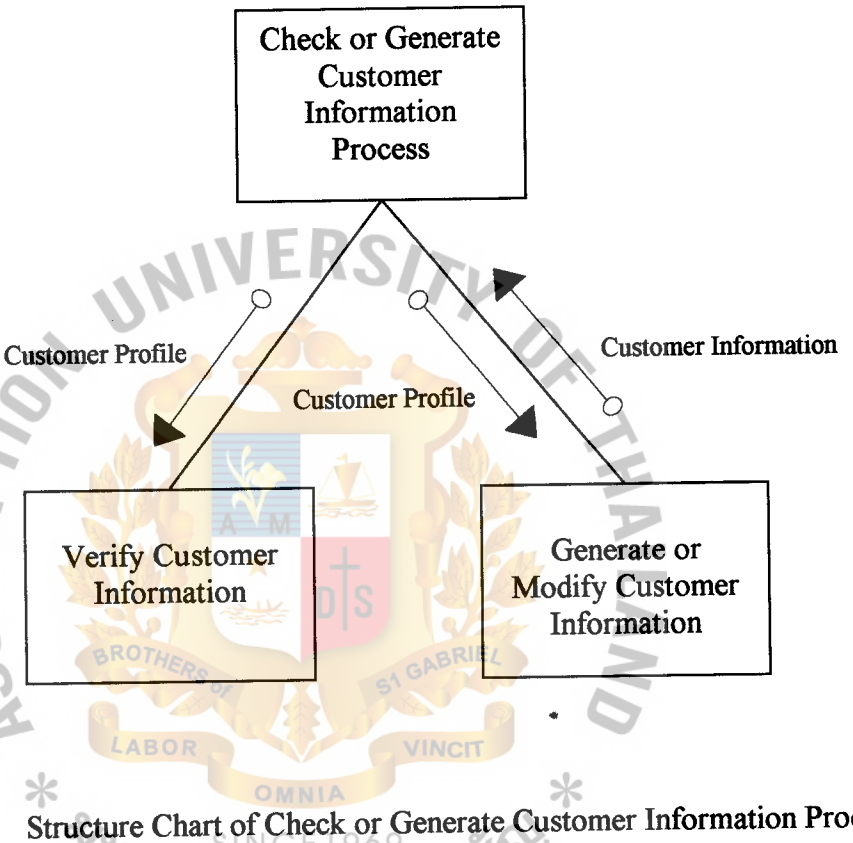


Figure D.1. Structure Chart of Check or Generate Customer Information Process.

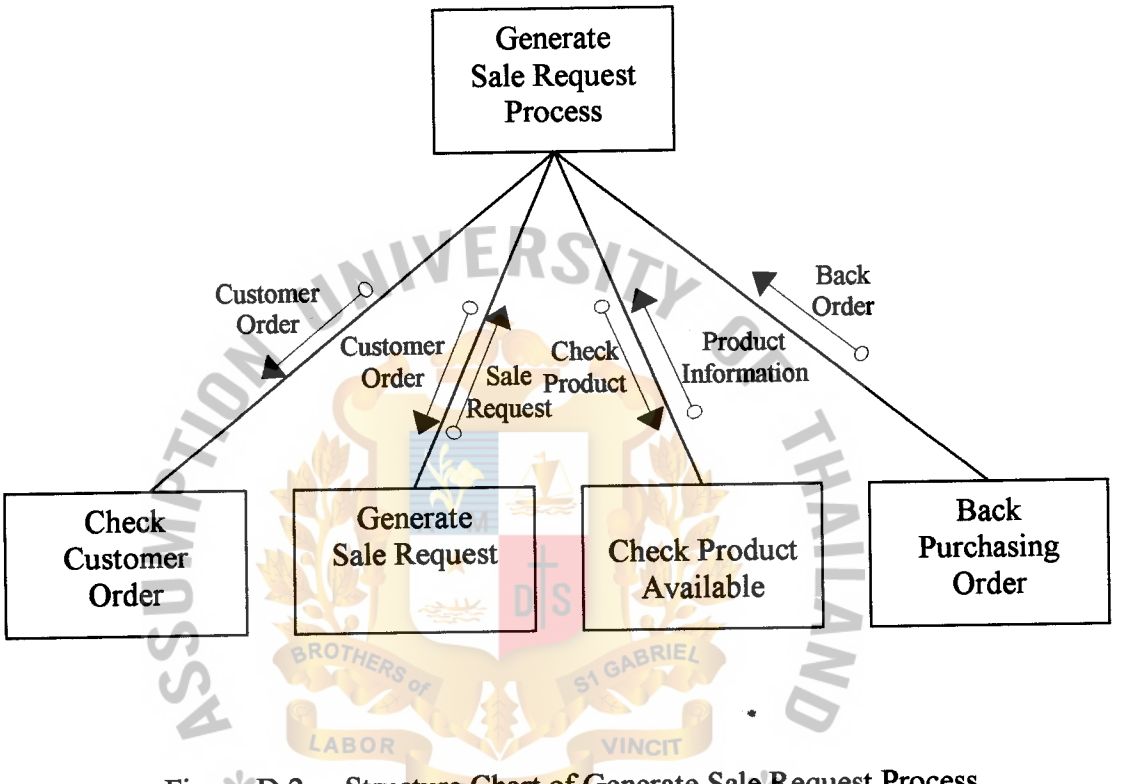


Figure D.2. Structure Chart of Generate Sale Request Process.

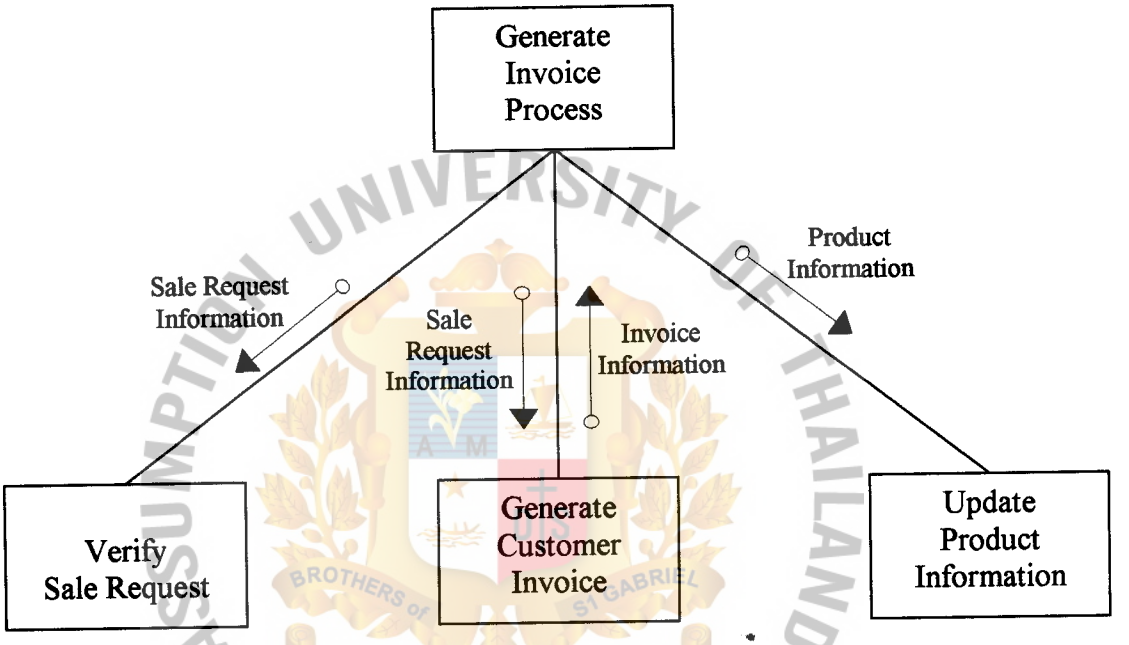


Figure D.3. Structure Chart of Generate Invoice Process.

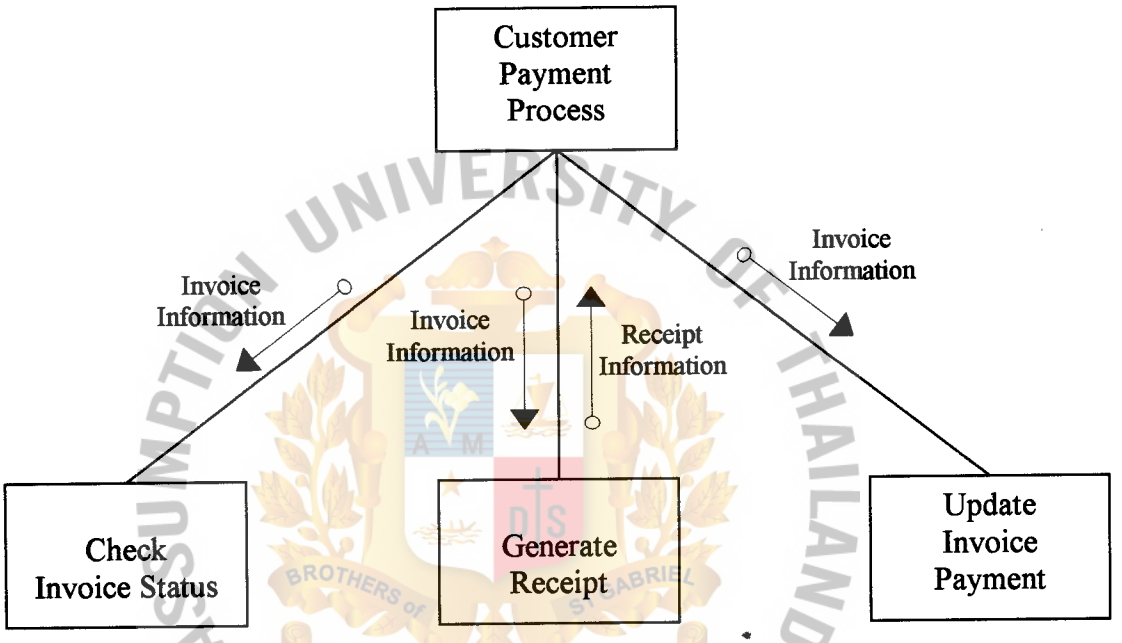


Figure D.4. Structure Chart of Customer Payment Process.

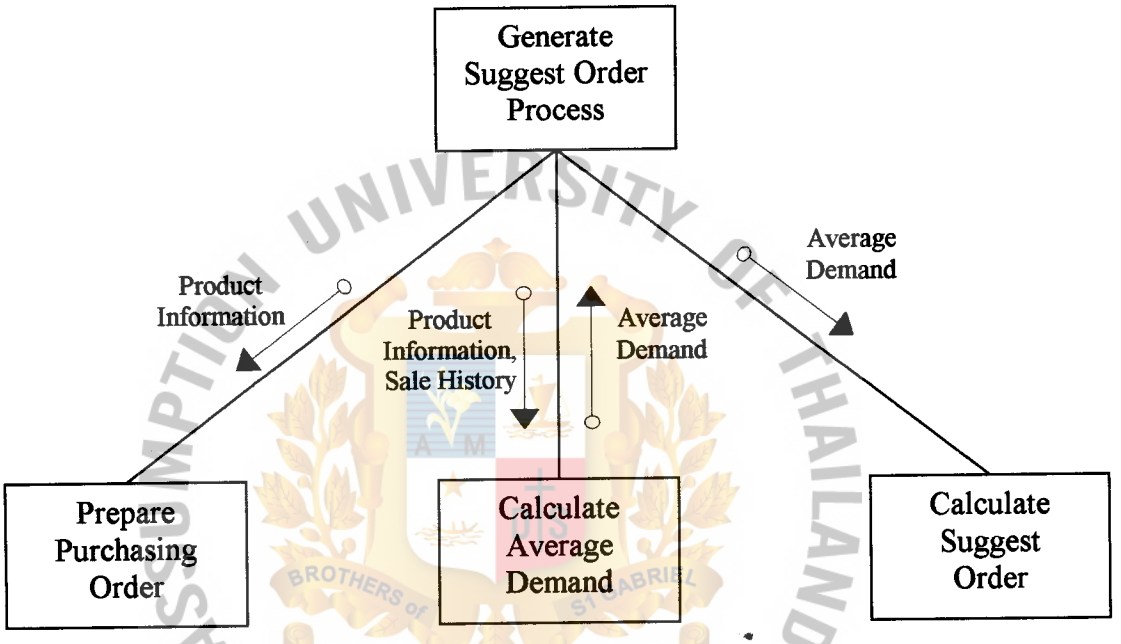


Figure D.5. Structure Chart of Generate Suggest Order Process.

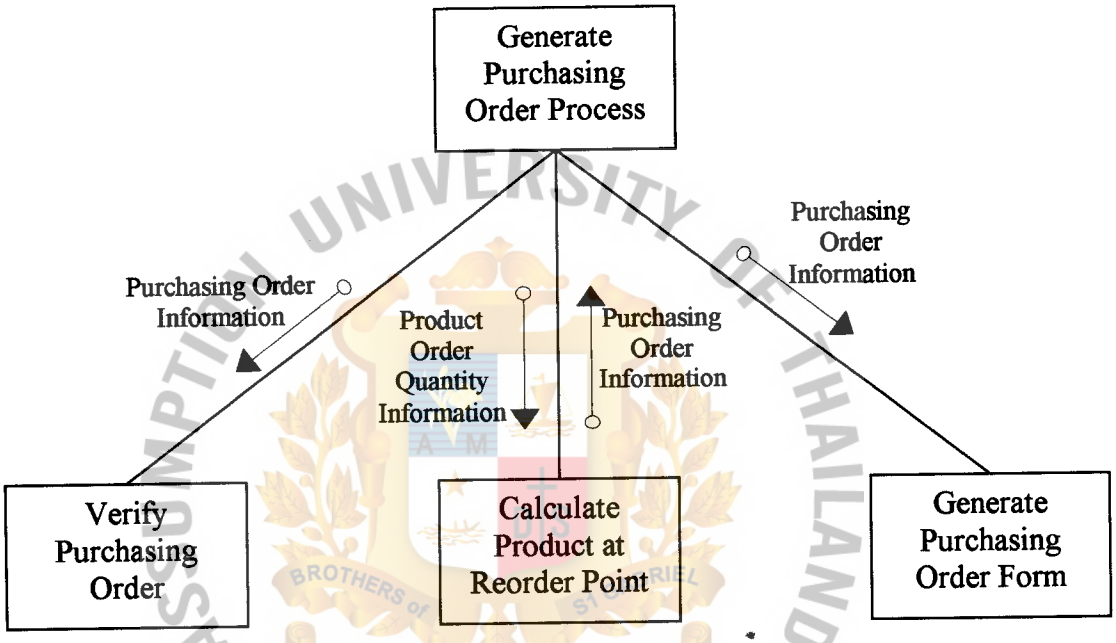


Figure D.6. Structure Chart of Generate Purchasing Order Process.

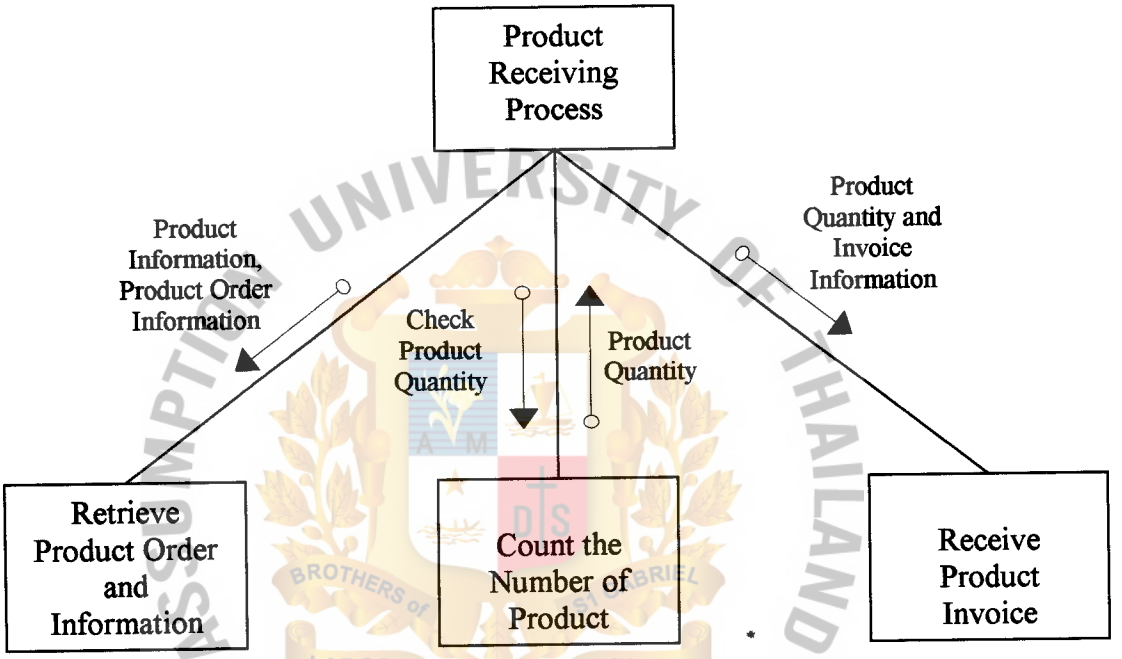


Figure D.7. Structure Chart of Generate Product Receiving Process.

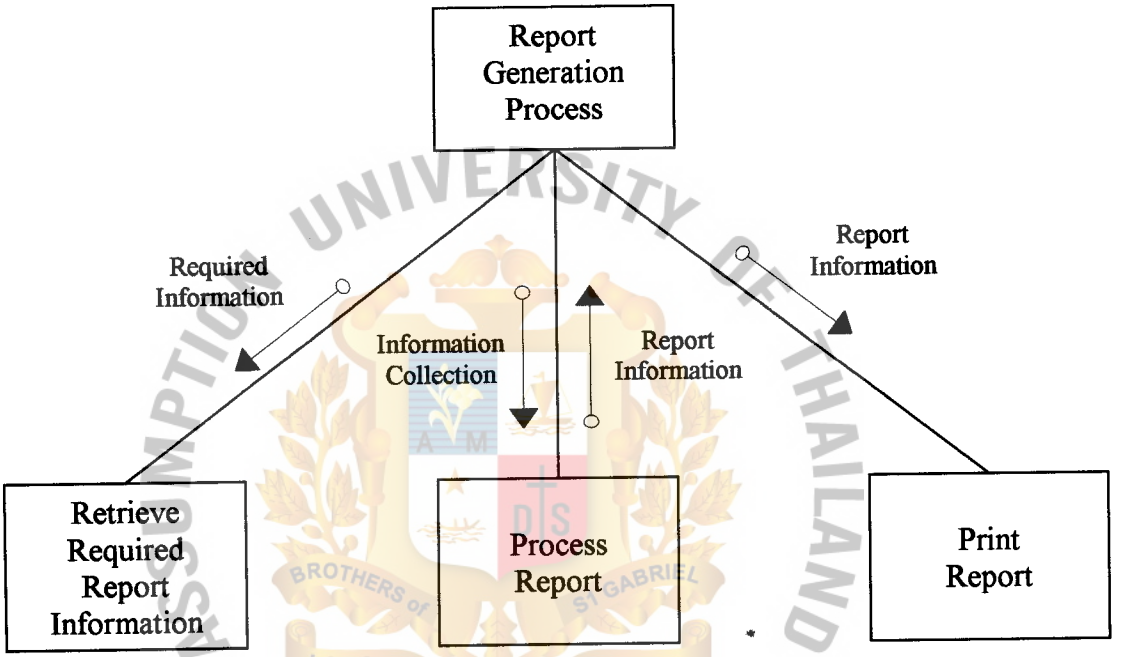


Figure D.8. Structure Chart of Report Generation Process.

APPENDIX E

ENTITY RELATIONSHIP DIAGRAM

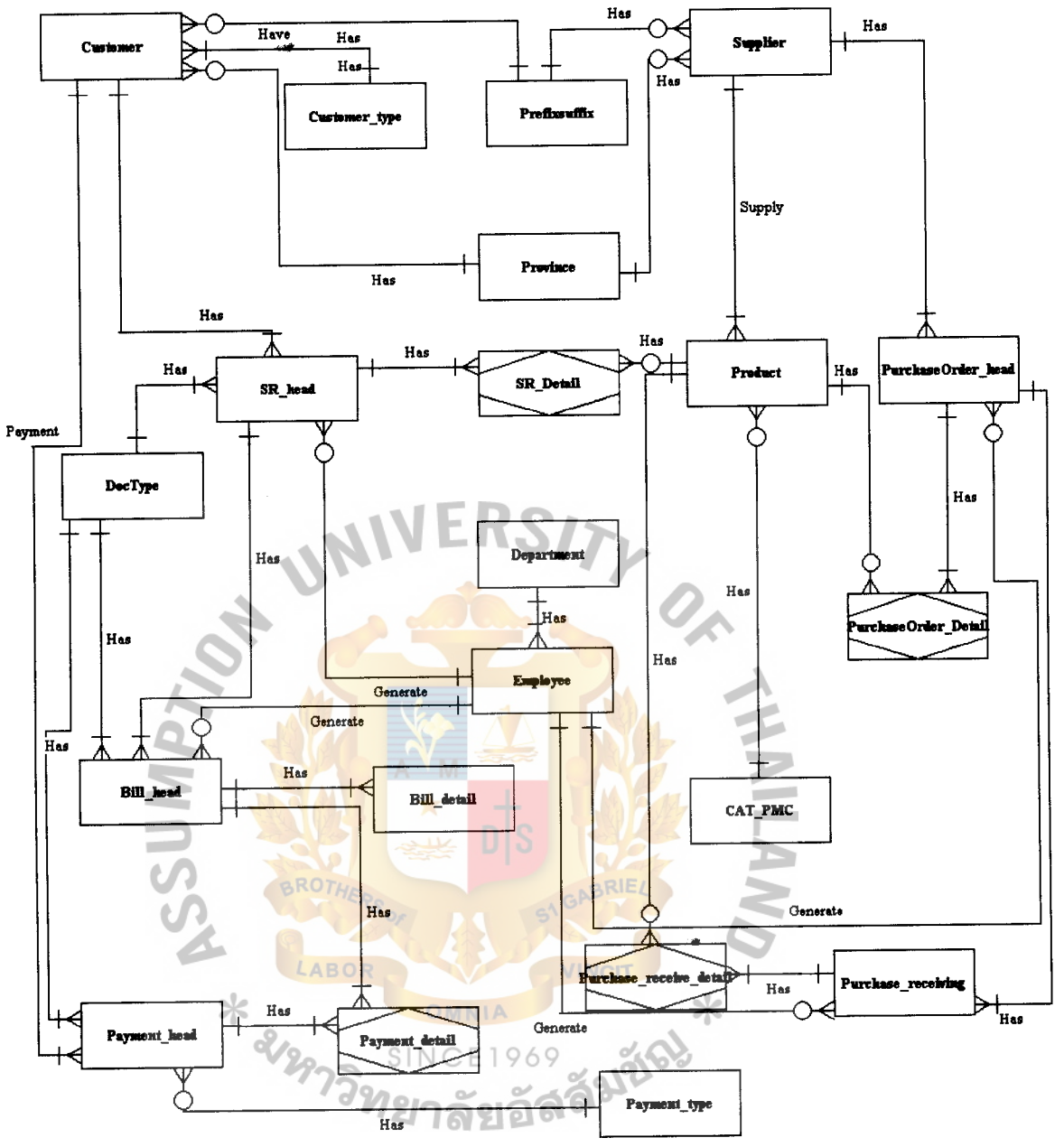


Figure E.1. Context Data model of Spare-part Inventory Management Information System.

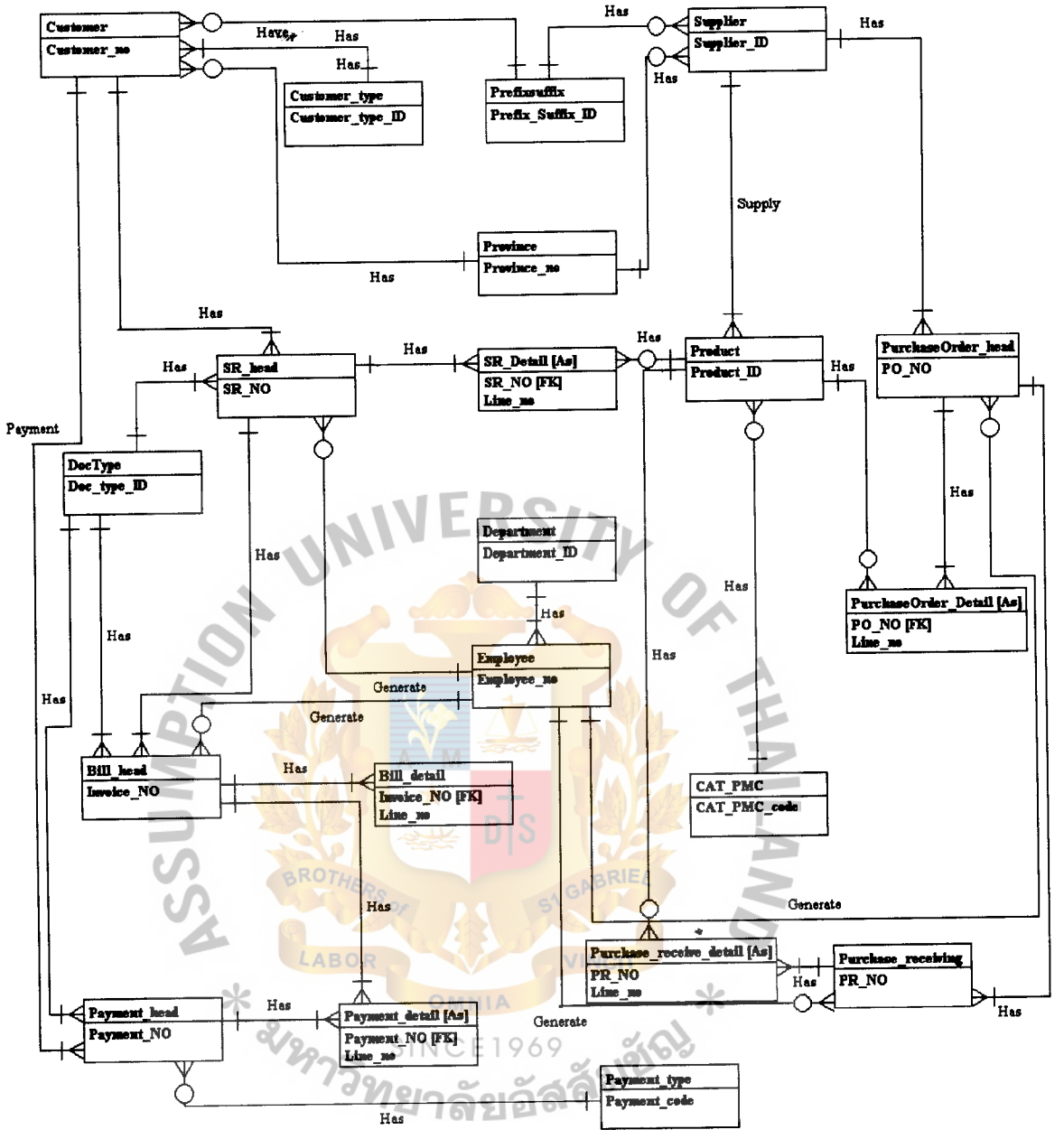


Figure E.2. Key-Based Data model of Spare-part Inventory Management Information System.

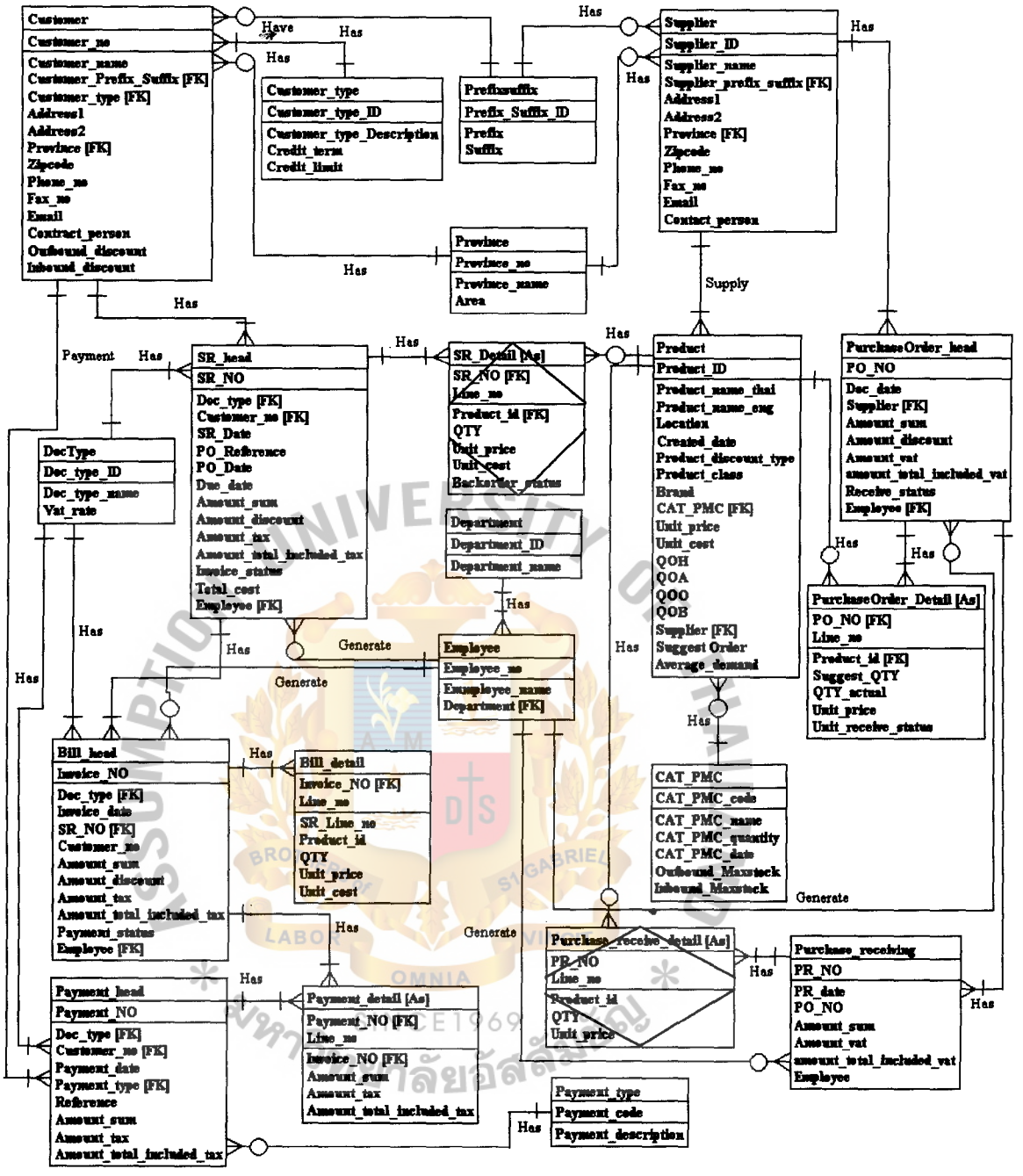


Figure E.3. Fully Attributed Data model of Spare-part Inventory Management Information System.

APPENDIX F

DATABASE DESIGN

Table F.1. The Design of Bill_head Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Invoice_NO	LargeInteger	8	Primary Key		Identity
Doc_type	Varchar	4	Foreign Key	DocType	No
Invoice_date	DateTime	8	Attribute		No
SR_NO	LargeInteger	8	Foreign Key	SR_head	No
Customer_no	Varchar	10	Attribute		No
Amount_sum	Decimal	20	Attribute		No
Amount_discount	Decimal	20	Attribute		No
Amount_tax	Decimal	20	Attribute		No
Amount_total_included_tax	Decimal	20	Attribute		No
Payment_status	Varchar	1	Attribute		No
Employee	Varchar	10	Foreign Key	Employee	No

Table F.2. The Design of Bill_detail Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Invoice_NO	LargeInteger	8	Primary Key Foreign Key	Bill_head	No
Line_no	Integer	4	Primary Key		No
Product_ID	Varchar	20	Foreign Key	Product	No
SR_Line_no	Integer	4	Attribute		No
QTY	Integer	4	Attribute		No
Unit_price	Decimal	20	Attribute		No
Unit_cost	Decimal	20	Attribute		No

Table F.3. The Design of CAT_PMC Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
CAT_PMC_code	Integer	4	Primary Key		Identity
CAT_PMC_name	Varchar	50	Attribute		Yes
CAT_PMC_quantity	Integer	4	Attribute		Yes
CAT_PMC_date	DateTime	8	Attribute		Yes
Outbound_Maxstock	Integer	4	Attribute		Yes
Inbound_Maxstock	Integer	4	Attribute		Yes

Table F.4. The Design of Customer Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Customer_no	Varchar	10	Primary Key		Identity
Customer_name	Varchar	50	Attribute		No
Customer_Prefix_Suffix	Varchar	2	Foreign Key	Prefixsuffix	Yes
Customer_type	Varchar	2	Foreign Key	Customer_type	No
Address1	Varchar	50	Attribute		Yes
Address2	Varchar	50	Attribute		Yes
Province	Varchar	2	Foreign Key	Province	Yes
Zipcode	Varchar	5	Attribute		Yes
Phone_no	Varchar	20	Attribute		Yes
Fax_no	Varchar	20	Attribute		Yes
Email	Varchar	50	Attribute		Yes
Contact_person	Varchar	50	Attribute		Yes
Outbound_discount	SmallInteger	2	Attribute		Yes
Inbound_discount	SmallInteger	2	Attribute		Yes

Table F.5. The Design of Customer_type Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Customer_type_ID	Varchar	2	Primary Key		Identity
Customer_type_Description	Varchar	50	Attribute		Yes
Credit_term	Varchar	3	Attribute		Yes
Credit_limit	Decimal	20	Attribute		Yes

Table F.6. The Design of Department Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Department_ID	Varchar	2	Primary Key		Identity
Department_name	Varchar	50	Attribute		Yes

Table F.7. The Design of DocType Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Doc_type_ID	Varchar	4	Primary Key		Identity
Doc_type_name	Varchar	50	Attribute		Yes
Vat_rate	Decimal	20	Attribute		No

Table F.8. The Design of Employee Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Employee_no	Varchar	10	Primary Key		Identity
Employee_name	Varchar	50	Attribute		Yes
Department	Varchar	2	Attribute		No

Table F.9. The Design of Payment_head Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Payment_NO	LargeInteger	8	Primary Key		Identity
Doc_type	Varchar	4	Foreign Key	DocType	No
Customer_no	Varchar	10	Foreign Key	Customer	No
Payment_date	DateTime	8	Attribute		No
Payment_type	Varchar	2	Foreign Key	Payment_type	No
Reference	Varchar	20	Attribute		Yes
Amount_sum	Decimal	20	Attribute		No
Amount_tax	Decimal	20	Attribute		No
Amount_total_included_tax	Decimal	20	Attribute		No

Table F.10. The Design of Payment_detail Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Payment_NO	LargeInteger	8	Primary Key Foreign Key	Payment_head	No
Line_no	Integer	4	Primary Key	DocType	No
Invoice_NO	LargeInteger	8	Foreign Key	Bill_head	No
Amount_sum	Decimal	20	Attribute		No
Amount_tax	Decimal	20	Attribute		No
Amount_total_included_tax	Decimal	20	Attribute		No

Table F.11. The Design of Payment_type Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Payment_code	Varchar	2	Primary Key		Identity
Code_description	Varchar	50	Attribute		No

Table F.12. The Design of Prefixsuffix Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Prefix_Suffix_ID	Varchar	2	Primary Key		Identity
Prefix	Varchar	50	Attribute		Yes
Suffix	Varchar	50	Attribute		Yes

Table F.13. The Design of Product Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Product_id	Varchar	20	Primary Key		Identity
Product_name_thai	Varchar	50	Attribute		Yes
Product_name_eng	Varchar	50	Attribute		Yes
Lacation	Varchar	10	Attribute		Yes
Created_date	DateTime	8	Attribute		No
Product_discount_type	Varchar	1	Attribute		No
Product_class	Varchar	1	Attribute		No
Brand	Varchar	20	Attribute		Yes
CAT_PMC	Integer	4	Foreign Key	CAT_PMC	No
Unit_price	Decimal	20	Attribute		No
Unit_cost	Decimal	20	Attribute		No
QOH	LargeInteger	8	Attribute		No
QOA	LargeInteger	8	Attribute		No
QOO	LargeInteger	8	Attribute		No
QOB	LargeInteger	8	Attribute		No
Supplier	Varchar	10	Foreign Key	Supplier	No
Suggest_Order	Decimal	8	Attribute		Yes
Average_demand	Decimal	8	Attribute		Yes

Table F.14. The Design of Province Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Province_ID	Varchar	2	Primary Key		Identity
Province_name	Varchar	30	Attribute		Yes
Area	Varchar	2	Attribute		Yes

Table F.15. The Design of PurchaseOrder_head Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
PO_NO	LargeInteger	8	Primary Key		Identity
Doc_date	DateTime	8	Attribute		No
Supplier	Varchar	10	Foreign Key	Supplier	No
Amount_sum	Decimal	20	Attribute		No
Amount_discount	Decimal	20	Attribute		No
Amount_tax	Decimal	20	Attribute		No
Amount_total_included_tax	Decimal	20	Attribute		No
Receive_status	Varchar	1	Attribute		No
Employee	Varchar	10	Foreign Key	Employee	No

Table F.16. The Design of PurchaseOrder_Detail Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
PO_NO	LargeInteger	8	Primary Key Foreign Key	Purchase Order_head	No
Line_no	Integer	4	Primary Key		No
Product_id	Varchar	20	Foreign Key	Product	No
Suggest_QTY	Integer	4	Attribute		No
QTY_actual	Integer	4	Attribute		No
Unit_price	Decimal	20	Attribute		No
Unit_receive_status	Varchar	1	Attribute		No

Table F.17. The Design of Purchase_receiving Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
PR_NO	LargeInteger	8	Primary Key		Identity
PR_date	DateTime	8	Attribute		No
PO_NO	LargeInteger	8	Foreign Key	Purchase Order_head	No
Amount_sum	Decimal	20	Attribute		No
Amount_tax	Decimal	20	Attribute		No
Amount_total_included_tax	Decimal	20	Attribute		No
Employee	Varchar	10	Foreign Key	Employee	No

Table F.18. The Design of Purchase_receive_detail Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
PR_NO	LargeInteger	8	Primary Key Foreign Key	Purchase _receiving	No
Line_no	Integer	4	Primary Key		No
Product_id	Varchar	20	Foreign Key	Product	No
QTY	Integer	4	Attribute		No
Unit_price	Decimal	20	Attribute		No

Table F.19. The Design of SR_head Table

Name	Type	Length	Key Type	Foreign Key Table	Null
SR_NO	LargeInteger	8	Primary Key		Identity
Doc_type	Varchar	4	Foreign Key	DocType	No
Customer_no	Varchar	10	Foreign Key	Customer	No
SR_date	DateTime	8	Attribute		No
PO_Reference	Varchar	20	Attribute		Yes
PO_Date	DateTime	8	Attribute		Yes
Due_date	DateTime	8	Attribute		Yes
Amount_sum	Decimal	20	Attribute		No
Amount_discount	Decimal	20	Attribute		No
Amount_tax	Decimal	20	Attribute		No
Amount_total_included_tax	Decimal	20	Attribute		No
Invoice_status	Varchar	1	Attribute		No
Total_cost	Decimal	20	Attribute		No
Employee	Varchar	10	Foreign Key	Employee	No

Table F.20. The Design of SR_detail Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
SR_NO	LargeInteger	8	Primary Key Foreign Key	SR_head	No
Line_no	Integer	4	Primary Key		No
Product_id	Varchar	20	Foreign Key	Product	No
QTY	Integer	4	Attribute		No
Unit_price	Decimal	20	Attribute		No
Unit_cost	Decimal	20	Attribute		No
Backorder_status	Varchar	1	Attribute		No

Table F.21. The Design of Supplier Table.

Name	Type	Length	Key Type	Foreign Key Table	Null
Supplier_ID	Varchar	10	Primary Key		Identity
Supplier_name	Varchar	50	Attribute		No
Supplier_prefix_suffix	Varchar	2	Foreign Key	Prefixsuffix	Yes
Address1	Varchar	50	Attribute		Yes
Address2	Varchar	50	Attribute		Yes
Province	Varchar	2	Foreign Key	Province	Yes
Zipcode	Varchar	5	Attribute		Yes
Phone_no	Varchar	20	Attribute		Yes
Fax_no	Varchar	20	Attribute		Yes
Email	Varchar	50	Attribute		Yes
Contact_person	Varchar	50	Attribute		Yes

APPENDIX G

DATA FLOW DIAGRAM

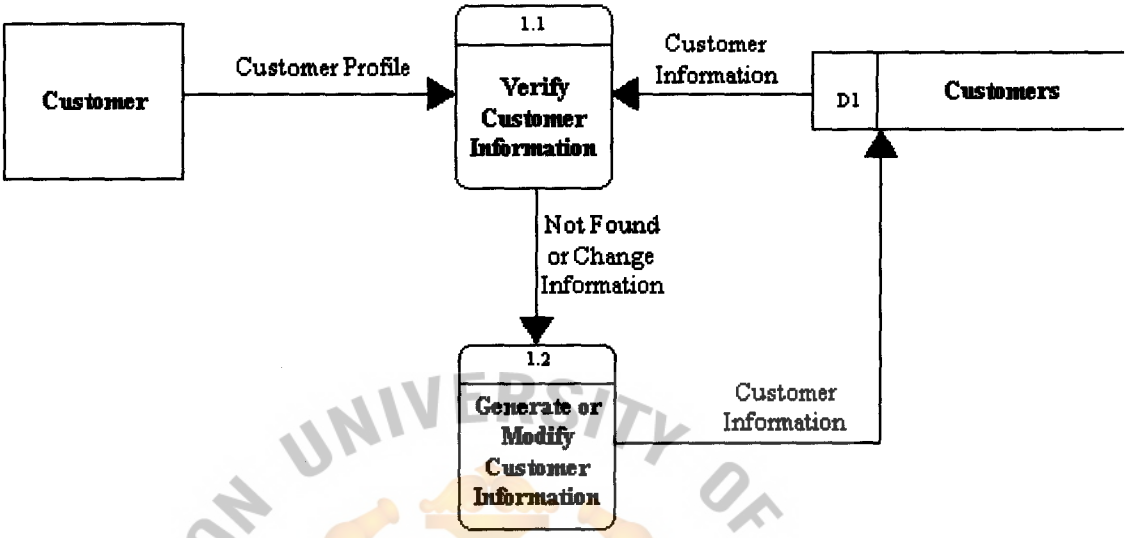


Figure G.1. Data Flow Diagram Level 1 Check or Generate Customer Information Process.

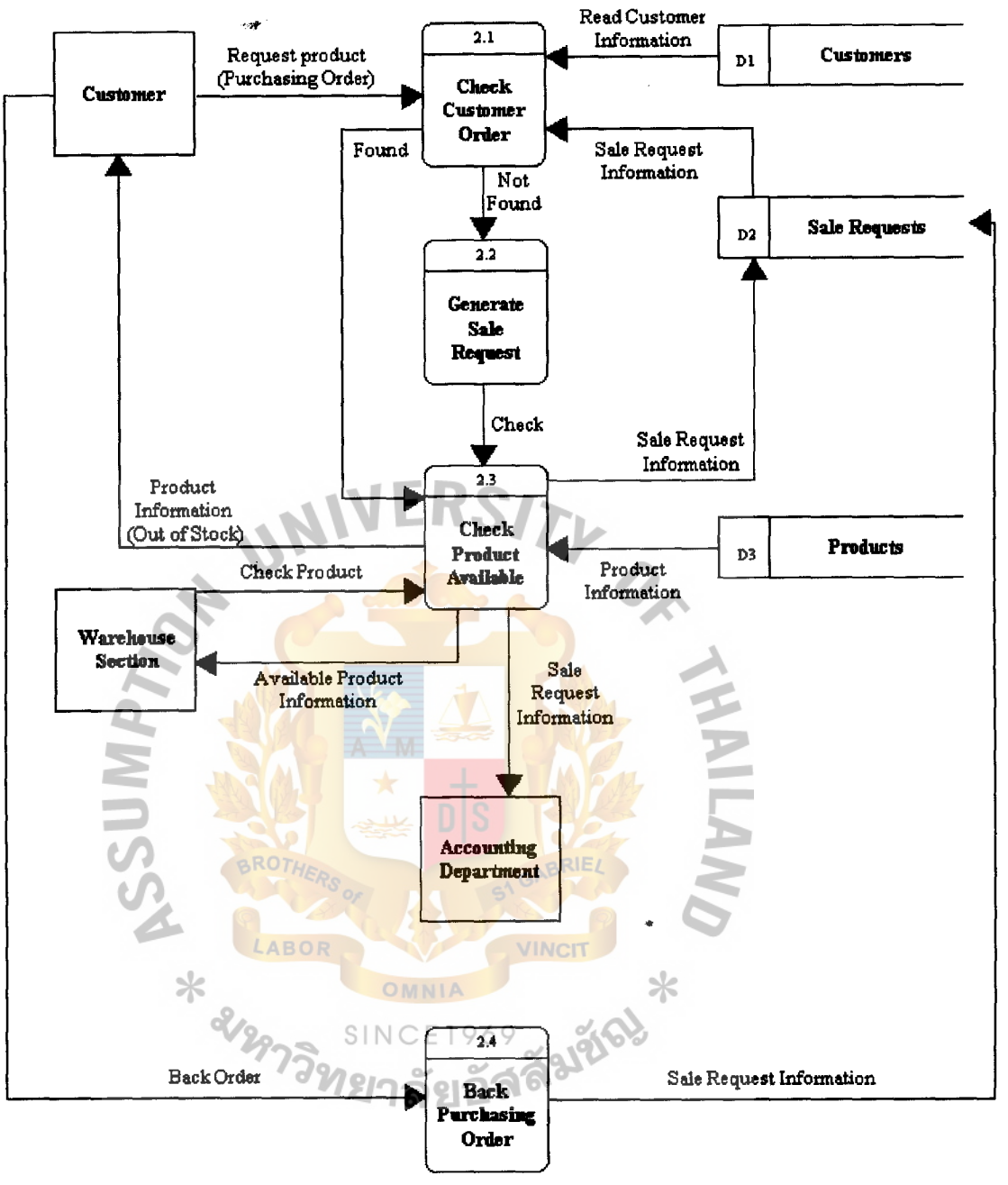


Figure G.2. Data Flow Diagram Level 1 Generate Sale Request Process.

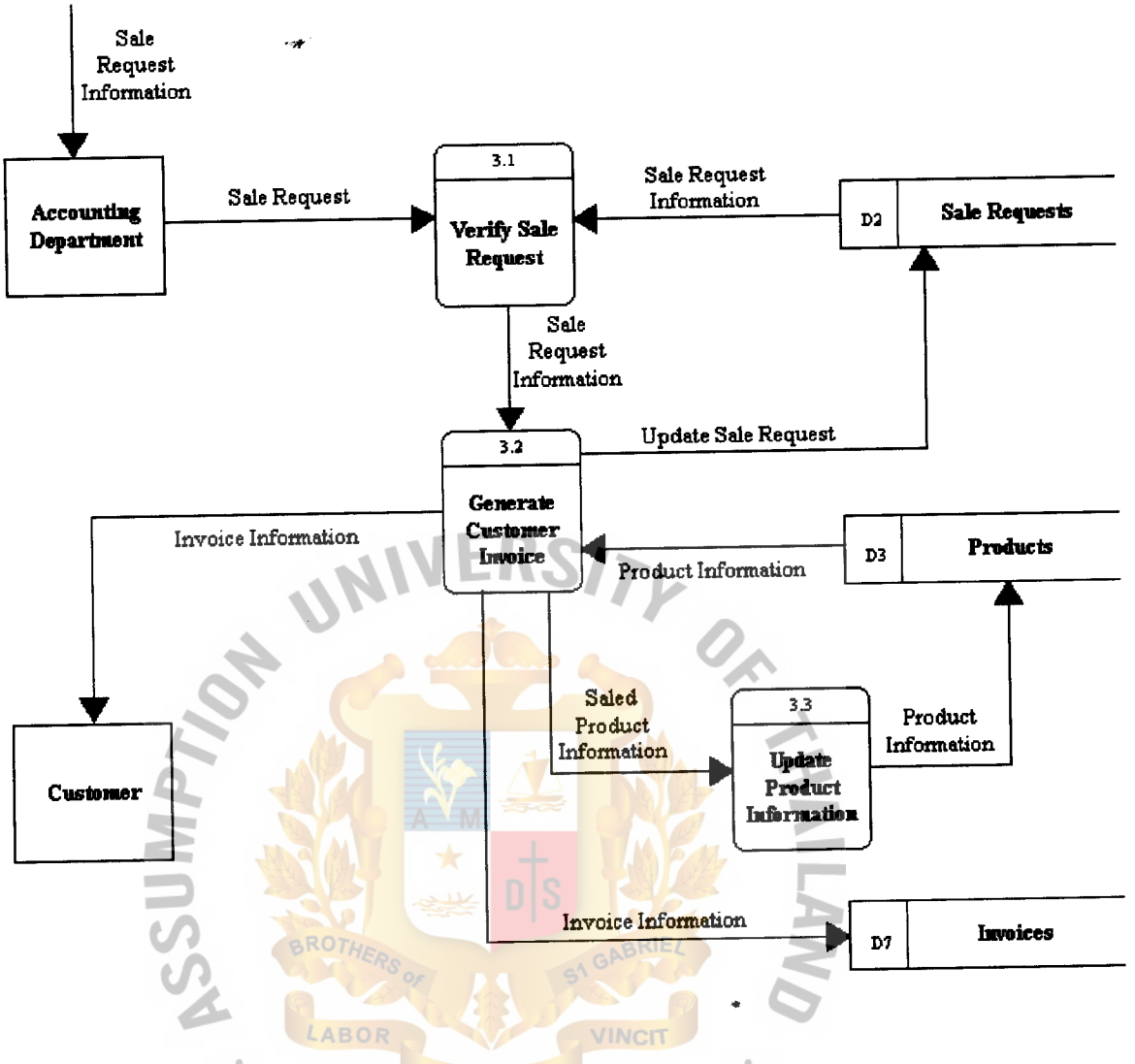


Figure G.3. Data Flow Diagram Level 1 Generate Invoice Process.

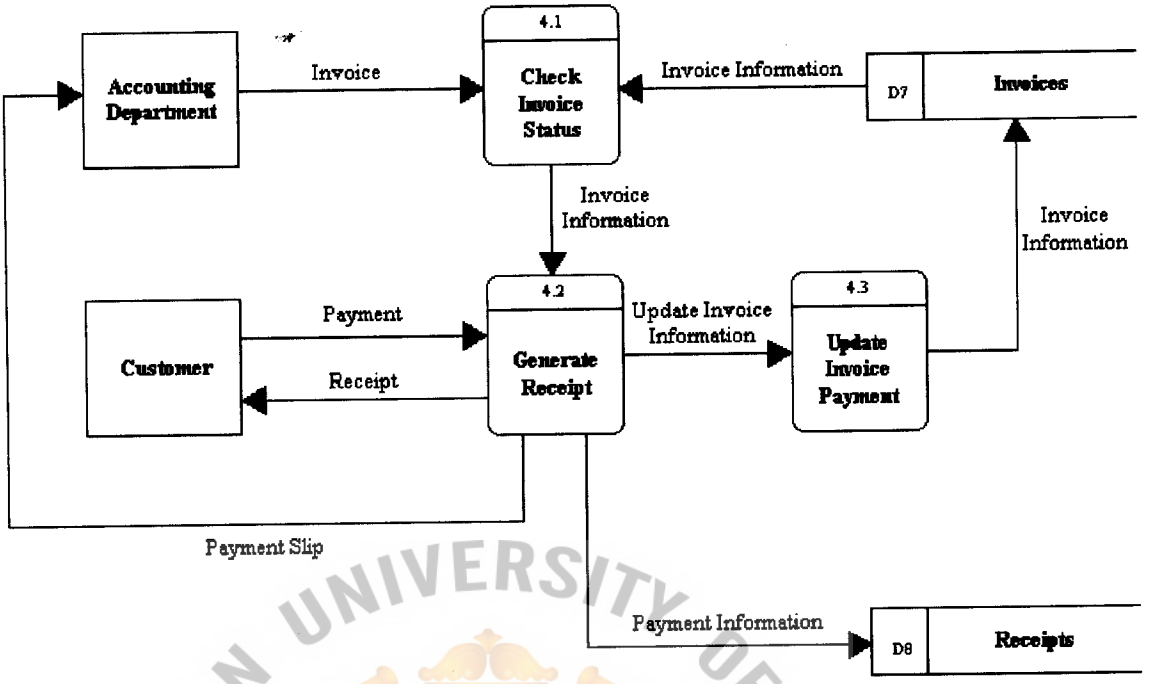


Figure G.4. Data Flow Diagram Level 1 Customer Payment Process.

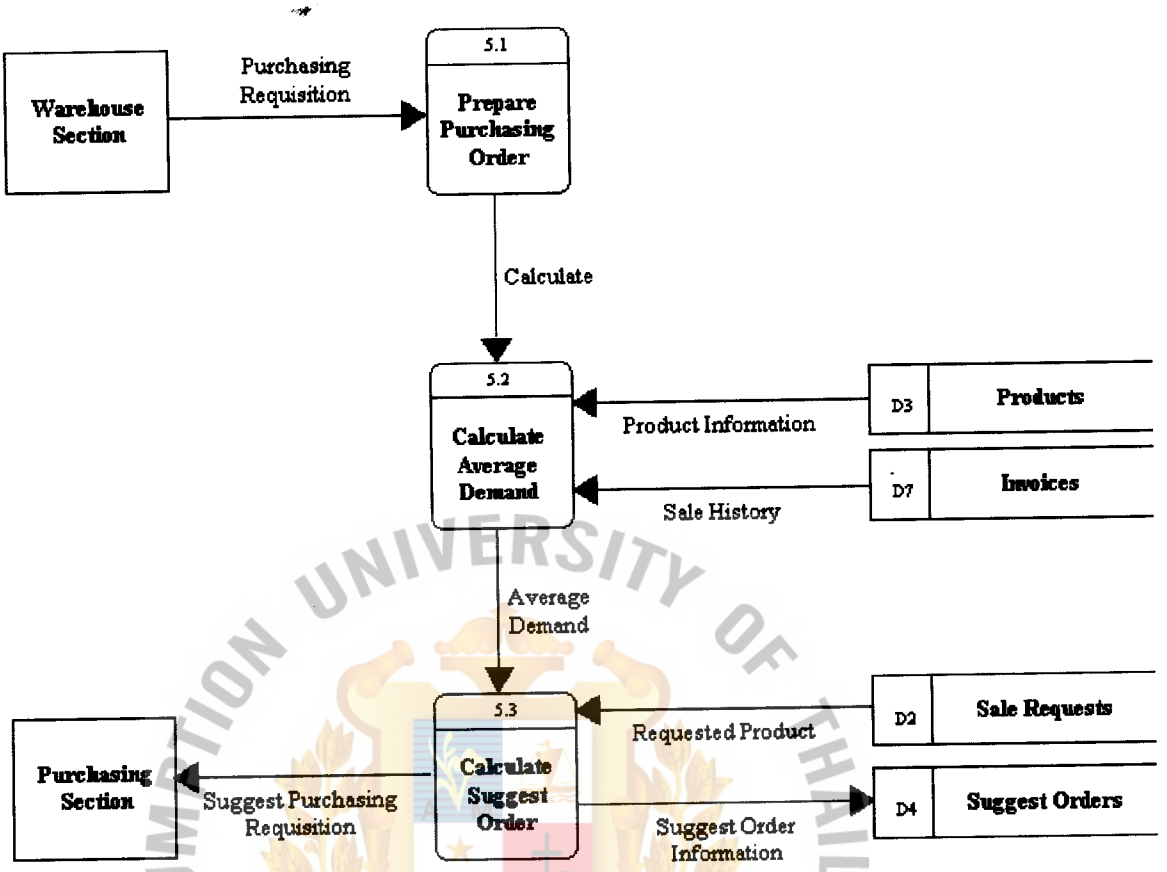


Figure G.5. Data Flow Diagram Level 1 Generate Suggested Order Process.

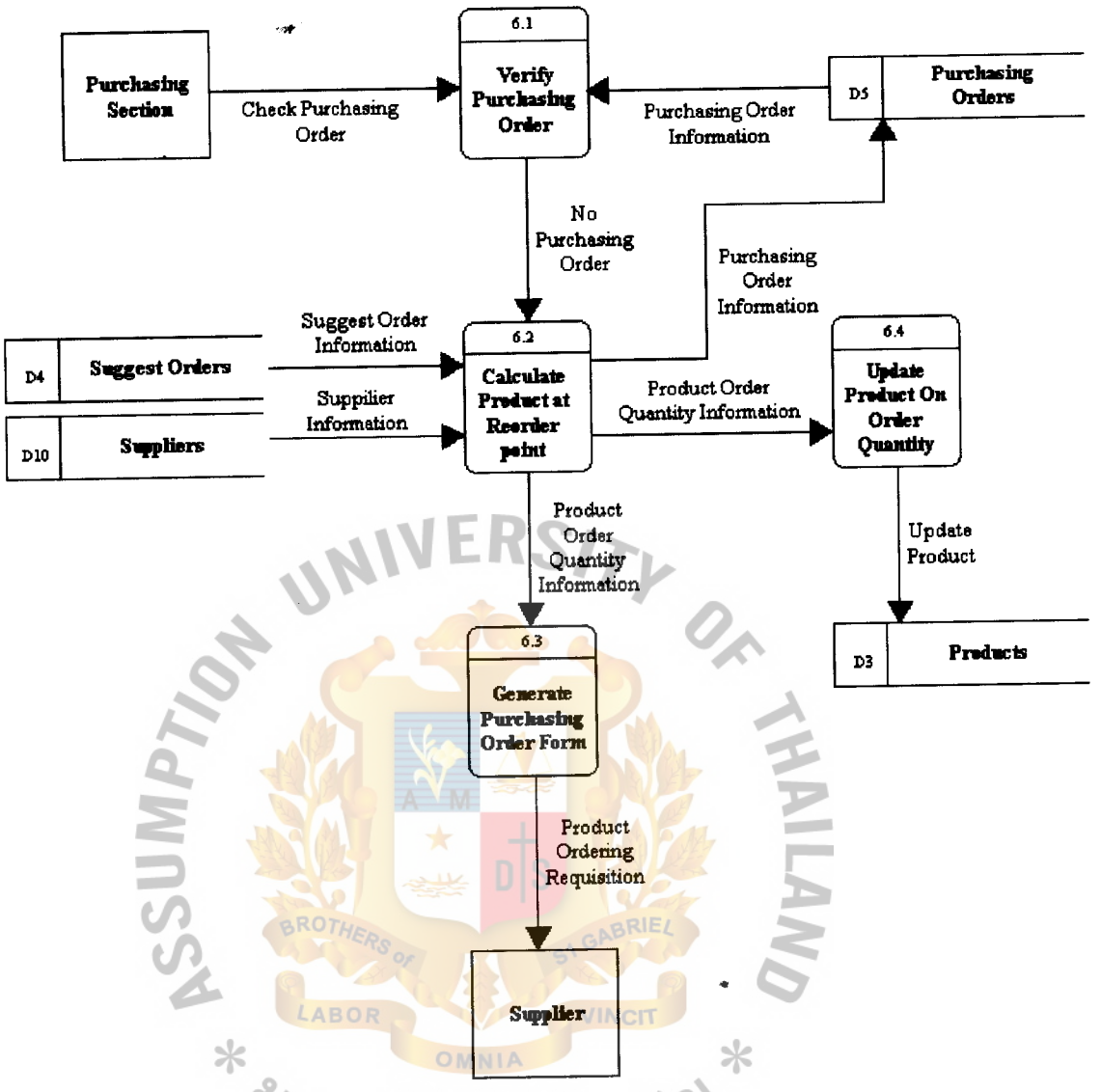


Figure G.6. Data Flow Diagram Level 1 Generate Purchasing Order Process.

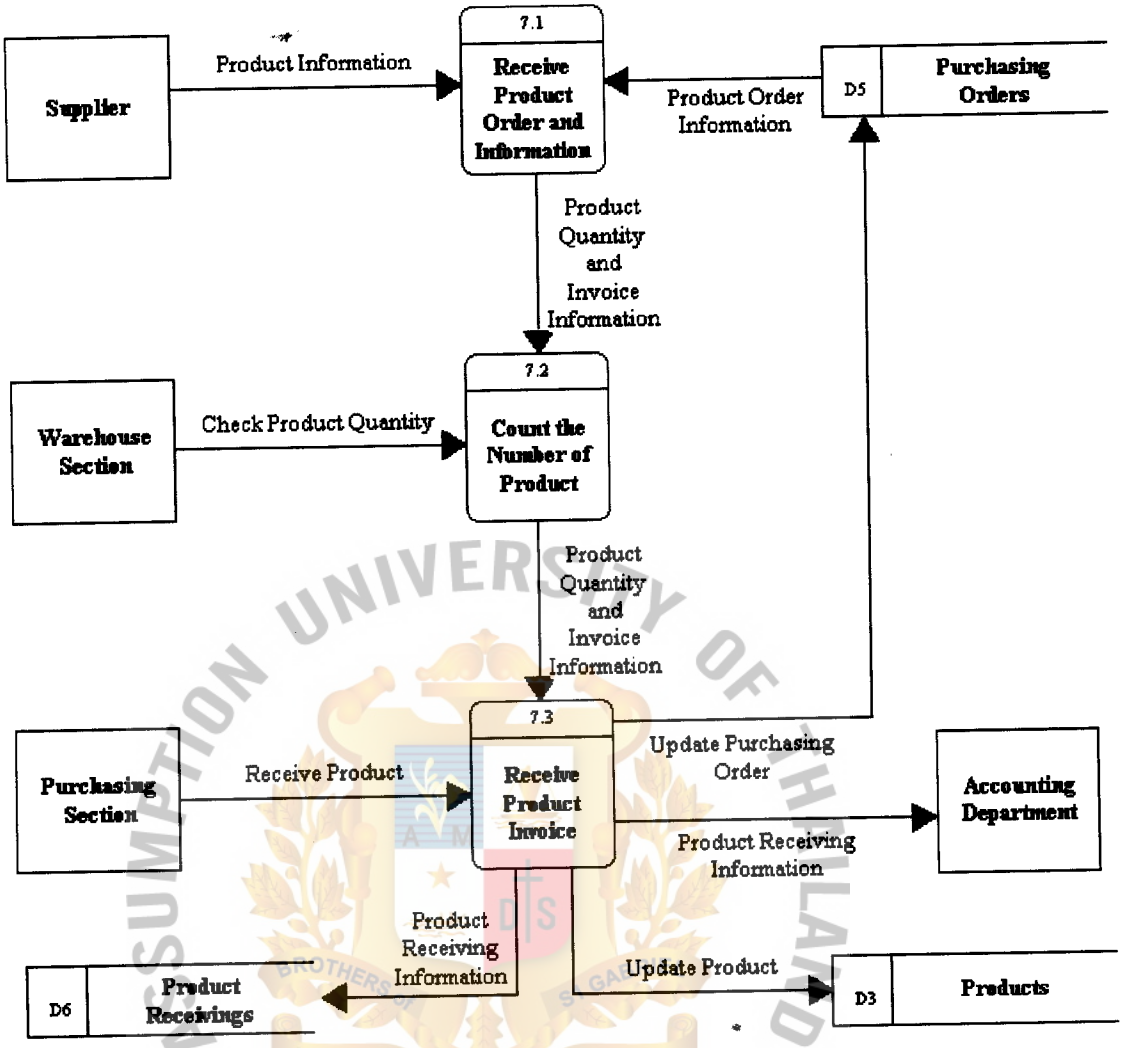


Figure G.7. Data Flow Diagram Level 1 Product Receiving Process.

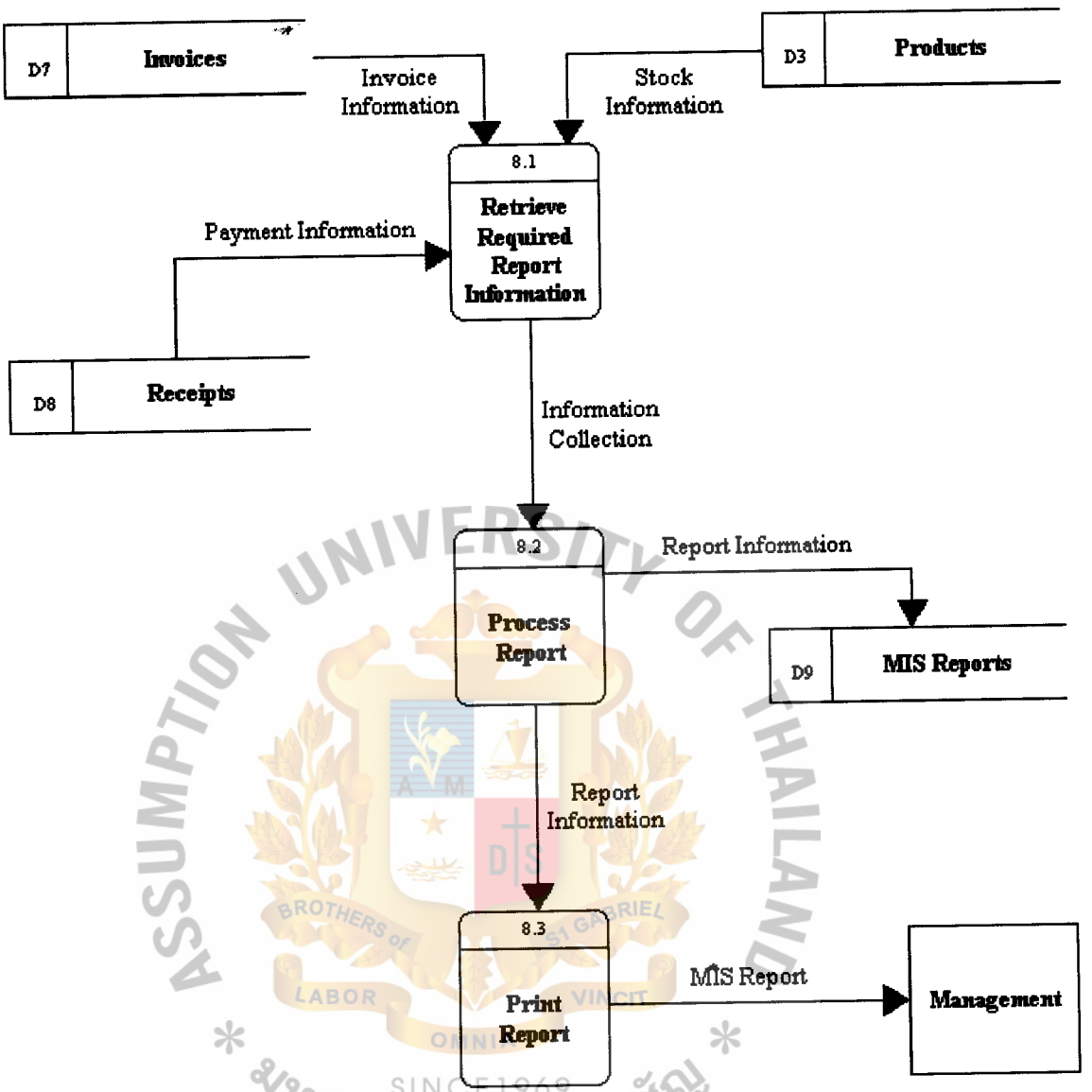


Figure G.8. Diagram Level 1 Report Generation Process.

APPENDIX H

PROCESS SPECIFICATION

Table H.1. Process Specification of Process 1.0.

Item	Description
Process Name	Check or Generate Customer Information
Data In	Customer Information
Data Out	Customer Information
Process	(1) Receive Customer Profile (2) Check Customer Data with Customer Database (3) If find Customer Data then exits the process (4) Elseif Customer Profile changed then Modified Customer Database with Customer Profile (5) Else Generate new Customer Information to Customer Database
Attachment	(1) Customer (2) Customer Database

Table H.2. Process Specification of Process 2.0.

Item	Description
Process Name	Generate Sale Request Process
Data In	Customer Information Product Information Sale Request Information Check Product Request Product Back Order
Data Out	Sale Request Information Available Product Information Product Information
Process	(1) Check Customer Information (2) If Customer Information is not found then go to Process 1.0 (3) Else Check Sale Request Information (4) If Sale Request is already created then check product available (5) If Product available then send Sale Request Information to Accounting Department (6) Else exits the process and send Product Information that still is not available to Customer (7) Else Generate new Sale Request Information (8) Check Product Information (9) If Product Quantity is not available then send Product Information to Customer (10) If Customer want to back order the product then change status of the product to back order (11) Else Continue to Generate Sale Request Information (12) Else Send Available Product Information to Warehouse Section (13) Send Sale Request Information to Accounting Department
Attachment	(1) Accounting Department (2) Customer (3) Warehouse Section (4) Customer Database (5) Product Database (6) Sale Request Database

Table H.3. Process Specification of Process 3.0.

Item	Description
Process Name	Generate Invoice Process
Data In	Sale Request Information Product Information
Data Out	Sale Request Information Product Information Invoice Information
Process	(1) Verify Sale Request Information (2) If Sale Request is already generated Invoice then exits the process (3) Else Generate Customer Invoice Information (4) Update Sale Request by changing status (5) Update Product Information into Product Database
Attachment	(1) Accounting Department (2) Customer (3) Invoice Database (4) Product Database (5) Sale Request Database

Table H.4. Process Specification of Process 4.0.

Item	Description
Process Name	Customer Payment Process
Data In	Invoice Information Customer payment
Data Out	Invoice Information Receipt Information
Process	(1) Check Invoice Information (2) If Invoice is already generated receipt then exits the process. (3) Else check Customer Payment. (4) If Customer Payment is not equal to the summary of Customer Invoice Information then exits the process. (5) Else Generate Receipt Information (6) Update Invoice Information into Invoice Database
Attachment	(1) Accounting Department (2) Customer (3) Invoice Database (4) Receipt Database

Table H.5. Process Specification of Process 5.0.

Item	Description
Process Name	Generate Suggest Order Process
Data In	Purchasing Requisition Product Information Requested Product from Sale Request Information Sale History from Invoice information
Data Out	Suggest Order Information Suggest Purchasing Requisition
Process	(1) Load Product Information and Sale History from Invoice Information (2) Calculate the Average Demand (3) Load the Requested Product from Sale Request Information (4) Calculate the Suggest Order (5) Generate Suggest Order Information
Attachment	(1) Warehouse Section (2) Purchasing Section (3) Invoice Database (4) Product Database (5) Sale Request Database (6) Suggest Order Database

Table H.6. Process Specification of Process 6.0.

Item	Description
Process Name	Generate Purchasing Order Process
Data In	Suggest Order Information Product Information Supplier Information
Data Out	Purchasing Order Information Product Information Product Ordering Requisition
Process	(1) Verify Purchasing Order (2) If Purchasing order is already generated then exits the process. (3) Load the Suggest Order Information. (4) Calculate Product at Reorder point. (5) Match the suppliers that supply the products are needed to order. (6) Generate Purchasing Order Information (7) Update Product Information
Attachment	(1) Purchasing Section (2) Supplier (3) Product Database (4) Suggest Order Database (5) Supplier Database (6) Purchasing Order Database

Table H.7. Process Specification of Process 7.0.

Item	Description
Process Name	Product Receiving Process
Data In	Purchasing Order Information Product Information
Data Out	Purchasing Order Information Product Information Product Receiving Information
Process	(1) Check Purchasing Order Information (2) If Purchasing Order is already generated to Product Receiving then exits the process. (3) Else Receive Product Information and Invoice information from Supplier. (4) Count The number of Product. (5) Generate Product Receiving Information. (6) Update Product Information. (7) Update Purchasing Order Information by changing status.
Attachment	(1) Purchasing Section (2) Warehouse Section (3) Accounting Department (4) Supplier (5) Product Database (6) Purchasing Order Database (7) Product Receiving Database

Table H.8. Process Specification of Process 8.0.

Item	Description
Process Name	Report Generation Process
Data In	Product Information(Stock) Invoice Information Receipt Information
Data Out	Report Information
Process	(1) Retrieve Required Report generation (2) Load Required Information (3) Generate the Report
Attachment	(1) Management (2) Product Database (3) Receipt Database (4) Invoice Database (5) MIS Report database

Table H.9. Process Specification of Process 1.1.

Item	Description
Process Name	Verify Customer Information.
Data In	Customer Information
Data Out	Customer Information
Process	(1) Receive Customer Profile (2) Check Customer Data with Customer Database. (3) If find Customer Data then exits the process. (4) Elseif Customer Profile changed then goes to process 1.2. (5) Else goes to process 1.2.
Attachment	(1) Customer (2) Customer Database (3) Generate or Modify Customer Information Process

Table H.10. Process Specification of Process 1.2.

Item	Description
Process Name	Generate or Modify Customer Information.
Data In	Customer Information
Data Out	Customer Information
Process	(1) If Customer Profile changed then modify the Customer Database with new Customer Information. (2) Else Generate the new Customer Information
Attachment	(1) Customer (2) Customer Database (3) Verify Customer Information Database

Table H.11. Process Specification of Process 2.1.

Item	Description
Process Name	Check Customer Order
Data In	Customer Information Sale Request Information Request Product
Data Out	Sale Request Information
Process	(1) Check Customer Information (2) If Customer Information is not found then go to Process 1.0. (3) Else Check Sale Request Information. (4) If Sale Request is already created then go to Process 2.3. (5) Else go to Process 2.2.
Attachment	(1) Customer (2) Customer Database (3) Sale Request Database (4) Generate Sale Request Process

Table H.12. Process Specification of Process 2.2.

Item	Description
Process Name	Generate Sale Request
Data In	Customer Information Product Information
Data Out	Sale Request Information
Process	(1) Generate Sale Request Information. (2) If Product non available then go to Process 2.4 (3) Else go to Process 2.3
Attachment	(1) Customer (2) Customer Database (3) Product Database (4) Check Customer Order Process (5) Check Product Available Process

Table H.13. Process Specification of Process 2.3.

Item	Description
Process Name	Check Product Available
Data In	Product Information Sale Request Information Check Product
Data Out	Sale Request Information Available Product Information Product Information
Process	(1) Check Product Available. (2) If Product Quantity is not available then send Product Information to Customer (3) ElseIf Customer want to back order the product then go to Process 2.4 (4) Else Send Available Product Information to Warehouse Section (5) Continue to Generate Sale Request Information and send Sale Request Information to Accounting Department
Attachment	(1) Accounting Department (2) Customer (3) Warehouse Section (4) Product Database (5) Sale Request Database (6) Generate Sale Request Process

Table H.14. Process Specification of Process 2.4.

Item	Description
Process Name	Back Purchasing Order
Data In	Back Order
Data Out	Sale Request Information
Process	(1) Customer wants to back order the product. (2) Change Back Order Status of Product in Sale Request Information
Attachment	(1) Customer (2) Sale Request Database

Table H.15. Process Specification of Process 3.1.

Item	Description
Process Name	Verify Sale Request
Data In	Sale Request Information
Data Out	Sale Request Information
Process	(1) Verify Sale Request Information (2) If Sale Request is already generated Invoice then exits the process. (3) Else goes to Process 3.2.
Attachment	(1) Accounting Department (2) Sale Request Database (3) Generate Customer Invoice Process

Table H.16. Process Specification of Process 3.2.

Item	Description
Process Name	Generate Customer Invoice
Data In	Sale Request Information Product Information
Data Out	Sale Request Information Invoice Information
Process	(1) Generate Customer Invoice Information (2) Update Sale Request by changing status (3) Go to Process 3.3
Attachment	(1) Customer (2) Invoice Database (3) Product Database (4) Sale Request Database (5) Verify Sale Request Process (6) Update Product Information Process

Table H.17. Process Specification of Process 3.3.

Item	Description
Process Name	Update Product Information
Data In	Sold Product Information
Data Out	Product Information
Process	(1) Update Product Information to Product Database
Attachment	(1) Product Database (2) Generate Customer Invoice Process

Table H.18. Process Specification of Process 4.1.

Item	Description
Process Name	Check Invoice Status
Data In	Invoice Information
Data Out	Invoice Information
Process	(1) Check Invoice Information (2) If Invoice is already generated receipt then exits the process. (3) Else goes to Process 4.2
Attachment	(1) Accounting Department (2) Invoice Database (3) Generate Receipt Process

Table H.19. Process Specification of Process 4.2.

Item	Description
Process Name	Generate Receipt
Data In	Invoice Information Customer payment
Data Out	Invoice Information Receipt Information Payment Slip
Process	(1) Check Customer Payment (2) If Customer Payment is not equal to the summary of Customer Invoice Information then exits the process (3) Else Generate Receipt Information (4) Go to Process 4.3
Attachment	(1) Customer (2) Receipt Database (3) Check Invoice Status Process (4) Update Invoice Payment Process

Table H.20. Process Specification of Process 4.3.

Item	Description
Process Name	Update Invoice Payment
Data In	Invoice Information
Data Out	Invoice Information
Process	(1) Update Invoice Information into Invoice Database
Attachment	(1) Generate Receipt Process (2) Invoice Database

Table H.21. Process Specification of Process 5.1.

Item	Description
Process Name	Prepare Purchasing Order
Data In	Purchasing Requisition
Data Out	Purchasing Requisition
Process	(1) Send the Purchasing Requisition for calculating
Attachment	(1) Warehouse Section (2) Calculate Average Demand Process

Table H.22. Process Specification of Process 5.2.

Item	Description
Process Name	Calculate Average Demand
Data In	Purchasing Requisition Product Information Sale History from Invoice information
Data Out	Average Demand
Process	(1) Load Product Information and Sale History from Invoice Information (2) Calculate the Average Demand 0f Last 6 Months
Attachment	(1) Warehouse Section (2) Product Information (3) Invoice Database (4) Prepare Purchasing Order Process (5) Calculate Suggest Order Process

Table H.23. Process Specification of Process 5.3.

Item	Description
Process Name	Calculate Suggest Order
Data In	Average Demand Requested Product from Sale Request Information
Data Out	Suggest Order Information Suggest Purchasing Requisition
Process	(1) Get average Demand of last 6 months (2) Calculate the Suggest Order Suggest Order = (Average Demand 6 Months x Max Stock Policy) – QOH – QOO + QOB (3) Generate Suggest Order Information
Attachment	(1) Purchasing Section (2) Sale Request Database (3) Suggest Order Database (4) Calculate Average Demand Process

Table H.24. Process Specification of Process 6.1.

Item	Description
Process Name	Verify Purchasing Order
Data In	Purchasing Order Information
Data Out	Purchasing Order Information
Process	(1) Verify Purchasing Order (2) If Purchasing order is already generated then exits the process. (3) Else go to Process 6.2
Attachment	(1) Purchasing Section (2) Purchasing Order Database
	(3) Calculate Product at Reorder Point Process

Table H.25. Process Specification of Process 6.2.

Item	Description
Process Name	Calculate Product at Reorder Point
Data In	Suggest Order Information Supplier Information
Data Out	Product Order Quantity Information Purchasing Order Information
Process	(1) Load the Suggest Order Information. (2) Calculate Product at Reorder point. (3) Match the suppliers that supply the products are needed to order. (4) Generate Purchasing Order Information. (5) Go to Process 6.3. (6) Go to Process 6.4.
Attachment	(1) Suggest Order Database (2) Supplier Database (3) Purchasing Order Database (4) Verify Purchasing Order Process (5) Generate Purchasing Order Form Process (6) Update Product On Order Quantity Process

Table H.26. Process Specification of Process 6.3.

Item	Description
Process Name	Generate Purchasing Order Form
Data In	Product Order Quantity Information
Data Out	Product Order Requisition
Process	(1) Get Purchasing Order Information (2) Generate Purchasing Order Form
Attachment	(1) Calculate Product at Reorder Point (2) Supplier

Table H.27. Process Specification of Process 6.4.

Item	Description
Process Name	Update Product On Order Quantity
Data In	Product Order Quantity Information
Data Out	Product Information
Process	(1) Get Product Order Quantity Information (2) Update Product On Order Quantity in Product Database
Attachment	(1) Calculate Product at Reorder Point (2) Product Database

Table H.28. Process Specification of Process 7.1.

Item	Description
Process Name	Receive Product Order and Information
Data In	Purchasing Order Information Product Information
Data Out	Product Quantity and Invoice Information
Process	(1) Check Purchasing Order Information (2) If Purchasing Order is already generated to Product Receiving then exits the process. (3) Else goes to Process 7.2
Attachment	(1) Purchasing Order Database (2) Supplier (3) Count the Number of Product

Table H.29. Process Specification of Process 7.2.

Item	Description
Process Name	Count the Number of Product
Data In	Product Quantity and Invoice Information Check Product Quantity
Data Out	Product Quantity and Invoice Information
Process	(1) Count The number of Product. (2) If not correct then exits the process. (3) Else goes to process 7.3
Attachment	(1) Warehouse Section (2) Receive Product Order and Information Process (3) Receive Product Invoice Process

Table H.30. Process Specification of Process 7.3.

Item	Description
Process Name	Receive Product Invoice
Data In	Product Quantity and Invoice Information Receive Product
Data Out	Purchasing Order Information Product Information Product Receiving Information
Process	(1) Generate Product Receiving Information. (2) Update Product Information. (3) Update Purchasing Order Information by changing status.
Attachment	(1) Purchasing Section (2) Accounting Department (3) Product Database (4) Purchasing Order Database (5) Product Receiving Database (6) Count the Number of Product Process

Table H.31. Process Specification of Process 8.1.

Item	Description
Process Name	Retrieve Required Report Information
Data In	Product Information(Stock) Invoice Information Receipt Information
Data Out	Information Collection
Process	(1) Retrieve Required Report generation (2) Go to Process 8.2
Attachment	(1) Product Database (2) Receipt Database (3) Invoice Database (4) Report Process

Table H.32. Process Specification of Process 8.2.

Item	Description
Process Name	Process Report
Data In	Information Collection
Data Out	Report Information
Process	(1) Load Required Information (2) Generate the Report
Attachment	(1) Management (2) MIS Report database (3) Retrieve Required Report Information Process

APPENDIX I

DATA DICTIONARY

Table I.1. Data Dictionary of Proposed System Database.

Fieldname	Meaning	Table
Address1	Customer Address Line 1	Customer
Address1	Supplier Address Line 1	Supplier
Address2	Customer Address Line 2	Customer
Address2	Supplier Address Line 2	Supplier
Amount_discount	Total Discount	Bill_head
Amount_discount	Total Discount	SR_head
Amount_discount	Total Discount	PurchaseOrder_head
Amount_sum	Total Amount excluded VAT	Bill_head
Amount_sum	Total Amount excluded VAT	Payment_detail
Amount_sum	Total Amount excluded VAT	Payment_head
Amount_sum	Total Amount excluded VAT	SR_head
Amount_sum	Total Amount excluded VAT	PurchaseOrder_head
Amount_sum	Total Amount excluded VAT	Purchase_receiving
Amount_tax	Total VAT	Bill_head
Amount_tax	Total VAT	Payment_detail
Amount_tax	Total VAT	Payment_head
Amount_tax	Total VAT	SR_head
Amount_tax	Total VAT	PurchaseOrder_head
Amount_tax	Total VAT	Purchase_receiving
Amount_total_included_tax	Total Amount Included VAT	Bill_head
Amount_total_included_tax	Total Amount Included VAT	Payment_detail
Amount_total_included_tax	Total Amount Included VAT	Payment_head
Amount_total_included_tax	Total Amount Included VAT	SR_head
Amount_total_included_tax	Total Amount Included VAT	PurchaseOrder_head
Amount_total_included_tax	Total Amount Included VAT	Purchase_receiving
Area	Area code of province	Province
Average_demand	Average Demand from past of 6 months	Product
Backorder_status	Backorder status	SR_Detail
Brand	Product brand	Product
CAT_PMC	Part Moving Code	Product
CAT_PMC_code	Part Moving Code	CAT_PMC
CAT_PMC_date	Date that classify Product	CAT_PMC
CAT_PMC_name	Part Moving Code Description	CAT_PMC
CAT_PMC_quantity	Quantity that classify Product	CAT_PMC

Fieldname	Meaning	Table
Contact_person	Contact person name	Customer
Contact_person	Contact person name	Supplier
Created_date	Date of Product_id created	Product
Credit_limit	Amount of money of credit limit	Customer_type
Credit_term	Length of days of credit limit	Customer_type
Customer_name	The name of customer	Customer
Customer_no	Customer Identification Number	Bill_head
Customer_no	Customer Identification Number	Customer
Customer_no	Customer Identification Number	Payment_head
Customer_no	Customer Identification Number	SR_head
Customer_Prefix_Suffix	Type of customer company	Customer
Customer_type	Type of customer	Customer
Customer_type_Description	Description about type of customer	Customer_type
Customer_type_ID	Type of customer	Customer_type
Department	Department ID	Employee
Department_ID	Department ID	Department
Department_name	Name of Department	Department
Doc_date	Date of purchasing order	PurchaseOrder_head
Doc_type	ID of type of document	Bill_head
Doc_type	ID of type of document	Payment_head
Doc_type	ID of type of document	SR_head
Doc_type_ID	ID of type of document	DocType
Doc_type_name	Description of type of document	DocType
Due_date	The due date of customer's payment	SR_head
Email	Email address of customer	Customer
Email	Email address of supplier	Supplier
Employee	Employee ID	Bill_head
Employee	Employee ID	SR_head
Employee	Employee ID	PurchaseOrder_head
Employee	Employee ID	Purchase_receiving
Employee_name	Name of Employee	Employee
Employee_no	Employee ID	Employee
Fax_no	Facsimile number of customer	Customer
Fax_no	Facsimile number of supplier	Supplier
Inbound_discount	Discount of Inbound product	Customer
Inbound_Maxstock	Inbound stock policy	CAT_PMC

Fieldname	Meaning	Table
Invoice_date	Date of created invoice	Bill_head
Invoice_NO	Invoice number	Bill_detail
Invoice_NO	Invoice number	Bill_head
Invoice_NO	Invoice number	Payment_detail
Invoice_status	Status of Invoice	SR_head
Lacation	Product Location	Product
Line_no	Line number of invoice	Bill_detail
Line_no	Line number of payment	Payment_detail
Line_no	Line number	SR_Detail
Line_no	Line number	PurchaseOrder_Detail
Line_no	Line number	Purchase_receive_detail
Outbound_discount	Discount of Outbound product	Customer
Outbound_Maxstock	Outbound stock policy	CAT_PMC
Payment_code	Code of payment_type	Payment_type
Payment_date	Payment Date	Payment_head
Payment_description	Description of payment code	Payment_type
Payment_NO	Payment Number	Payment_detail
Payment_NO	Payment Number	Payment_head
Payment_status	Payment Status	Bill_head
Payment_type	Type of payment	Payment_head
Phone_no	Telephone number of customer	Customer
Phone_no	Telephone number of supplier	Supplier
PO_Date	Date of Purchasing Order	SR_head
PO_NO	Purchase order Identification Number	PurchaseOrder_head
PO_NO	Purchase order Identification Number	PurchaseOrder_Detail
PO_NO	Purchase order Identification Number	Purchase_receiving
PO_Reference	Purchasing Order ID of customer	SR_head
PR_date	Date of purchase Receiving	Purchase_receiving
PR_NO	Purchase receiving Number	Purchase_receiving
PR_NO	Purchase receiving Number	Purchase_receive_detail
Prefix	Prefix name	Prefixsuffix
Prefix_Suffix_ID	Prefix Suffix code	Prefixsuffix
Product_class	Classify product that can discount or not	Product
Product_discount_type	Inbound or Outbound Product	Product
Product_ID	Product Identification Number	Bill_detail
Product_id	Product Identification Number	Product

Fieldname	Meaning	Table
Product_id	Product Identification Number	SR_Detail
Product_id	Product Identification Number	PurchaseOrder_Detail
Product_id	Product Identification Number	Purchase_receive_detail
Product_name_eng	English product name	Product
Product_name_thai	Thai product name	Product
Province	Customer Province	Customer
Province	Supplier Province	Supplier
Province_ID	Province Identification Number	Province
Province_name	Name of Province	Province
QOA	Quantity on Account	Product
QOB	Quantity on Backorder	Product
QOH	Quantity on Hand	Product
QOO	Quantity on Order	Product
QTY	Quantity of product	Bill_detail
QTY	Quantity of product	SR_Detail
QTY	Quantity of product	Purchase_receive_detail
QTY_actual	Actual quantity of product to order	PurchaseOrder_Detail
Receive_status	Status of Purchase Order	PurchaseOrder_head
SR_date	Date of sale request	SR_head
SR_Line_no	Line number of sale request	Bill_detail
SR_NO	Number of sale request	Bill_head
SR_NO	Number of sale request	SR_Detail
SR_NO	Number of sale request	SR_head
Suffix	Suffix name	Prefixsuffix
Suggest_Order	Quantity that need to purchase	Product
Suggest_QTY	Suggest quantity of product to order	PurchaseOrder_Detail
Supplier	Supplier Identification Number	Product
Supplier	Supplier Code	PurchaseOrder_head
Supplier_ID	Supplier Identification Number	Supplier
Supplier_name	Name of Supplier	Supplier
Supplier_prefix_suffix	Type of supplier company	Supplier
Total_cost	Total cost of products	SR_head
Unit_cost	Cost of each product	Bill_detail
Unit_cost	Cost of each product at that time	Product
Unit_cost	Cost of each product	SR_Detail
Unit_price	Price of each product	Bill_detail

Fieldname	Meaning	Table
Unit_price	Price of each product at that time	Product
Unit_price	Price of each product	SR_Detail
Unit_price	Price of each product	PurchaseOrder_Detail
Unit_price	Price of each product	Purchase_receive_detail
Unit_receive_status	Status of Receiving	PurchaseOrder_Detail
Vat_rate	Tax rate	DocType
Zipcode	Customer address zipcode	Customer
Zipcode	Supplier address zipcode	Supplier

APPENDIX J

SUGGESTED ORDER

SUGGESTED ORDER

About 10,000 items of forklift spare-parts are divided into sub-groups by using sale quantities per average sale volume for last 6 months as a standard. Spare-part department is considered in order to have advantage in ordering, selling and reducing time consumption for each order. So spare-parts are divided into 8 groups, called "Part Moving Code" or "PMC" or "CAT-PMC" (Category of Part Moving Code). The details of each code are described as follows:

(1) PMC 1 is used to describe season and campaign parts. They are seasonal selling items. For example, wiper blade, wiper refill and spare-parts which are promoted will be sold in large quantities during the rainy season. Order of this PMC should be especially considered in order to follow the demand in high seasonal selling and campaign. The stock of PMC 1 should be in least volume or zero.

(2) PMC 2 is used to describe new parts. They are new item spare-parts, including spare-parts of new model forklift, which have low sale volume in introduction stage. The demand of new model forklift may be low but when the demand increases in the next stage, the quantity of spare-parts of new model forklift will tend to increase also if the number of former parts are replaced by the number of new parts, which are already in the program. The PMC of new parts should be the same as PMC of former parts. New parts should have a chance to be sold before stocking; otherwise the stock may become dead items.

(3) PMC 3 is Fast Moving. They are items of spare-parts which are good to sell. The parts, which are in this PMC, are considered for keeping stocks in high volume.

(4) PMC 4 is Medium Moving. They are items of spare-parts which are moderately sold.

(5) PMC 5 is Slow Moving. They are items of spare-parts which are slowly sold. The parts, which are in this PMC, must be careful in ordering and stocking.

(6) PMC 6 are Standard parts. They are items of spare-parts which are costless or cost less than or equal to 15 – 20 baht, such as nut, bolt, and screw tapping.

(7) PMC 7 are Inactive parts. They are items of spare-parts which have no selling or not moved for more than 6 months but less than or equal to 36 months or 3 years.

(8) PMC 8 are Dead parts. They are items of spare-parts which have no selling or not moved for more than 36 months or 3 years.

Formula for calculation of spare-part ordering

$$\text{Suggested Order} = \text{Max.stock} - (Q/H + Q/O) + B/O$$

Where: Max.stock = Maximum stock = AVG.D x Stock level

AVG.D = Average Demand

$$= \frac{(D\text{-}1) + (D\text{-}2) + (D\text{-}3) + (D\text{-}4) + (D\text{-}5) + (D\text{-}6)}{6}$$

D-1 = Demand of last 1 month

D-2 = Demand of last 2 months

D-3 = Demand of last 3 months

D-4 = Demand of last 4 months

D-5 = Demand of last 5 months

D-6 = Demand of last 6 months

Stock level	=	Safety stock + Stock for sale + Lead time + other
Safety stock	=	Safety stock is additional quantity of spare-parts held in inventory to be used in time when there are some problem in transportation and when there are uncertain demand and when lead time is longer than expected during reorder periods.
Lead time	=	Lead time is length of time required to replenish the inventory for a spare-part from the time that a need for additional spare-part is sensed until the new order for the spare-part is in inventory and ready to be sold.
Q/H	=	Quantity on Hand (stock)
Q/O	=	Quantity on Order is the quantity of parts that are ordered.
B/O	=	Quantity on Backorder is the quantity of parts that are requested to order by customers.

The PMC code and formula for calculation of spare-parts ordering are the tools that are used for managing lots of spare-parts. These tools provide decision making support for the spare-part department.

Table J.1. Example of Suggested Order, Co-efficient is 1.

a: 6 month sales average					10	
b: co-efficient, max stock policy (Month supply + Lead time)					0 + 1	
lead time					3	months
SO: Sales Order						
PO: Suggest order = (a x b) - OH - OO + BO						
received	SO	shipped	OH	OO	BO	PO
0	10	10	50	0	0	-40
0	10	10	40	0	0	-30
0	10	10	30	0	0	-20
0	10	10	20	0	0	-10
0	10	10	10	0	0	0
0	10	10	0	0	0	10
0	10	0	0	10	10	10
0	10	0	0	20	20	10
10	10	10	0	20	20	10
10	10	10	0	20	20	10

Table J.2. Example of Suggested Order, Co-efficient is 2.

a: 6 month sales average					10	
b: co-efficient, max stock policy (Month supply + Lead time)					0 + 2	
lead time					3	months
SO: Sales Order						
PO: Suggest order = (a x b) - OH - OO + BO						
received	SO	shipped	OH	OO	BO	PO
0	10	10	50	0	0	-30
0	10	10	40	0	0	-20
0	10	10	30	0	0	-10
0	10	10	20	0	0	0
0	10	10	10	0	0	10
0	10	10	0	10	0	10
0	10	0	0	20	10	10
10	10	10	0	20	10	10
10	10	10	0	20	10	10
10	10	10	0	20	10	10

Table J.3. Example of Suggested Order, Co-efficient is 3.

a: 6 month sales average					10	
b: co-efficient, max stock policy (Month supply + Lead time)					0 + 3	
lead time					3	months
SO: Sales Order						
PO: Suggest order = (a x b) - OH - OO + BO						
received	SO	shipped	OH	OO	BO	PO
0	10	10	50	0	0	-20
0	10	10	40	0	0	-10
0	10	10	30	0	0	0
0	10	10	20	0	0	10
0	10	10	10	10	0	10
0	10	10	0	20	0	10
10	10	10	0	20	0	10
10	10	10	0	20	0	10
10	10	10	0	20	0	10
10	10	10	0	20	0	10

Table J.4. Example of Suggested Order, Co-efficient is 4.

a: 6 month sales average					10	
b: co-efficient, max stock policy (Month supply + Lead time)					1 + 3	
lead time					3	months
SO: Sales Order						
PO: Suggest order = (a x b) - OH - OO + BO						
received	SO	shipped	OH	OO	BO	PO
0	10	10	50	0	0	-10
0	10	10	40	0	0	0
0	10	10	30	0	0	10
0	10	10	20	10	0	10
0	10	10	10	20	0	10
10	10	10	10	20	0	10
10	10	10	10	20	0	10
10	10	10	10	20	0	10
10	10	10	10	20	0	10
10	10	10	10	20	0	10

Table J.5. Example of Suggested Order, Co-efficient is 5.

a: 6 month sales average					10	
b: co-efficient, max stock policy (Month supply + Lead time)					2 + 3	
lead time					3	months
SO: Sales Order						
PO: Suggest order = (a x b) - OH - OO + BO						
received	SO	shipped	OH	OO	BO	PO
0	10	10	50	0	0	0
0	10	10	40	0	0	10
0	10	10	30	10	0	10
0	10	10	20	20	0	10
10	10	10	20	20	0	10
10	10	10	20	20	0	10
10	10	10	20	20	0	10
10	10	10	20	20	0	10
10	10	10	20	20	0	10
10	10	10	20	20	0	10

Table J.6. Example of Suggested Order, Co-efficient is 6.

a: 6 month sales average					10	
b: co-efficient, max stock policy (Month supply + Lead time)					3 + 3	
lead time					3	months
SO: Sales Order						
PO: Suggest order = (a x b) - OH - OO + BO						
received	SO	shipped	OH	OO	BO	PO
0	10	10	50	0	0	10
0	10	10	40	10	0	10
0	10	10	30	20	0	10
10	10	10	30	20	0	10
10	10	10	30	20	0	10
10	10	10	30	20	0	10
10	10	10	30	20	0	10
10	10	10	30	20	0	10
10	10	10	30	20	0	10
10	10	10	30	20	0	10

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