Raw Material and Production Information System
for Ban-Ya Pharmaceutical Company

by

Ms. Preeyada Charoendho

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

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer Information Systems
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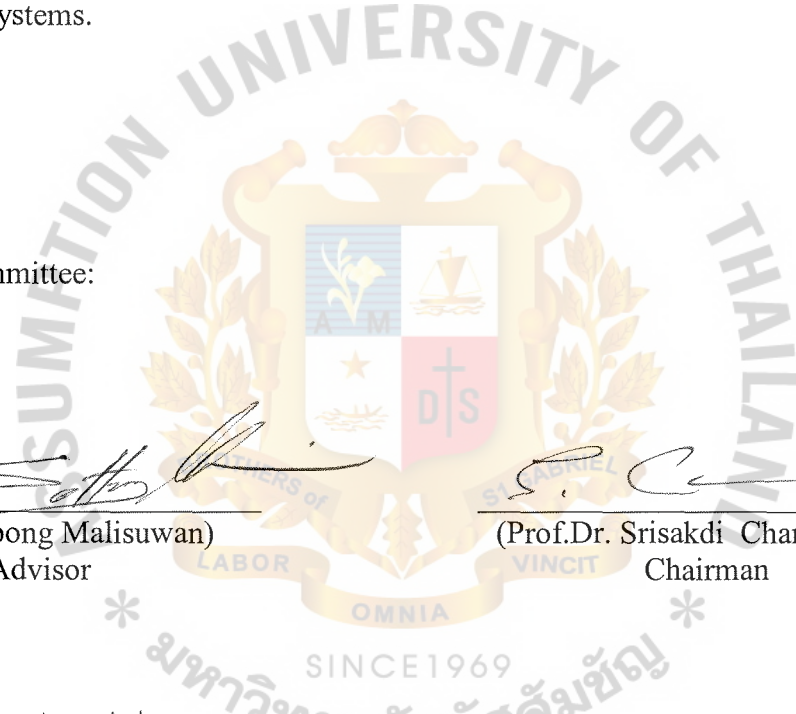|	
Project Title	Raw Material and Production Information System for Ban-Ya Pharmaceutical Company
Name	Ms. Preeyada Charoendho
Project Advisor	Dr. Settapong Malisuwan
Academic Year	March 2004

The Graduate School of Assumption University has approved this final report of the six-credit course, CS 6998 - CS 6999 System Development Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.

Approval Committee:

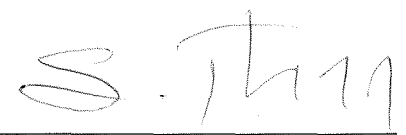|	
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ABSTRACT

The System Development Project is written under the topic of Raw Material and Production Information System for Ban-Ya Pharmaceutical Company. The main objective of the project development is to create a new system that allows the company to have and expand more growth opportunity by the use of the computerized system. This project is not only designed for Raw Material and Production Information System but also for Executive Information System which will be useful as a Decision Supporting System for the management.

The current existing system is based on the manual and some computerized system. Most of the data are stored on paper, while some parts are kept in the Microsoft Word and stored in the hard disk of personal computer. It requires many operating staff to maintain the system, and has to face general problems of the manual system, which is error-prone and has a high maintenance cost

The project begins by analyzing the existing system and then designing the new computer system to meet expectation and requirements of the users. The new system will give up-to-date information of order number, customer details, raw material, product information system and stock. The system will provide the productive, effectiveness, and efficiency for production control and produce required reports for the department.

The new proposed system is developed to replace the manual and some computerized information system with the computerized system. All data are kept in the database server, Microsoft Access. In order to increase productivity, company utilizes technology such as information technology to gather data in each factory and to generate reports to support decision making for production and sales forecast.

ACKNOWLEDGEMENTS

In preparing this project, several people have made contributions to the completion of the project with their kindness. The writer would like to acknowledge their efforts and thank them for their contributions.

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Finally, she appreciates her beloved family and friends who have supported and encouraged her over the years.

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Production system is the heart of the company; it is necessary to have standard quality for distributing products to consumers. Raw material and chemical compound is important for the process because it is the beginning of the production process. The quality control system will check every step of the process.

Initially, medicine stock system is used to record finished product, and the paper card (manual) is used for the raw material when checking stock at the warehouse. There will be problems such as updating raw material stock and checking quality reports which are not up-to-date and time-consuming. Also, many problems occur and it is inefficient in finding out the status of medicine production. In addition, it does not support GMP (Good Manufacturing Practice). For this reason, the company should improve the existing production system.

Nowadays, the government has new regulation regarding GMP (Good Manufacturing Practice) standard and pharmaceutical manufacturing companies have to practice according to the standard strictly. From this regulation, pharmaceutical manufacturing companies need to have complete information where the sources of raw materials are, details of production process until product is finished completely, and details of the suppliers. These information will be helpful whenever it is necessary to collect the product back immediately if problems occur.

In order to increase productivity, the company utilizes technology such as Information Technology to gather data in each process and to generate reports to support decision making for production and sale forecast.

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1.2 Objective of the Project

The objectives of the project on Raw Material and Production Information System can be categorized as follows:

(1) To study and understand the existing system of the Raw Material and Production Information System in order to identify the new development system for the company, and to analyze the existing system in order to know the current situation of the system so as to design the new system.

(2) To analyze the problem of users' requests.

(3) To improve efficiency and effectiveness of finding the relationship among them by using a computerized system such as raw material details, product details, supplier details, and customer details (dealer); the address will be available when there is a need to call back the product in case it is rejected for any problem.

(4) To control the pharmaceutical production by using a computerized system.

(5) To utilize Database Management Techniques in order to provide up-to-date, effective and accurate information for the Raw Material and Production Information System, and to create management information system and an executive information system using decision supporting system for the management.

(6) To generate reports which will be submitted to the Ministry of Public Health from time-to-time.

(7) To reduce the cost incurred through manual operation.

1.3   Scope of the Project

The scope of this project can be divided into 3 parts which are the scope of data, the scope of processes, and the scope of interfaces. The details in each part are as follows:

(1)   The Scope of Data

This project includes all data or information that play as input or output in Raw Material and Production Information System. The names are as listed below:

    (a)   Raw Material Information

    (b)   Product Information

    (c)   Customer (Dealer) Information

    (d)   Supplier Information

    (e)   Quality Control Information

    (f)   Improvement Information

(2)   The scope of Processes

In this project, all ongoing processes that occur in the Raw Material and Production Information System will be studied and analyzed. The names of processes are as listed below:

    (a)   Mixed Raw Material and Chemical Compound Function

    (b)   Control Quality Function

    (c)   Produce Items Function

    (d)   Delivery Products to Stock Function

    (e)   Confirm Order Function

(3)   The scope of Interfaces

The external entities concerning Raw Material and Production Information System will be covered in this project as follows:

(a)   Quality Assurance and Control Department

(b)   Regulatory Department

(c)   Sales and Marketing Department

(d)   Purchasing Department

1.4   Deliverables

The deliverables, which occur in this project of the Raw Material and Production Information System for Pharmaceutical Company, are as follows:

(1)   Results of existing system study

(2)   Design of proposed system

(3)   Analysis of candidate solution

(4)   Benefit and cost analysis

(5)   System specification

(a)   Design Specification

(b)   Context Diagram

(c)   Data Flow Diagram

(d)   Entity Relationships Diagram

(6)   Data dictionary

(7)   Screens comprise of 11 items as follows:

(a)   User Login Screen

(b)   Main Menu Interface

(c)   Sub Menu 1 Interface

(d)   Sub Menu 2 Interface

(e) Raw Material Input Interface

(f) Improve Raw Material Quarantine Interface

(g) Raw Material Issue Interface

(h) Production Input Interface

(i) Customer Order Record Interface

(j) Purchase Order Record Interface

(k) Query of Raw Material Balance Record

(l) Query of Product Balance Record

(m) User Input Interface

(8) Report comprises of 5 reports as follows:

(a) Generate Formal Monthly Production Report for Submitting to the Ministry of Public Health

(b) Generate Raw Material Balance Report

(c) Generate Raw Material Receipt Report

(d) Generate Product Balance Report

(e) Generate Product after QC process Report

(f) Generate Finished Product Balance Report

(g) Generate Finished Product in Stock Report

1.5 Project Plan

As shown by Project Gantt Chart in Figure 1.1, the system development project plan started from November 1, 2003 to February 29, 2003. The project consists of three main tasks: Analysis of the Existing System, Analysis and Design of the Proposed System and Implementation of the Proposed System. The project plan can be represented as in Figure 1.1.

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No.	Task Name	November 1	November 2	November 3	November 4	December 1	December 2	December 3	December 4	January 1	January 2	January 3	January 4	February 1	February 2	February 3	February 4
I.	Analysis of the Existing System																
1	Define the Objective and Scope	▨															
2	Study the Existing System		▨														
3	Identify the Existing Problems			▨													
4	Study the Existing Computer System			▨													
5	Develop Context Diagram				▨												
6	Develop Data Flow Diagram					▨											
7	Cost and Benefit Analysis						▨										
II.	Analysis and Design of the Proposed System																
8	Interface Design							▨									
9	Report Design							▨									
10	Database Design								▨								
11	Network Design							▨									
12	Program Design							▨									
III.	Implementation of the Proposed System																
13	Coding									▨	▨						
14	Testing									▨							
15	Hardware Installation										▨						
16	Software Installation															▨	
17	Conversion																▨

Figure 1.1.   Project Plan of Raw Material and Production Information System for Ban-Ya Pharmaceutical Company.

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II. THE EXISTING SYSTEM

2.1 Background of the Organization

Ban-Ya Pharmaceutical Company was established in June of 2000 and it has always been our objective to manufacture quality pharmaceuticals for the better health of Thai people. We have always insisted upon employing modern, efficient machinery together with strict quality control by expert production pharmacists. With three years of growth and development, Ban-Ya Pharmaceutical has almost become a leading manufacturer. There are 3 kinds of products such as Tablets, Solutions, and Creams. There are 180 employees.

We have the knowledge, technology and equipment that serve our aims in developing greater production efficiency. Due to continuous research, our product development gives us an edge to better respond to the changing needs of the consumer and the market. The company's operation is classified into 8 departments as follows. The organization chart is shown in Figure 2.1.
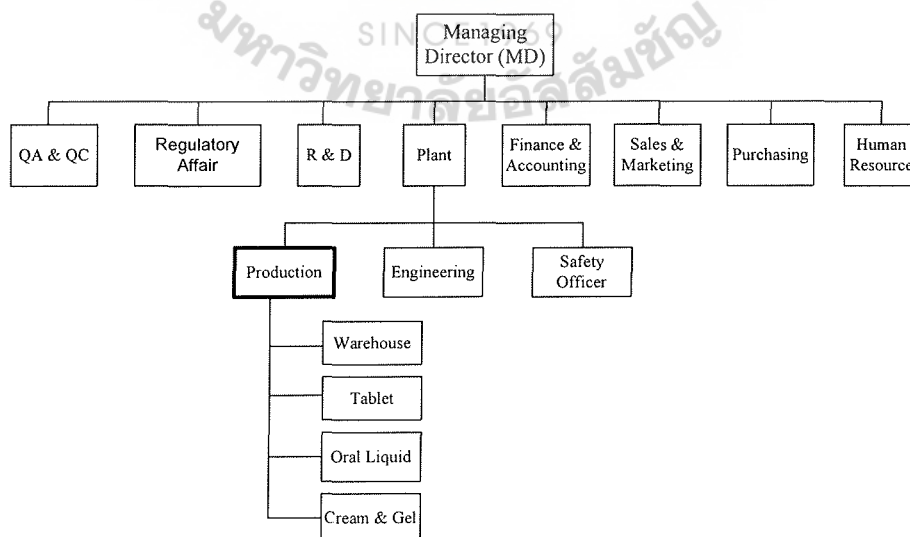
Figure 2.1. The Organization Chart of Ban-Ya Pharmaceutical Company.

(1) QA & QC Department: The main function of this department is to be responsible in assuring and controlling all steps in medicine production. Responsibility starts by checking and approving the raw material receipt and controlling the processing steps until checking and approving the product (finished product). It is also responsible in accepting production request.

(2) Regulator Affair Department: The main function of this department is to be responsible in representing production document including registration number in order to make the production process according to Thai law.

(3) R & D Department: The main function of this department is to be responsible in researching and developing new medicines including representing all information of research and development for registration number. It is also responsible in testing the medicine that has a complaint.

(4) Plant Department: The main function of this department is to be responsible in production control and plan. It is also concerned with internal management and relationship among management. There are 3 sections under this department as shown below:

    (a) Production Section

    (b) Engineering Section

    (c) Safety Officer Section

(5) Purchasing Department: The main function of this department is to be responsible in ordering raw material, equipment, goods, and packaging material.

(6) Human Resource Department: The main function of this department is to be responsible in taking care of staff performance, recruiting employee, and preparing staff training both of the office and factory.

(7) Finance & Accounting Department: The main function of this department is to be responsible for monthly salary of employee and also taking care of raw material issue.

(8) Sales & Marketing Department: The main function of this department is to be responsible in keeping track of the business in terms of fulfilling customer satisfaction. Thus, promotional plans need to be launched at the correct time and penetrate the correct target group of customers. It is also responsible in creating positive public relationships both internal and external.

2.2 Existing System Functions

As the existing system is done on a manual basis and PC workstation, receiving and distributing of raw material for storage have been done on a manual booking system and some information is prepared by personal computer that do not implement database application at present.

The management has noticed that there is lack of control both of raw material and finished product procedures. Also, it does not support GMP (Good Manufacturing Practice). As mentioned before, pharmaceutical manufacturing needs to have complete information such as where the source of raw materials is, details of production process, and also details of customer and suppliers of each medicine category. All of these are recorded by using the Microsoft Excel program on the PC. This causes a lot of problems in document management and data updating of raw material and production information.

The context diagram of the existing system is shown in Figure 2.2.
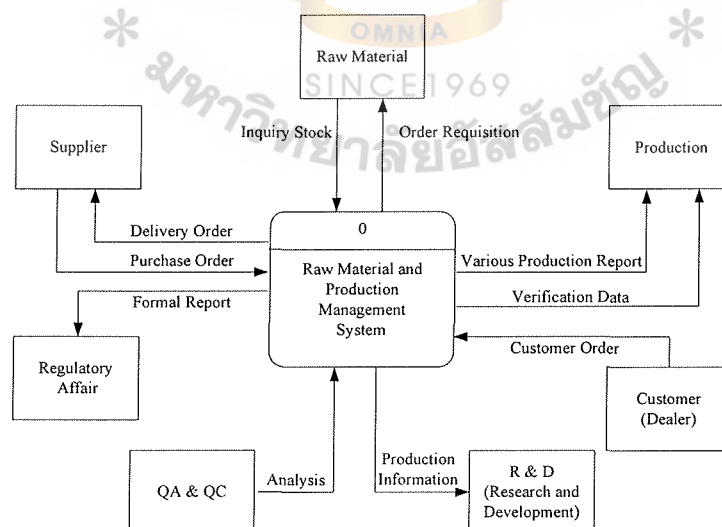
Figure 2.2. Context Diagram of the Existing System.

2.3 Current Problems and Areas for Improvement

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

(1) There are many transactions of task in the inventory system where each transaction needs accurate information.

(2) The existing system is still a manual system that requires more workers to handle all the transactions of the inventory system.

(3) The old data are hard copy. So, it has many problems as follows:

(a) It is difficult to retrieve data to make the report.

(b) It is difficult to search data for the information.

(c) It is difficult to compare cost of raw material to calculate the price of product.

(d) It is difficult to count the amount of raw material and production.

(e) It takes time to do monthly reports for submitting to the Ministry of Public Health.

(f) The production data is not up-to-date.

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III. THE PROPOSED SYSTEM

3.1 System Specification

3.1.1 User Requirements

As Ban-Ya Pharmaceutical Company uses the manual system, it needs to be replaced with a new computerized system, which can improve the performance, information, economy, control, efficiency and service in all processes. In order to get the complete set of user requirements, all the existing forms were analyzed and also the users were approached for finding out what they really need or want from the new computerized system. The following information was collected through interviews, questionnaires, and facilitated meetings. Hence, the new computerized system is designed to have the 5 functional requirements categorized as follows:

(1)   Raw Material Stock Control.

    (a)   The system can show all quantities of each raw material which are in stock.

    (b)   The system can show raw material list automatically when it reaches the purchasing level.

    (c)   The system can deliver raw material information into raw material stock automatically when it has already passed QC process.

    (d)   The system can keep track of all suppliers' information; therefore, it will be convenient to contact suppliers for later purchasing.

(2)   Production Control.

    (a)   The system must handle all recorded production transaction into the database.

    (b)   The system can record all production process which is useful for R&D process.

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(c) The system can calculate the percentage of loss during production process.

(3) Finished Product Stock Control.

    (a) The system can show all quantity of each finished product which is in stock.

    (b) The system can show finished product list automatically when it is at production level.

    (c) The system can show customer address immediately with the information of who bought the product from the company in case some products rejected by the Ministry of Public Health need to be recalled from consumers.

    (d) The system can support production forecast by customer orders.

(4) Generate Report.

    (a) The system can generate monthly report to be submitted to the Ministry of Public Health.

    (b) The system can be useful for printing report with formal format according the Ministry of Publish Health role.

(5) Maintenance System.

    (a) The system shall provide smooth operations to add, update, and delete information about basic data, receive-request raw material, and production in the system.

3.1.2 Data Modeling

For better understanding of user requirements, several models are built in this project. First, data modeling is used for defining business requirements for database. The Martin (information engineering) notation for entity relationship diagrams (ERDs) is adopted because of its widespread use. The relationships in the models are names from parent to child.

3.1.3 Process Modeling

In this section, system analysis process model called data flow diagrams (DFDs) is adopted to graphically depict the flow of data through a system and the work or processing performed by the system. Diagramming symbols, used for data flow diagrams are based on work of C. Gane and T. Sarson. Also, a DFD planning tool called decomposition diagram is introduced. A context diagram that actually illustrates a system's interfaces to the business and outside world, including other information system is developed as well.

(1)   Context Data Flow Diagram

First, a context data flow diagram is created to document the initial project scope and to help grasp basic data movement. As shown in Figure3.1, the main purposes of the production information system for Ban-Ya Pharmaceutical are process contract transactions. Management has also emphasized the need for various reports.

(2)   Decomposition Diagram

The decomposition diagram as shown in Figure3.2 is developed to show the top-down function decomposition of the system and to provide the beginnings of an outline for drawing data flow diagrams. The root process corresponds to the entire

system. The system is initially factored into subsystems that are built as cross-functional

system to streamline processing and data sharing.

(3)   Data Flow Diagrams

The DFDs for each level shown in Figure 3.3 to Figure 3.7 are

developed to show a context diagram for each signal event.
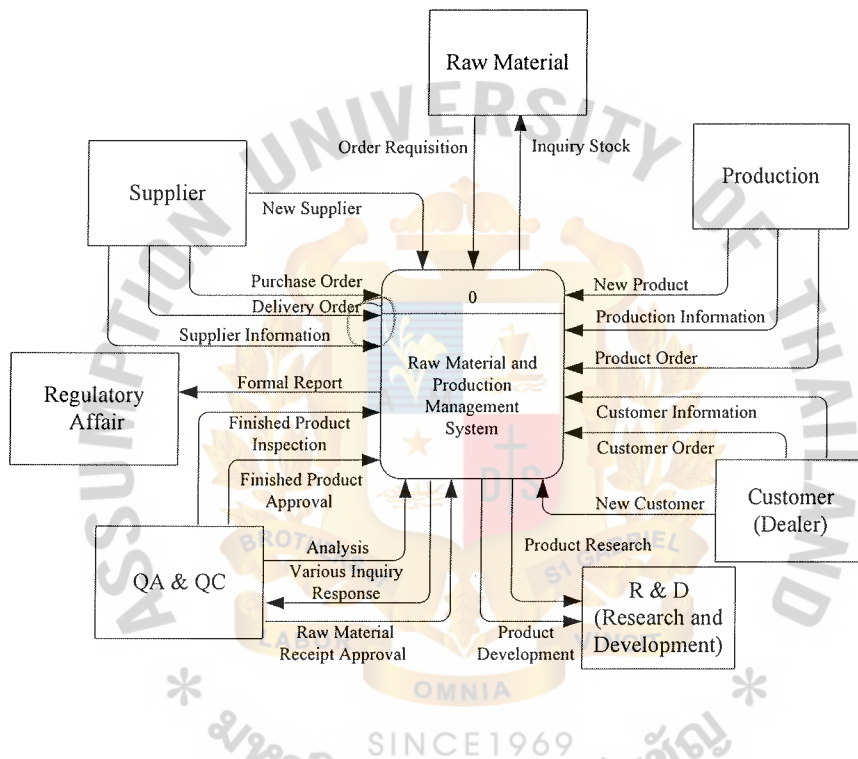
Figure 3.1.   Context Diagram of the Proposed System.

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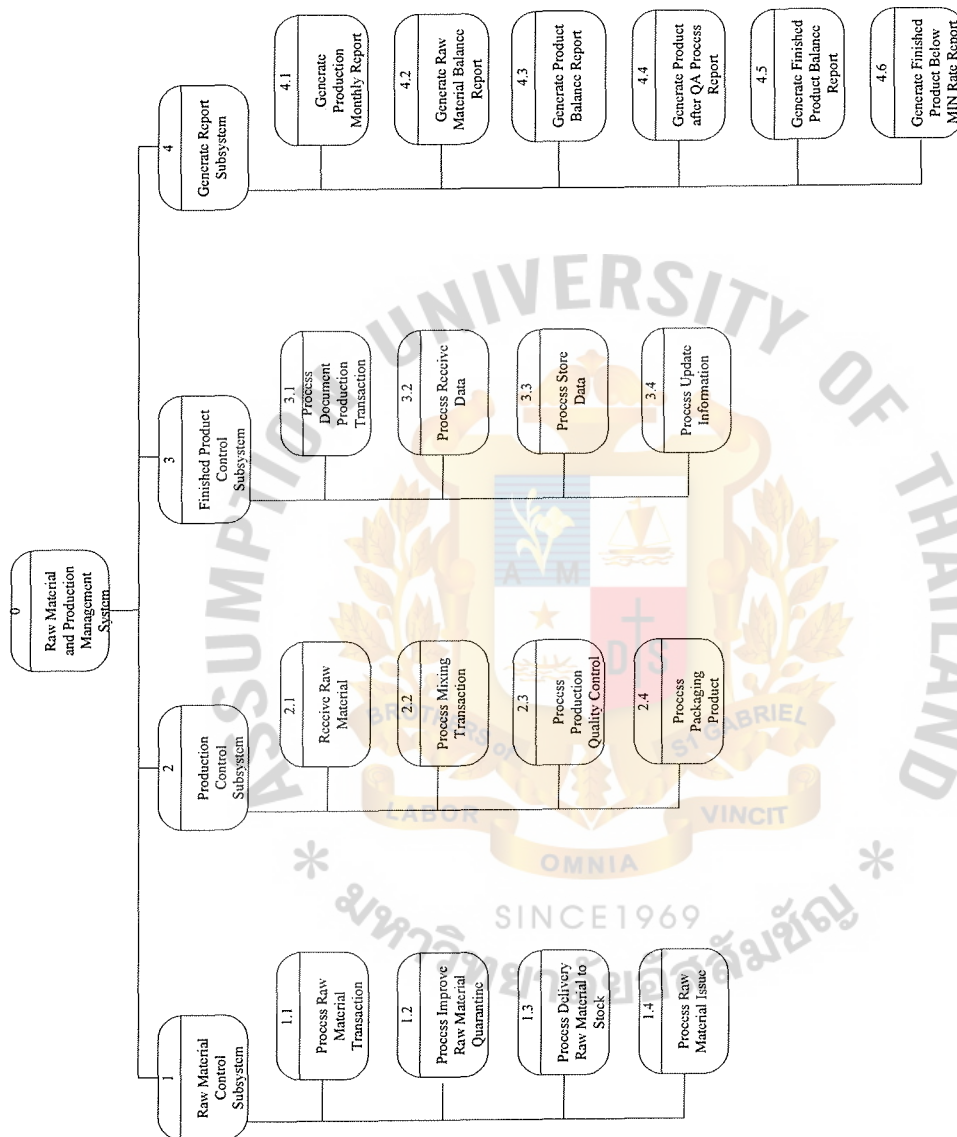
Figure 3.2. Decomposition Diagram of the Proposed System.

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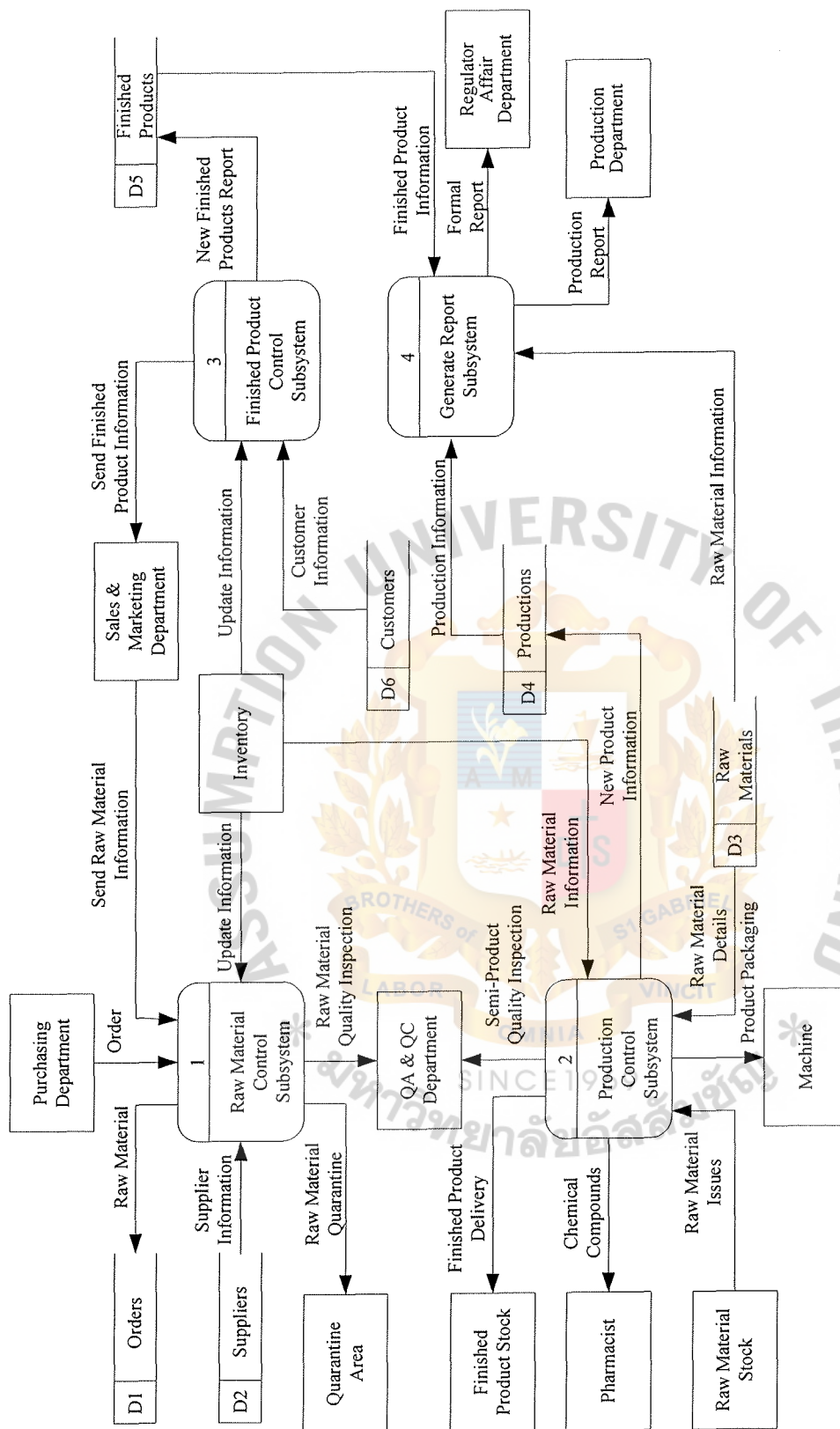
Figure 3.3.   Data Flow Diagram Level-0 of the Proposed System.

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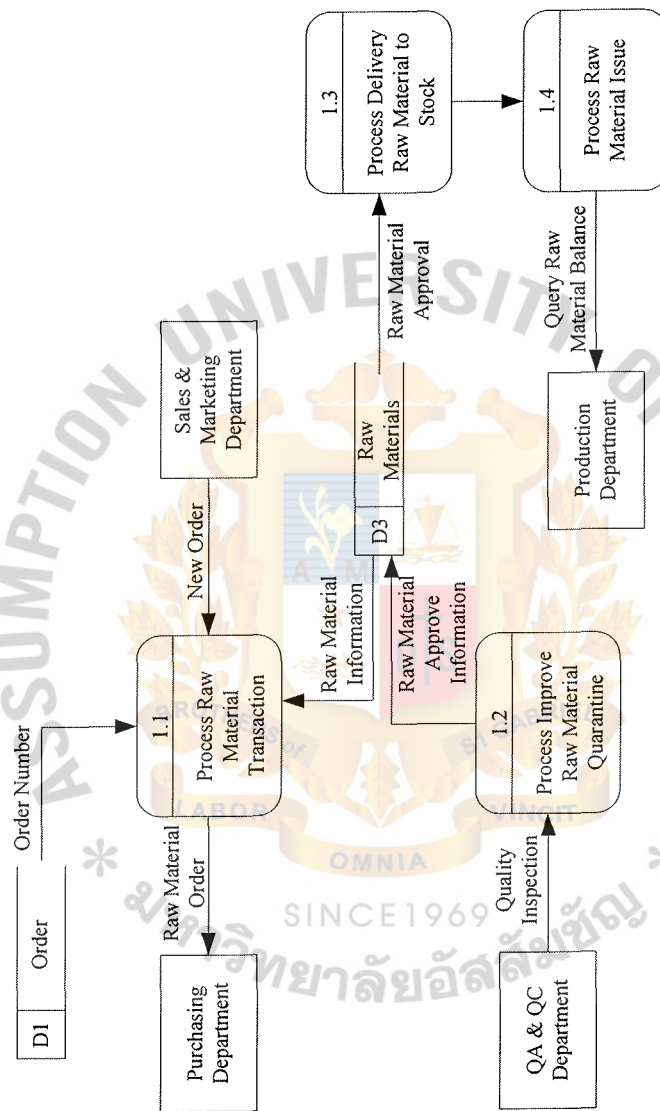
Figure 3.4. Data Flow Diagram Level-1 of Process 1.

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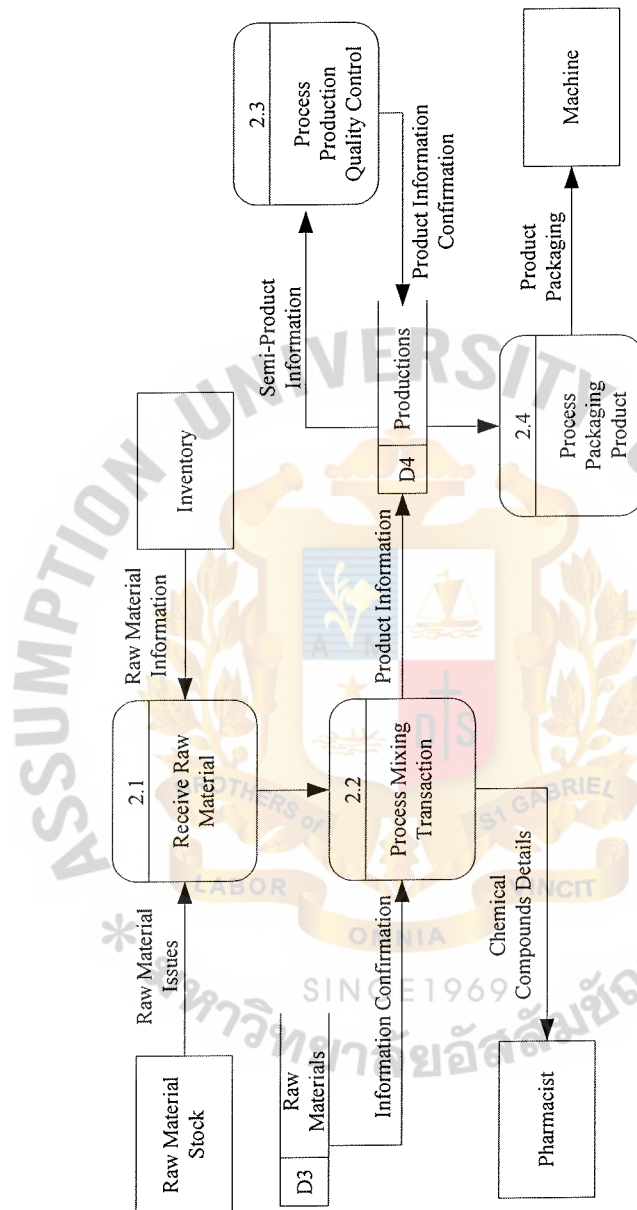
Figure 3.5. Data Flow Diagram Level-1 of Process 2.

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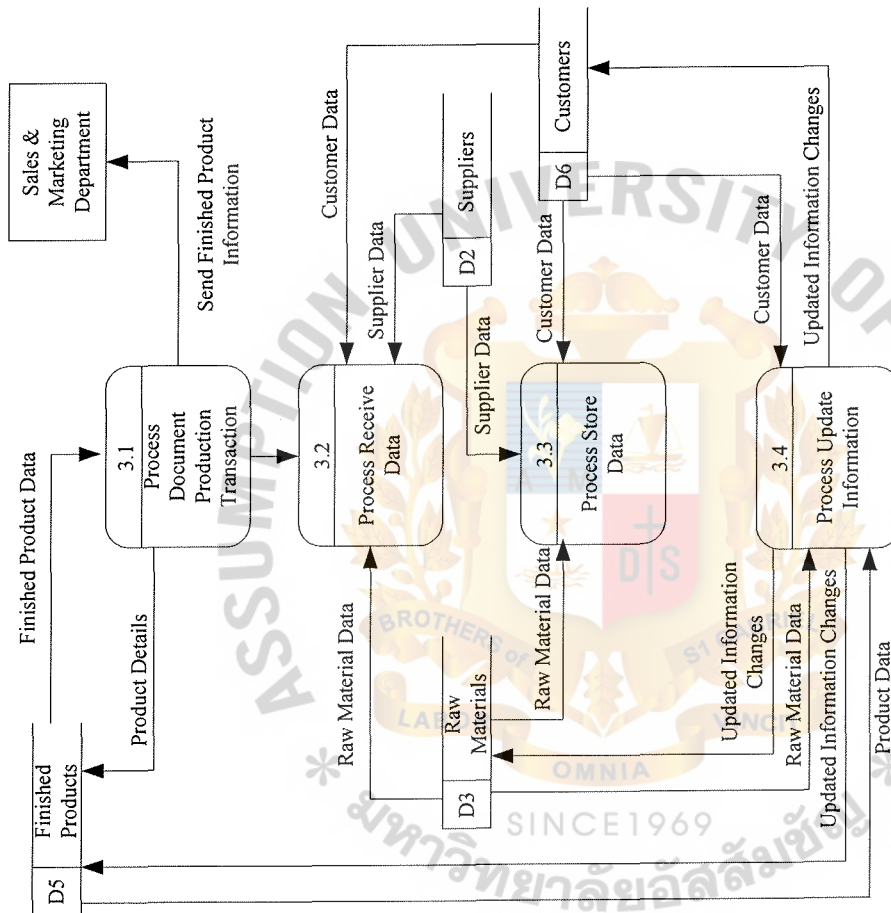
Figure 3.6. Data Flow Diagram Level-1 of Process 3.
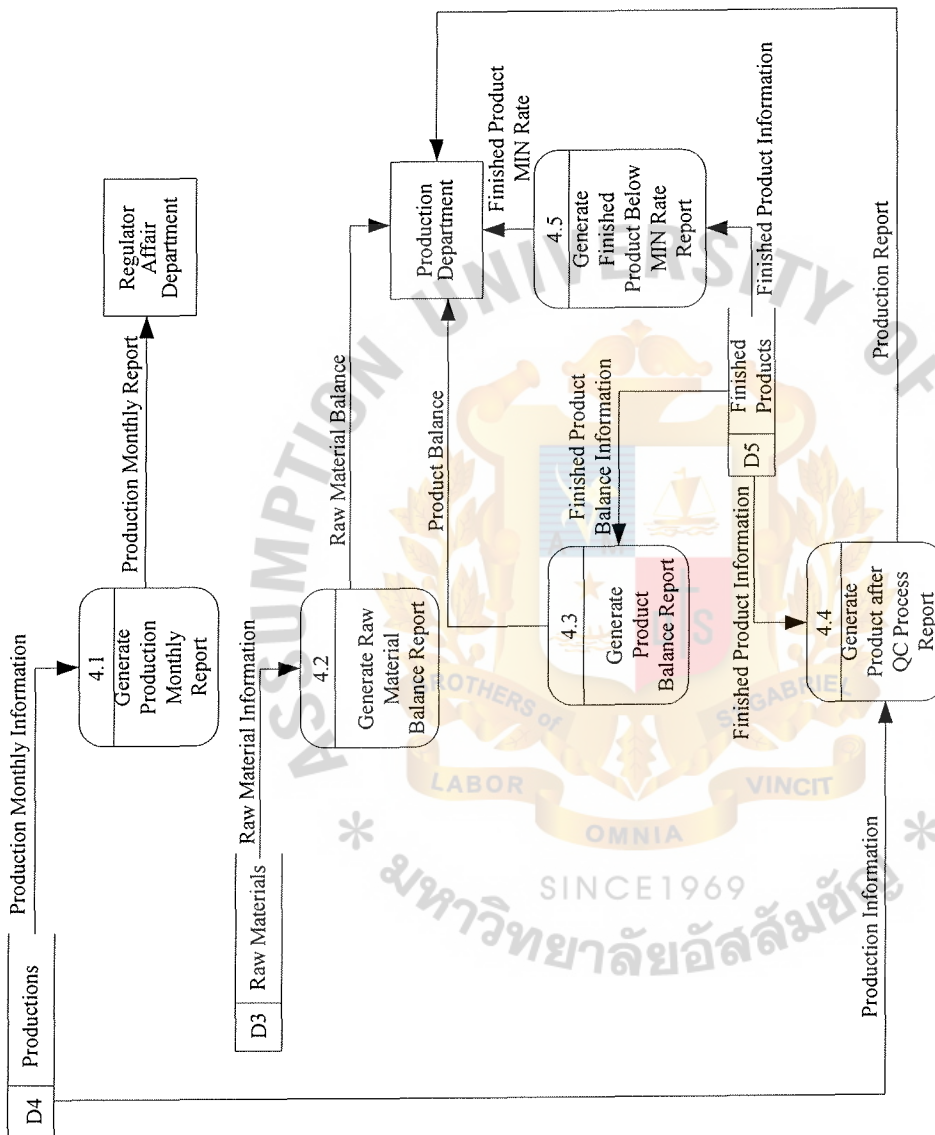
Figure 3.7. Data Flow Diagram Level-1 of Process 4.

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3.2 System Design

3.2.1 Application Architecture

Given the approved system proposal, the business requirement is transformed into design specifications for construction. At this stage, an architecture blueprint is developed to serve as an outline for subsequent internal and external design. This part focuses on that blueprint and current alternatives for application architecture that specifies the technologies to be used to implement the information system in terms of DATA, PROCESS, INTERFACE, and how these components interact and communicate across a NETWORK.

(1) NETWORK Architecture

The two-tiered client/server (Distributed Data) is implemented on a LAN topology network. Server is located at only one site, which uses OS Windows 2000 Server. The OS Windows 2000 Professional is installed for clients.

(2) DATA Architecture

The MS Access 2002 is selected in place of other available distributed RDBMS in the market due to the best capacity size of its database. In addition, there are more transactions for the access each year and more recorded information for each process. So, more capacity of database repository is needed.

(3) PROCESS Architecture

As presented earlier, two-tier client/server architecture is implemented for this project, so the selected application for this network architecture is Microsoft's Visual Basic (Client/Server Edition) which is a client-based programming language with built-in SQL connectivity database engines.

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(4)   INTERFACE Architecture

An on-line or real-time processing alternative is selected for designing the information system interface architecture because fast feedback in response to transactions is needed. Most users in the company are not proficient in using computer. They prefer to work with the system that is friendly. Accordingly, the GUI (Graphic User Interface) technology is adopted so that users will be comfortable with computers.

3.2.2 Database Design

The structures of each table in the database are presented in Appendix E.

3.2.3 Interface Design

The input, output, and dialogue specifications are developed. The interface design for the system and the report design are demonstrated in Appendix A and Appendix B respectively.

3.2.4 Structure Charts

The logical DFDs from the requirement analysis are then transformed into structure charts that illustrate a top-down hierarchy of software modules and are shown in Appendix F.
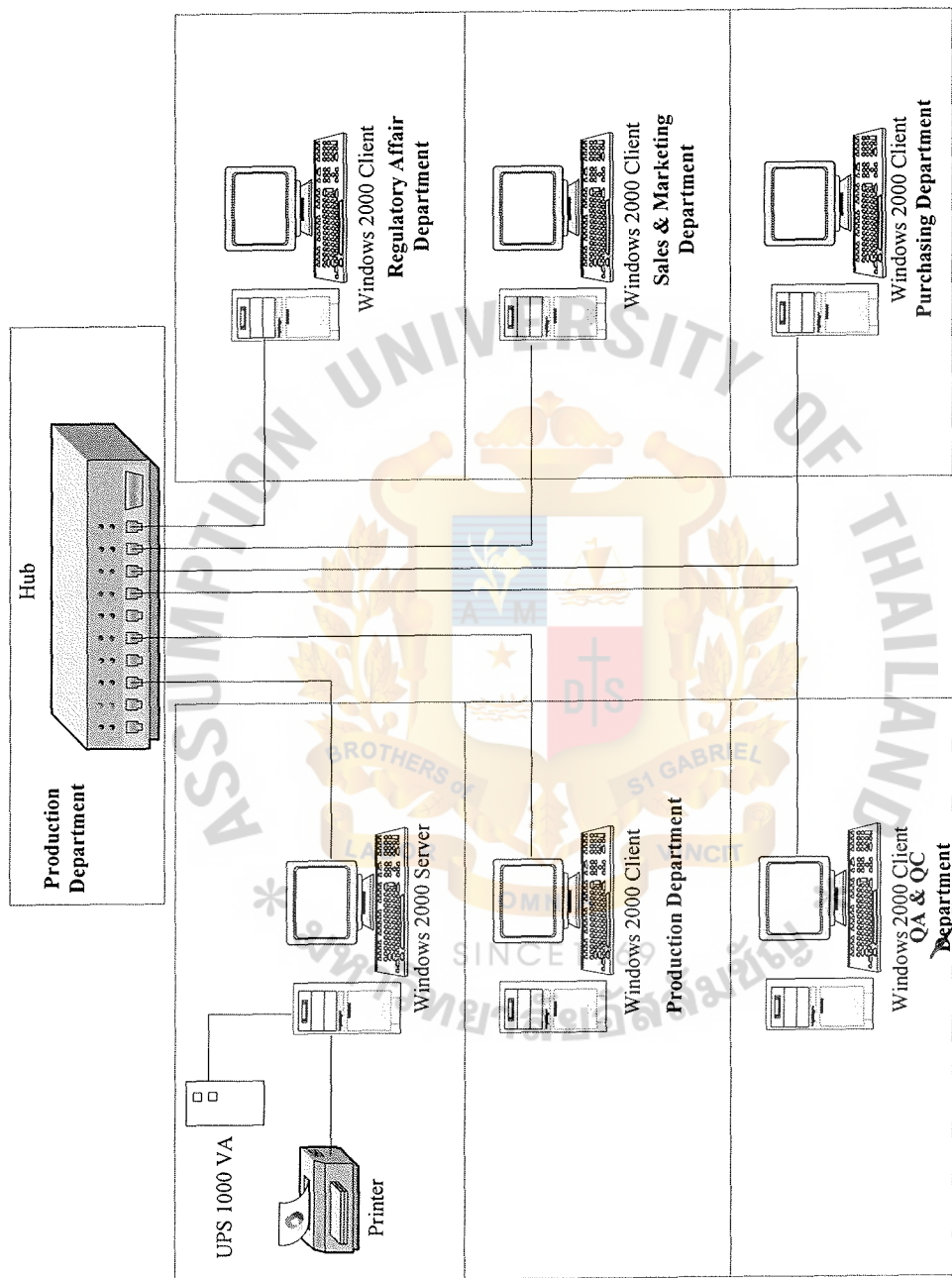
Figure 3.8. Hardware Configuration of the Ban-Ya Pharmaceutical Company.

3.3 Candidate Solutions and Feasibility Analysis

Table 3.1. Candidate Systems Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Portion of System Computerized Brief description of the business benefits that would be computerized for this candidate.	Fully supports user requirements Of Raw Material & Production Management System.	Same as candidate 1	COTS package of Production would be purchased and customized to satisfy Raw Material & Production Management System required functionality.
Benefits Brief description of the business benefits that would be realized for this candidate.	Fully supports user requirements of Raw Material & Production Management	Same as candidate 1	This solution can be implemented quickly because it is a purchase solution
Servers and Workstations A description of the servers and workstations needed to support this candidate.	Technically architecture dictates Pentium IV MS Windows 2000 class server, MS Windows 2000 workstations (Clients)	Technically architecture dictates Pentium III MS Windows 2000 class server, MS Windows 2000 workstations (Clients)	Technically architecture dictates Pentium III, MS Windows NT class servers, MS Windows NT 4.0 workstations (Clients)
Software Tools Needed Software Tools needed to design and build the candidate (e.g., database management system, emulators, operating systems, languages, etc.). Non general packages are to be purchased.	MS Visual Basic 6.0 MS Access MS Visio 2000	Ms Visual Basic 6.0 MS Access MS Visio 2000	COTS

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Table 3.1.   Candidate Systems Matrix (Continued).

Characteristics	Candidate 1	Candidate 2	Candidate 3
Application Software A description of the software to be purchased, built, accessed, or some combination of these techniques	Custom Solution	Same as candidate 1	Package Solution
Method of Data Processing Generally some combination of online, batch, deferred batch, remote batch, and real time.	2 Tiered Client/Server	Same as candidate 1	Same as candidate 2
Out Devices and Implications A description of output devices that would be used, special output requirement (e.g., network, preprinted forms, etc), and output considerations (e.g., constraints)	(4) HP Laser 1000 Laser printers (4) OKI ML380 Dot-matrix printers	Same as candidate 1	Same as candidate 2
Input Devices and Implications A description of input devices for work that use input devices (e.g., key board, mouse, etc). special input requirements.	Keyboard & Mouse	Keyboard & Mouse	Keyboard & Mouse
Storage Devices and Implications Brief description of 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.	MS Access	MS SQL	Same as candidate 1

Table 3.2.   Feasibility Analysts Matrix.

Feasibility Criteria	Weight	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 both user management, user and organization perspective	30%	Fully supports user requirements and current business processes would have to be modified to take advantage of software functionality Score: 100	Same as candidate 1 Score: 100	Partially supports user requirements and current business would have to be modified to take advantage of software functionality Score: 80
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%	MS Visual Basic Demonstration and presentation have agreed the transition will be simple and finding programmers will be easier and more proper to Ban-Ya Pharmaceutical Company Score: 85	Maturity of product is a risk. Required hiring external expertise to perform modification for integration requirements. Score: 70	Same as candidate2 Score: 70

Table 3.2.   Feasibility Analysts Matrix (Continued).

Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3
Economic Feasibility Cost to develop:	30%	Approximately 415,000 Baht	Approximately 550,000 Baht	Approximately 580,000 Baht
Payback period (discounted):		Approximately 1.3 year	Approximately 1.7 year	Approximately 2.1 year
Net present values:		Approximately 1,128,944 Baht	Approximately 1,028,407 Baht	Approximately 233,359 Baht
		Score: 90	Score: 80	Score: 70
Schedule Feasibility An assessment of how long the solution will take to design and implement.	10%	10 months	Same as candidate 1	Less than 3 months.
		Score: 85	Score: 85	Score: 90
Ranking	100%	91	83.5	75

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3.4 Security and Control

Security and control in the proposed system is considered as one of the critical parts that need to be in the system. Access to the program by unauthorized persons can destroy the whole system. Therefore, access should be controlled by username and password for login to the system at each level because personnel data is a very sensitive one.

For this project, three interrelated aspects of security and control that must work together are determined.

(1) Physical Security

Physical security refers to securing the computer facility, its equipment, and software through physical means. Physical controls include:

(a) Data is backed up once a week. There is no large amount of data every week at this moment. However, the frequency of backing up data can be changed according to the amount of data later.

(b) All backup is stored in fireproof and waterproof area.

(c) UPS is adopted to prevent loss of data during power failure.

(2) Logical Security

Logical security refers to logical controls within software itself. The logical controls implemented here are passwords or authorization codes that are used to control accessing to the system and to assign the authority of a person to see the data.

(3) Behavioral Security

The following behavioral controls are set to ensure that users are fully aware of expectations and responsibilities assigned by the organization.

(a)   Monitor behavior at irregular intervals in order to ascertain that proper

procedures are being followed.

(b)   Periodic count and inventory of computer equipment and software.

3.5 Hardware and Software Requirement

The Raw Material and Production Information System for Ban-Ya Pharmaceutical will be designed based on 2-tier architecture, which is composed of thin clients and a fat server. The client computers are used as terminal computers and connected to the server through the network. The server comprises of both application and database in which the main function is to provide requested services from clients. The details of both each client and the server computers are shown as follows.

Table 3.3.   Hardware Specification for the Server.

Hardware	Specification
CPU	Pentium IV 2.53 GHz, or higher
Cache	512 KB or higher
Memory	512 MB or higher
Hard Disk	100 GB or higher
CD-Rom Drive	50X or higher
Floppy Drive	1.44 MB
Network Adapter	Ethernet 10/100-Base T
Display Adapter	SVGA card
Display	15" SVGA monitor
UPS	1000VA
Printer	Laser and Dot-matrix printer

Table 3.4.   Software Specification for the Server.

Software	Specification
Operating System	Microsoft Windows 2000 Advanced Server
Database Server	Microsoft Access 2002

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Table 3.5. Hardware Specification for Each Client Machine.

Hardware	Specification
CPU	Celeron II 1.2 GHz, or higher
Cache	256 KB or higher
Memory	256 MB or higher
Hard Disk	40 GB or higher
CD-Rom Drive	50X or higher
Floppy Drive	1.44 MB
Network Adapter	Fast Ethernet
Display Adapter	SVGA card
Display	15" SVGA monitor

Table 3.6. Software Specification for Each Client Machine.

Software	Specification
Operating System	Microsoft Windows 2000 Professional
Application Software	Microsoft Office 2000

3.6 Cost and Benefit Analysis

3.6.1 System Costs

(1) Costs of Manual System

Table 3.7. Manual System Cost Analysis, in Baht.

Cost items		Years				
		1	2	3	4	5
Fixed Cost						
Typewriter	2 units @ 8,500	17,000.00	–	–	–	–
Calculator	10 units @ 2,150	21,500.00	–	–	–	–
Total Fixed Cost		38,500.00	–	–	–	–
Operating Cost						
Salary Cost:						
Personal Manager 1 person @ 12,000		12,000.00	13,500.00	16,000.00	19,000.00	22,500.00
Staff:						
Personal Officer	2 persons @ 8,000	16,000.00	20,000.00	24,245.00	27,469.00	28,863.70
Key Operator	3 persons @ 5,500	16,500.00	16,950.00	17,250.00	18,450.00	21,647.70
Total Monthly Salary Cost		44,500.00	50,450.00	57,495.00	64,919.50	73,011.40
Total Annual Salary Cost		534,000.00	605,400.00	689,940.00	779,034.00	876,137.00
Office Supplies & Miscellaneous Cost:						
Paper	Per Annual	90,000.00	118,000.00	130,000.00	150,000.00	165,000.00
Stationary	Per Annual	12,000.00	12,000.00	16,500.00	20,500.00	25,000.00
Utility	Per Annual	60,000.00	60,000.00	60,000.00	60,500.00	60,050.00
Miscellaneous	Per Annual	50,000.00	55,900.00	73,000.00	97,000.00	99,000.00
Total Annual Office Supplies & Miscellaneous Cost		212,000.00	245,900.00	279,500.00	328,000.00	349,050.00
Total Annual Operating Cost		746,000.00	851,300.00	969,440.00	1,107,034.00	1,225,187.00
Total Manual System Cost		784,500.00	851,300.00	969,440.00	1,107,034.00	1,225,187.00

Table 3.8. Five Years Accumulated Manual System Cost, in Baht.

Year	Total Manual Cost	Accumulated Cost
1	784,500.00	784,500.00
2	851,300.00	1,635,800.00
3	969,440.00	2,605,240.00
4	1,107,034.00	3,712,274.00
5	1,225,187.00	4,937,461.00
Total	4,937,461.00	–

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(2) Costs of Computerized System

Table 3.9. Computerized System Cost Analysis, in Baht.

Cost items	Years				
	1	2	3	4	5
Fixed Cost					
Hardware Cost:					
Computer Server Cost	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
Workstation Cost	89000.00	89,000.00	89,000.00	89,000.00	89,000.00
Printer	8,200.00	8,200.00	8,200.00	8,200.00	8,200.00
UPS	2,450.00	2,450.00	2,450.00	2,450.00	2,450.00
Other equipment	4,750.00	4,750.00	4,750.00	4,750.00	4,750.00
Total Hardware Cost	154,400.00	154,400.00	154,400.00	154,400.00	154,400.00
Maintenance Cost:					
Maintenance Cost	–	–	–	33,894.00	33,894.00
Total Maintenance Cost	–	–	–	33,894.00	33,894.00
Software Cost:					
Software Cost	47,400.00	47,400.00	47,400.00	47,400.00	47,400.00
Network Cost	45,000.00	45,000.00	45,000.00	45,000.00	45,000.00
Total Software Cost	92,400.00	92,400.00	92,400.00	92,400.00	92,400.00
Implementation Cost:					
Training Cost	80,000.00	–	–		–
Set up Cost	75,000.00	–	–		–
Total Implementation Cost	155,000.00	–	–		–
Office Equipment Cost:					
Calculator 5 Units @ 2,640	13,200.00	–	–		–
Total Office Equipment Cost	168,200.00	–	–		–
Total Fixed Cost	415,000.00	246,800.00	246,800.00	280,694.00	280,694.00
Operating Cost					
People-Ware Cost:					
Personal Manager 1 person @ 15,000	15,000.00	16,500.00	18,000.00	19,000.00	23,000.00
Staff:					
Key Operator 1 person @ 12,500	12,500.00	14,500.00	15,500.00	17,250.00	18,890.00
Total Monthly Salary Cost	27,500.00	31,000.00	33,500.00	36,250.00	41,890.00
Total Annual Salary Cost	330,000.00	372,000.00	402,000.00	435,000.00	502,680.00
Office Supplies & Miscellaneous Cost:					
Stationary	11,000.00	10,500.00	8,000.00	7,500.00	8,109.00
Paper	51,000.00	50,500.00	48,040.00	46,000.00	36,500.00
Utility	66,000.00	66,000.00	64,000.00	67,000.00	69,500.00
Miscellaneous	48,000.00	47,900.00	39,000.00	38,500.00	36,000.00
Annual Office Supplies & Miscellaneous Cost	176,000.00	174,900.00	159,040.00	159,000.00	150,109.00
Total Operating Cost	403,800.00	546,900.00	561,040.00	594,000.00	652,789.00
Total Computerized System Cost	818,800.00	793,700.00	807,840.00	874,694.00	933,483.00

Table 3.10.   Five Years Accumulated Computerized Cost, in Baht.

Year	Total Computerized Cost	Accumulated Cost
1	818,800.00	818,800.00
2	793,700.00	1,612,500.00
3	807,840.00	2,420,340.00
4	874,694.00	3,295,034.00
5	933,483.00	4,228,517.00
Total	4,228,517.00	–

(3)   The Comparison of the System Costs between Computerized System and Manual System

Table 3.11.   Comparison of the System Costs, in Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	784,500.00	818,800.00
2	1,635,800.00	1,612,500.00
3	2,605,240.00	2,420,340.00
4	3,712,274.00	3,295,034.00
5	4,937,461.00	4,228,517.00

3.6.2 System Costs

(1)   Payback Analysis for Computerized System

As shown in Table 3.12, it will take approximately 1.3 years to pay back for the initial investment for candidate 1, approximately 1.7 years for candidate 2, and approximately 2.1 years for candidate 3, assuming that the payback period guideline states that all investment must have a payback period less than or equal to 5 years. As a result both candidates 1 and 2 are worth investing. Besides, the net present values of both candidates are determined. Candidate 1 yields a net present value of 1,128,944 and 1,028,407 for candidate 2. When we compare candidate 1 with candidate 2, candidate 1 identifies greater positive net present value. This shows that the candidate 1 is the best investment. If we invest 415,000 at 12 percent for five years, we will earn the same profit that we would make by implementing this information system solution.
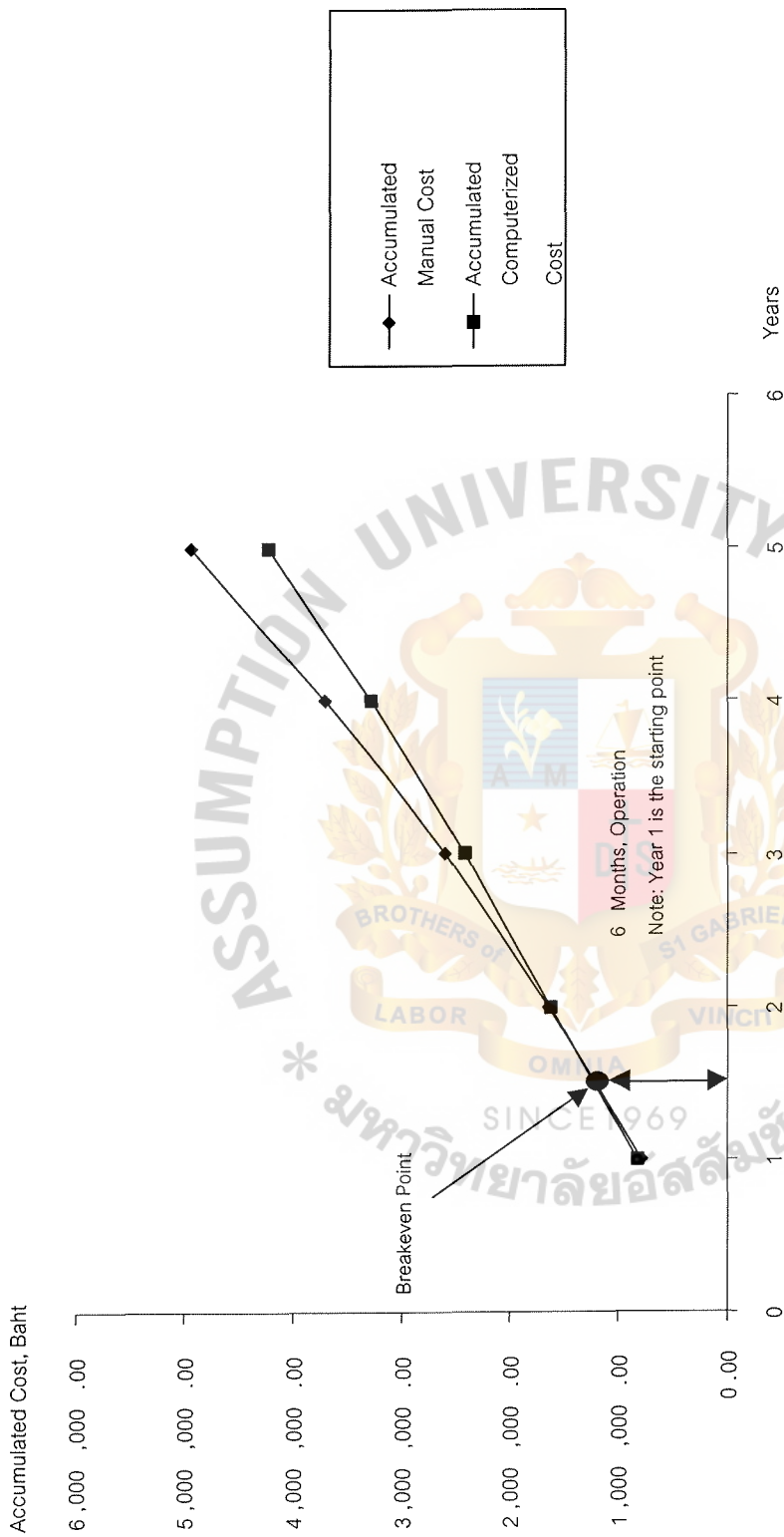
Figure 3.9. Cost Comparison between Manual and Computerized System.

Accumulated Cost, Baht

6,000,000.00

5,000,000.00

4,000,000.00

3,000,000.00

2,000,000.00

1,000,000.00

0.00

Accumulated
Manual Cost

Accumulated
Computerized
Cost

Breakeven Point

6 Months, Operation

Note: Year 1 is the starting point

Years

0 1 2 3 4 5 6

Table 3.12. Payback Analysis for Candidate Solution 1, in Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	-415,000					
Operations & maintenance cost:		-43,600	-47,960	-52,756	-58,032	-63,835
Discount factors for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs (adjusted to present value):	-415,000	-38,935	-38,224	-37,562	-36,908	-36,194
Cumulative time-adjusted costs over lifetime:	-415,000	-453,935	-492,159	-529,721	-566,629	-602,824
Benefit derived from operation of new system:	0	402,000	442,200	486,420	535,062	588,568
Discount factors for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits (current of present value):	0	358,986	352,433	346,331	340,299	333,718
Cumulative time-adjusted benefits over lifetime:	0	358,986	711,419	1,057,750	1,398,050	1,731,768
Cumulative lifetime Time adjusted costs +benefits:	-415,000	-94,949	219,260	528,029	831,421	1,128,944
The Payback Period is approximately 1.3 years						

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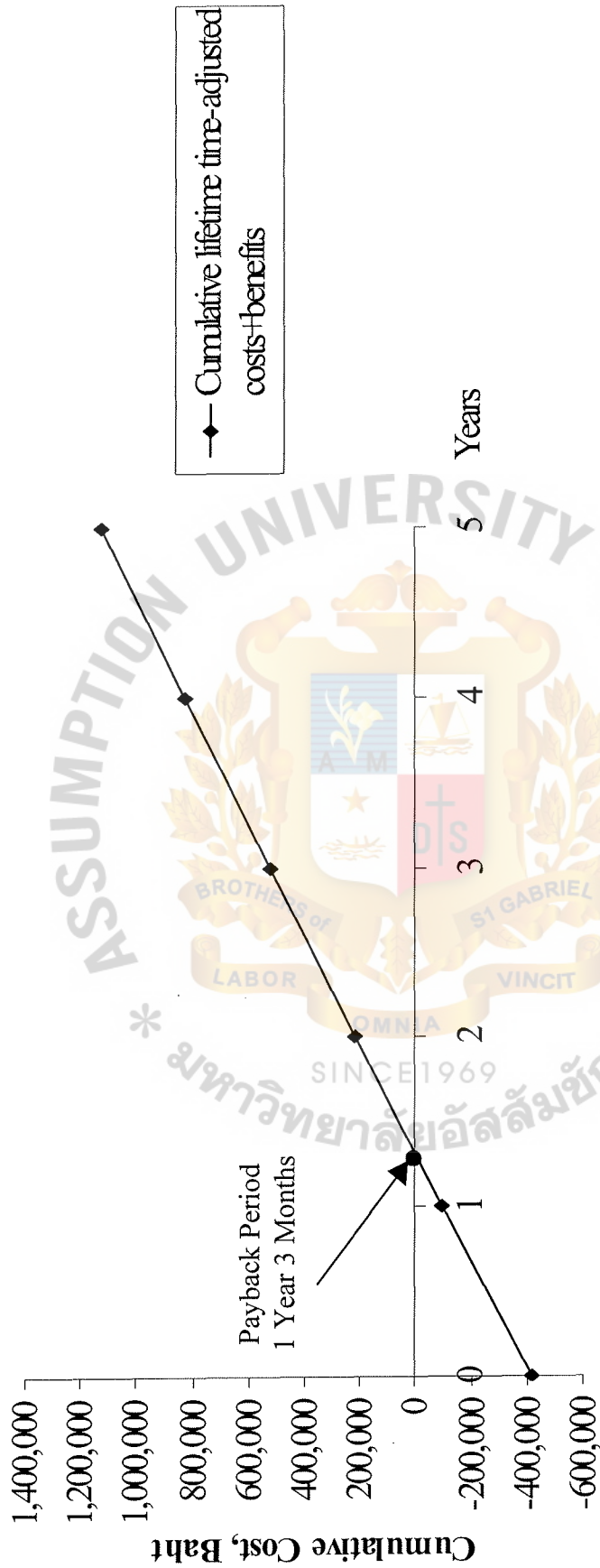
Payback Analysis

Figure 3.10. Payback Analysis Graph for Candidate Solution 1.

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Table 3.13.   Payback Analysis for Candidate Solution 2, in Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	-550,000					
Operations & maintenance cost:		-43,600	-47,960	-52,756	-58,032	-63,835
Discount factors for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs (adjusted to present value):	-550,000	-38,935	-38,224	-37,562	-36,908	-36,194
Cumulative time-adjusted costs over lifetime:	-550,000	-588,935	-627,159	-664,721	-701,629	-737,824
Benefit derived from operation of new system:	0	410,000	451,000	496,100	545,710	600,281
Discount factors for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits (current of present value):	0	366,130	359,447	353,223	347,072	340,359
Cumulative time-adjusted benefits over lifetime:	0	366,130	725,577	1,078,800	1,425,872	1,766,231
Cumulative lifetime Time adjusted costs +benefits:	-550,000	-222,805	98,418	414,079	724,242	1,028,407
The Payback Period is approximately 1.7 years						

Payback Analysis
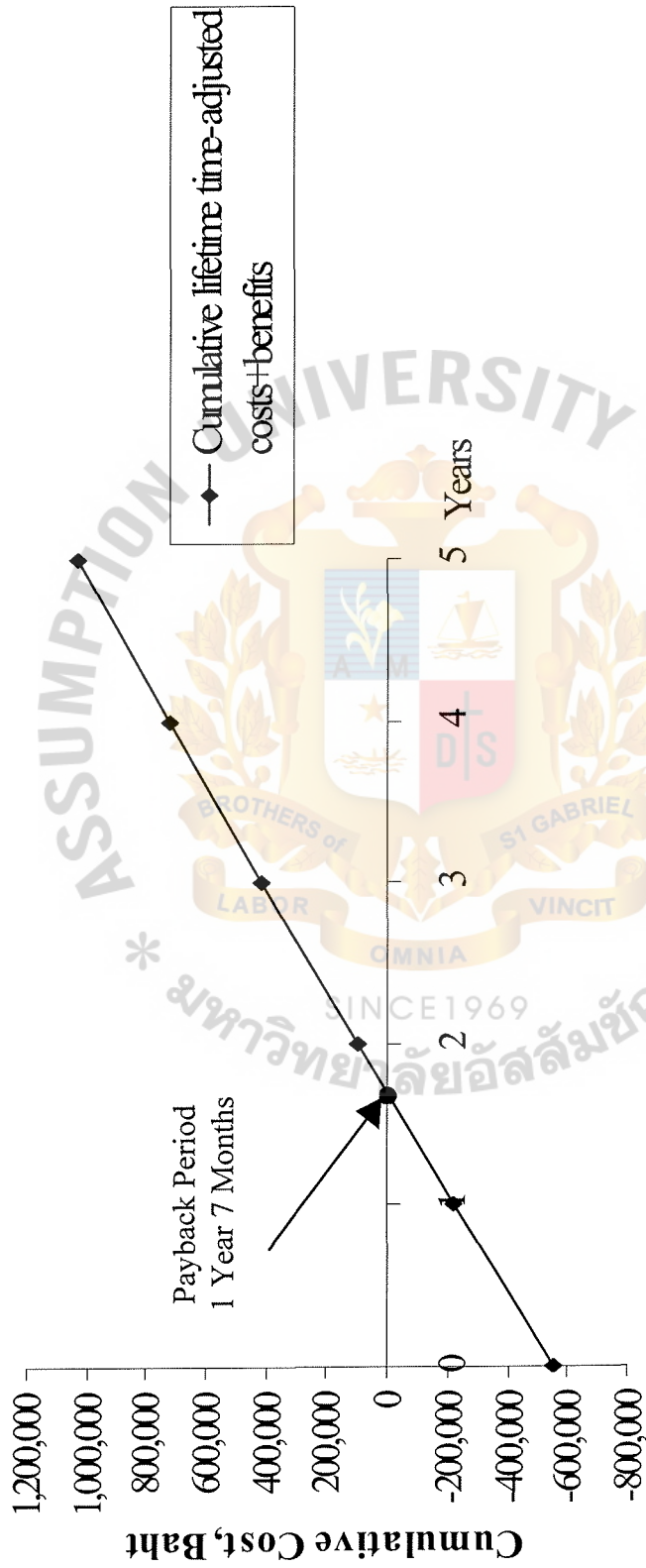
Figure 3.11. Payback Analysis Graph for Candidate Solution 2.

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Table 3.14. Payback Analysis for Candidate Solution 3, in Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	-580,000					
Operations & maintenance cost:		-43,600	-47,960	-52,756	-58,032	-63,835
Discount factors for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs (adjusted to present value):	-580,000	-38,935	-38,224	-37,562	-36,908	-36,194
Cumulative time-adjusted costs over lifetime:	-580,000	-618,935	-657,159	-694,721	-731,629	-767,823
Benefit derived from operation of new system:	0	350,000	385,000	423,500	465,850	512,435
Discount factors for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits (current of present value):	0	312,550	306,845	301,532	296,281	290,551
Cumulative time-adjusted benefits over lifetime:	0	312,550	619,395	920,927	1,217,208	1,507,759
Cumulative lifetime Time adjusted costs +benefits:	-580,000	-306,385	-37,764	226,206	485,579	739,936
The Payback Period is approximately 2.1 years						

Payback Analysis
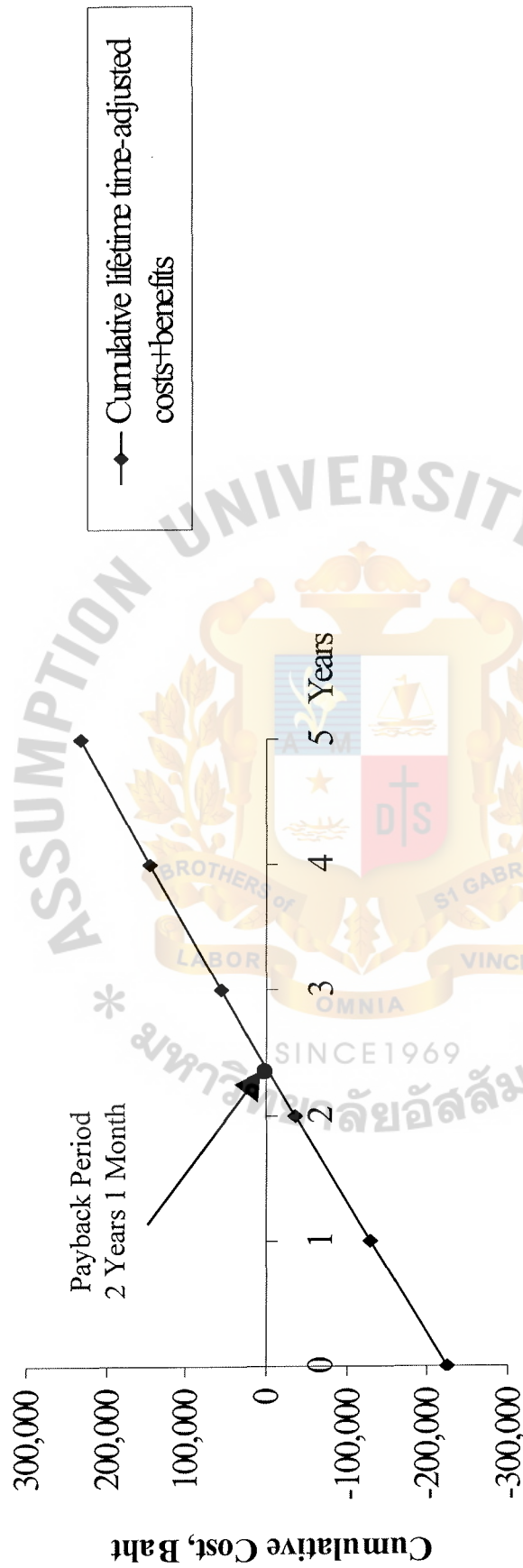
Figure 3.12. Payback Analysis Graph for Candidate Solution 3.

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

A smooth transition from the old system to the new system is performed in system implementation. System implementation is the construction of the new system and includes all the activities that are related to preparing the system for end users. The following activities are carried out in the typical process of the system implementation phase.

(1) Software acquisition, development and installation

(2) Hardware acquisition and installation

(3) Personnel training

(4) Site preparation

(5) Data preparation

(6) Testing

(7) Conversion

(8) Documentation

Successful system implementing can ensure that the proposed system is operational and normal start-up problems are totally and completely solved before it is replaced in operation later.

(1) Software Acquisition, Development and Installation

For this project, the proposed system solution is developed by hiring a software company. So, once the network has been built, the new software is installed on the network server. Participation from the software vendor is required for installation and testing process.

(2)   Hardware Acquisition and Installation

The existing system is manually processed, so new hardware components are required. The hardware vendor installs those new hardware components including operating system, application software, and other office automation software.

(3)   Personnel Training

Group training is implemented for this project. All people who have secondary or primary use of the system will be trained. This includes everyone from data-entry personnel to those who use output to make decisions without personally using a computer. Due to the content of the operation that is focused on management tasks, users in the management level are separated so that they will not be bored with so much basic details. So, trainees are separated into operation group and management group. The training objectives for each group must be spelled out clearly so that trainees clearly know what is expected from them. The objectives for operation group training is to train trainees so that they will know such basics as turning on the machine, what to do when common errors occur, basic troubleshooting, and how to end an entry. For management group training, the management level users are expected to know the overall operations, what output they will see, how to interpret it, when it is scheduled to arrive, and what to do when critical errors occur.

(4)   Site Preparation

Computer site operation comes before the installation of the new system. This phase, site preparation involves installation of electrical and

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network equipment. Electrical installation includes electrical wiring and replacement of outlets if they are not already in place.

(5)   Data Preparation

Since the new system will be computerized, traditional files are needed to prepare for transferring to the system as a database. Clerks as key-in operators are required to input those data in the database as well. Conversion of the traditional file to the database needs careful preparation because data fields in the database need the right input format.

(6)   Testing

At this stage, real data will be obtained and ensure that different tests have been successfully performed, such as "stub testing" (done on individual modules, subroutines or subprograms), unit testing (modules are tested as an integrated unit) and system unit (ensure that all isolated integrated units are properly working put in the whole system).

(7)   Conversion

For preparing the conversion plan, one strategy, called parallel conversion, is used. It means that both the old and new systems are operated for some period of time. This is done to ensure that all major problems in the new system have been solved before the old system is discarded. The final cutoffs may be gradual so that the old system is terminated. The new system is placed into operation because major errors have been fixed at the beginning.

(8)   Documentation

Detailed documentation showing how the system works from both a technical and end-user standpoint is finalized during conversion time for use

in training and everyday operations. Training materials include manuals, prototypes and mock-ups of output and training cases in which users are assigned to work through a case that incorporates most of the commonly encountered interactions with the system. These documents are clearly written so that user can easily understand the system.

4.2 Test Plan

Test plan is very important for the development of the proposed system because it can be used to discover hidden failure, bug, error and any needed requirement that cannot be discovered at the design stage.

The following are required steps for the test plan.

(1)   Test program logic plan

In this step, the programmer will check all program functions to see any error or bug in any function of the program. The programmer will test the program in three levels.

(a)   Test individual object in the program to see how well they perform their functions.

(b)   Test each page of program to see whether pages have any error or not and how well each object in program pages works with each other.

(c)   System testing this level will ensure that the system program is working properly when integrated with hardware and other system software.

(2)   Test program with sample data and invalid data plan

This step will test the program by simply inputting sample data to see how the program will process them. Programmers and users will look at the output of the program and compare it with the prepared correct results.

This step will test the correctness of data processing in the system.

(a)   Test with individual object

This test level will discover how each object in the system process of a sample data is.

(b)   Test with individual page

This test level will discover how all objects in each program page process a sample data and to see a new requirement for the user. System development team can use this requirement in order to improve this program and also see how each object in each page is linked together in data processing process.

(c)   Link testing within a system

This testing is implemented to ensure that each object link works properly and see how each individual page in the system is interdependently linked as needed or not. All sample data will input into the system to ensure there is no problem and also tested by entering invalid data to see whether the program can detect it or not.

(3)   System testing plan

All users and programmers will test the proposed system by opening full system operation. In full operation, both hardware and software will be tested with a sample data to see how the proposed system works and to ensure that no error or malfunction occurs in the system. Also checking all required output is needed to see correctness and test all mistakes that may occur in the system to see whether the error detection procedure can detect it or not and how the system will detect and correct it.

Testing an operation procedure is required for users in the system to ensure that all users are clear and familiar with the procedure.

(4) Backup and recovery testing plan

This testing is an important testing for the proposed system. Users must test backup procedure for the system to see any difficulty that may occur in the system and to test some errors that can occur during backup process such as power failure, program error and data error.

(5) Concurrent testing plan

Before replacing the existing system with the new proposed system, it is required that both the existing system and the proposed system are run concurrently for one month to see any effects of the proposed system on the ABAC Supermarket and ensure that the proposed system can truly replace the existing system. This testing also can discover more users' needs in a real working environment and if an error occurs, the development team can continue to correct it to ensure smoothness of operation.

4.3 Conversion

When the system test has been totally completed, the new system is ready to run in operation. However, a conversion plan is needed to provide a smooth transition from the old system to the new system.

The steps to be followed are:

(1) Collect and review the design specification of the new system to identify database installation and needs of user training.

(2) Build a schedule for database installation.

(3) Identify a training program and schedule for system users.

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(4) Develop a detailed installation strategy to follow the conversion from the existing system to the new system.

Parallel conversion is chosen in this project because it affects the system less. Both the old and the new system are operated together for the beginning period. This is done to ensure that all major problems in the new system have been resolved before the old system is discarded. This strategy minimizes the risk of major flows in the new system-causing harm to the ABAC Supermarket.

(5) Make a final test for the new system called "system acceptance test". It uses real data over an extended time period. In this project, beta testing or validation is suitable for this ABAC Supermarket system.

Validation testing is a test that runs the system in a live environment using real data and follows the five steps below.

(a) System performance

The throughput and response time for processes have to meet a normal processing workload.

(b) Peak workload processing performance

The new system has to handle the workload. If not, the hardware and software have to be improved to increase efficiency.

(c) Human engineering test

The new system has to be easy to learn for staff.

(d) Method and procedure test

The methods and procedures have to be modified if they prove to be inefficient and awkward from the users' point of view.

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(e)   Backup and recovery testing

Loss of data is made to test recovery in case of disaster. The time and data is checked to ensure that they work very well.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The manual system that requires many people to handle many transactions of inventory tasks has become computerized Raw Material and Production Information System that needs just only a small group of people to handle the whole system. This project is designed under the concept of utilizing the computer system to increase the company's performance, benefit, reduce human errors and achieve customers' satisfaction.

The existing system had caused difficulties in managing the raw material and production inventory system, using stock card to keep records of all transactions of the input and output of the products, and many mistakes from human error. From the existing system, all information is updated monthly in the form of an official report so that management has to wait until the end of the month in order to get the completed report for their decision making.

Nowadays, most companies are aware of the advantages of the computer hardware and have already invested in that hardware. However, how they can utilize the computer efficiently is a matter for consideration. The software that is developed can help the company to utilize the hardware more efficiently.

The proposed computerized procedure and database system will help production process operation instead of the manual system. It also provides several benefits such as saving time and expenses. It provides timely information, and it increases the effectiveness and efficiency in production process. It provides up-to-date information and it is accurate in all the information that is stored or changed in the database.

Regarding the table of achievement Table 5.1 shows the performance in terms of processing time on some processes of the proposed system in comparison with the

existing system. As we can see, the proposed system provides faster response than the existing system.

Table 5.1.   Degree of Achievement of the Proposed System.

Process	Existing System	Proposed System
1.Raw Material Checking	30 minutes	5 minutes
2.Mixing and Verifying	20 minutes	3 minute
3.Raw Material Quality Control Checking	30 minutes	5 minutes
4. Finished Product Quality Control Checking	20 minutes	2 minutes
5.Updating Information	1 hour	20 minutes
6.Generate Report to Ministry of Publish Health	1 hour	1 minute

By considering the table of achievement, it shows those relevant processes of the existing system need approximately 4 hours to do all processes. On the other hand, the proposed system needs only 36 minutes to finish those processes. Therefore, it is obvious that the proposed system can help the workgroup work more efficiently by reducing time and it will increase revenue to the company.

5.2   Recommendations

The system could improve the design of this information system by including the employee's commission inventory control process to control sale and marketing revenue. This will facilitate the cooperation between the sales department and the production department so that sales staff can know how many customers each employee gets by automatic calculation system. However, this project considers much only about Raw Material and Production Information System that was designed to serve the immediate needs of management. So, for future development, a fully computerized

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system should be established not only for this system but also for all systems in the organization. Each system can be developed individually and integrated as soon as possible by connecting through Local Area Network (LANs). Information as well as other resources can be sent immediately in a few minutes without mistakes and on time.

APPENDIX   A

USER INTERFACE DESIGN

Figure A.1. Log In Screen.

Figure A.2. Main Menu Screen.

Figure A.3. Sub Menu 1 Screen.

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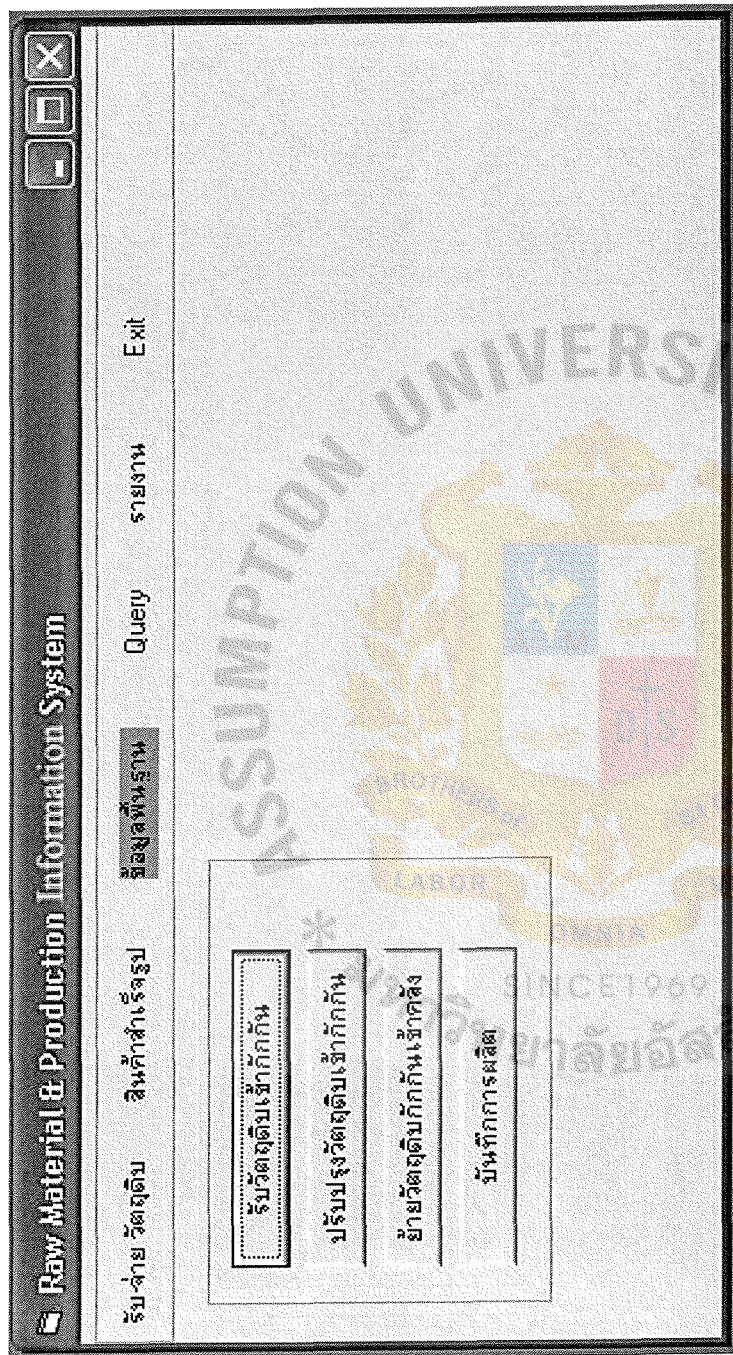
Figure A.4. Sub Menu 2 Screen.

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Figure A.5.   Raw Material In-Put Screen.

Figure A.6. Improve Raw Material Quarantine Screen.

Figure A.7. Raw Material Issue Screen.

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Figure A.8. Production In-Put Screen.

Figure A.9. Customer Order Record Screen.

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Figure A.10. Purchase Order Record Screen.
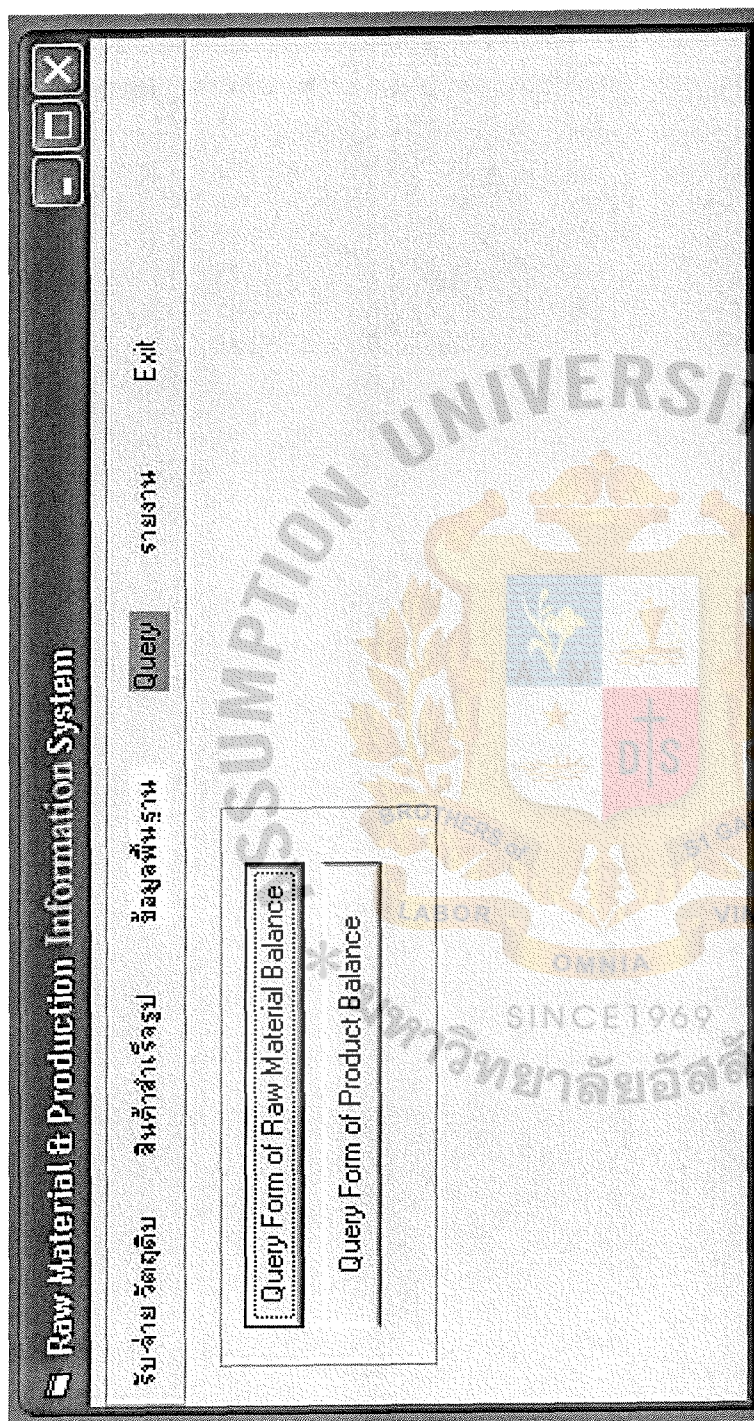
Figure A.11. Query Menu Screen.
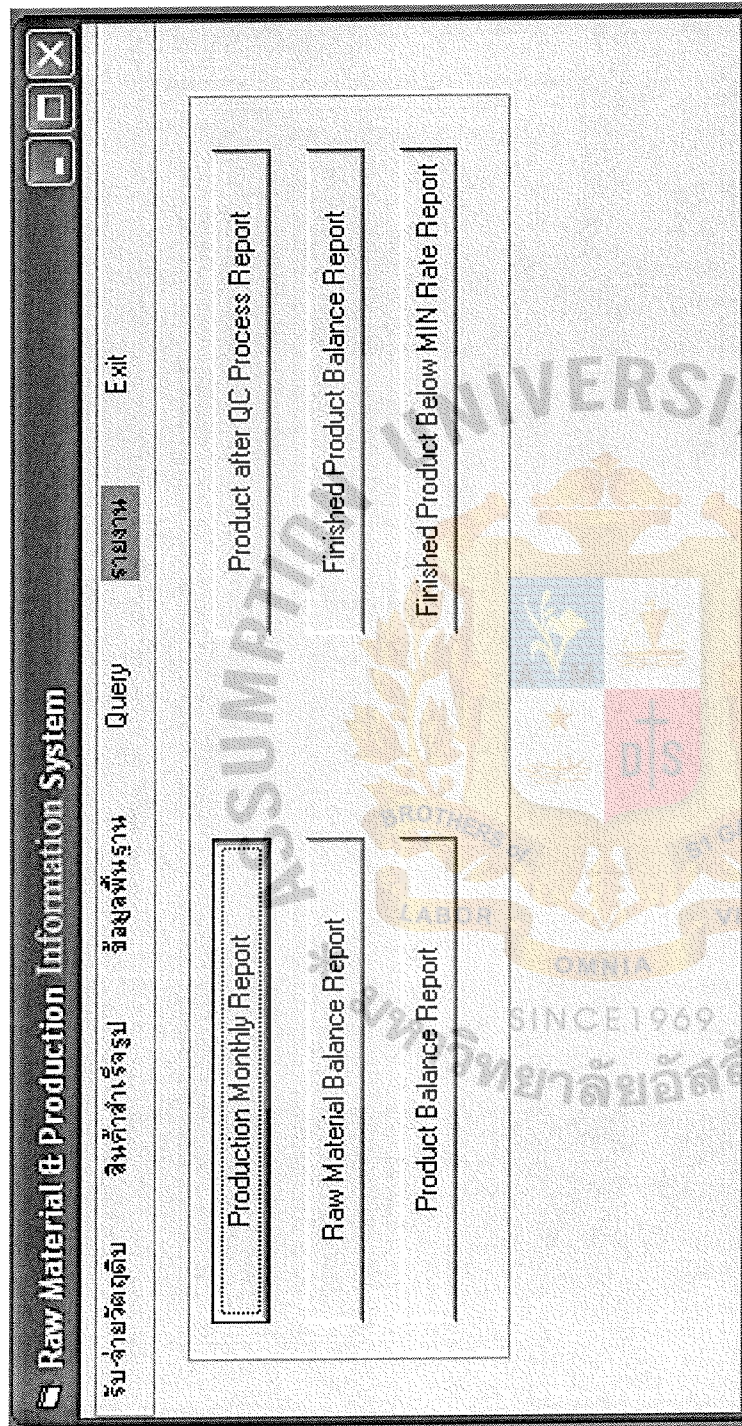
Figure A.12. Generate Formal Report Screen.

66
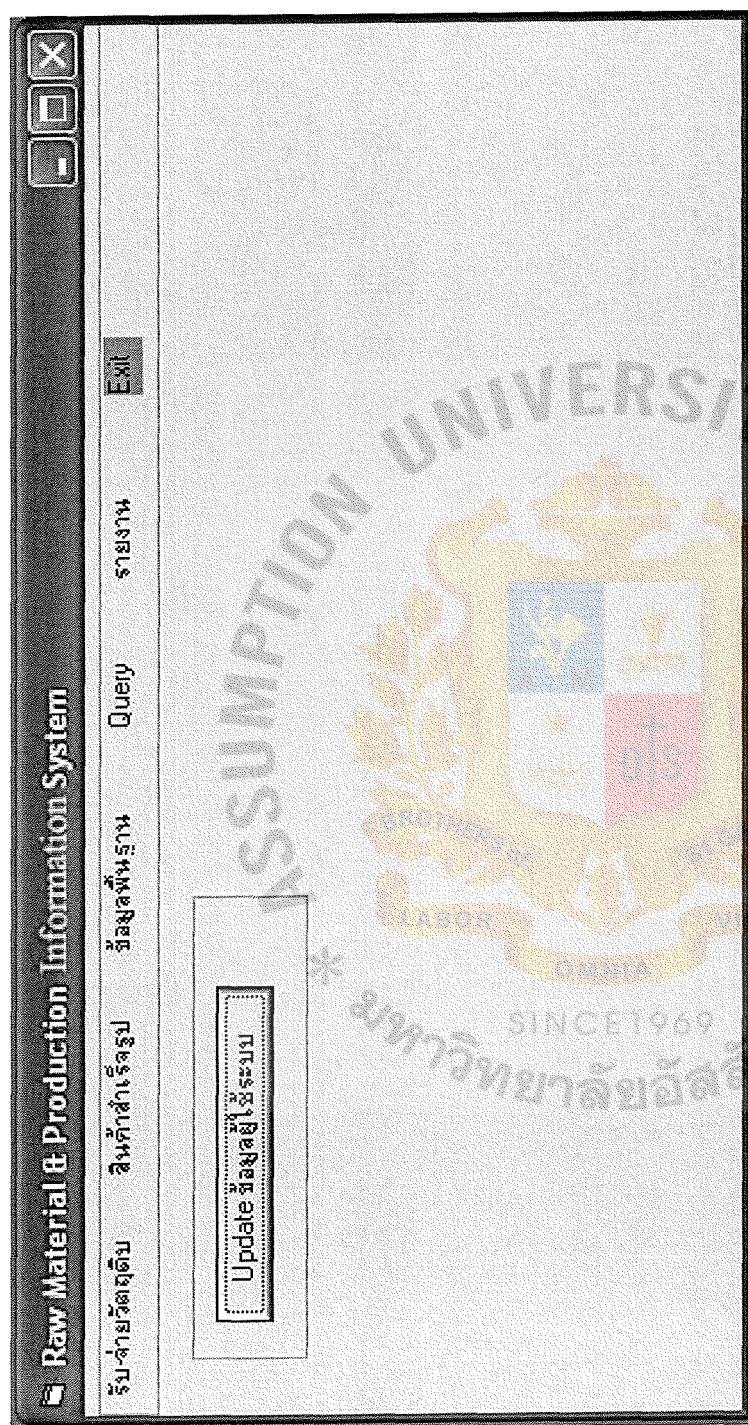
Figure A.13. Menu Exit Screen.

Figure A.14. User In-Put Screen.

APPENDIX   B

REPORT DESIGN

Table B.1.   Raw Material Balance Report.

Raw Material ID	Raw Material Name	Balance
M0123	TALCUM POWDER	99.000 Kg.
M2354	AVICEL POWDER	49.000 Kg.
M1024	CORN STARCH	122.000 Kg.
M1156	METHYLSALICYLATE	140.000 Kg.
M4354	LIGHT MINERAL OIL	550.000 Kg.
M3325	SODIUM LAURYL SULFATE	20.000 Kg.
M6785	HEAVY MINERAL OIL	160.000 Kg.
M5927	PARACETAMOL	600.000 Kg.

Table B.2. Semi-Product Balance Report.

Semi-Product ID	Semi-Product Name	Balance
P9523	COLD CREAM 30 G	1000.000 TABLET
P2894	ASPRIRN TABLET	500.000 TABLET
P1898	RANIDINE TABLET	300.000 TABLET
P3566	ROMILAR TABLET	120.000 TABLET
P8254	BROMHEXINE TABLET	440.000 TABLET
P8925	CHLORPHENIRAINE TABLET	90.000 TABLET
P5985	VITAMIN B1-6-12 TABLET	540.000 TABLET
P5790	PARACETAMOL 500 MG TABLET	70.000 TABLET

Table B.3. Finished Product Balance Report.

Product ID	Product Name	Balance
F7423	PARACETAMOL 500 MG TABLET	1000.000 TABLET
F2353	CHLORPHENIRAINE TABLET	500.000 TABLET
F6724	BROMHEXINE TABLET	300.000 TABLET
F4556	ROMILAR TABLET	120.000 TABLET
F9054	RANIDINE TABLET	440.000 TABLET
F1125	ASPRIRN TABLET	90.000 TABLET
F8785	VITAMIN B1-6-12 TABLET	540.000 TABLET
F5427	COLD CREAM 30 G	70.000 TABLET

Table B.4. Product after QC Process Report.

Product ID	Product Name	Lot No.
QC7423	CHLORPHENIRAINE TABLET	1254L64
QC2353	COLD CREAM 30 G	6354L90
QC6724	BROMHEXINE TABLET	4254L12
QC4556	PARACETAMOL 500 MG TABLET	1554L77
QC9054	VITAMIN B1-6-12 TABLET	7654L11
QC1125	ASPRIRN TABLET	5734L80
QC8785	RANIDINE TABLET	3264L09
QC5427	ROMILAR TABLET	6354L18

Table B.5. Finished Product Below MIN Rate Report.

Product ID	Product Name	Lot No.
F7423	PARACETAMOL 500 MG TABLET	800.000 TABLET
F2353	CHLORPHENIRAINE TABLET	200.000 TABLET
F6724	BROMHEXINE TABLET	150.000 TABLET
F4556	ROMILAR TABLET	20.000 TABLET
F9054	RANIDINE TABLET	40.000 TABLET
F1125	ASPRIRN TABLET	20.000 TABLET
F8785	VITAMIN B1-6-12 TABLET	60.000 TABLET
F5427	COLD CREAM 30 G	10.000 TABLET

APPENDIX C

PROCESS SPECIFICATION

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ชื่อผู้รับอนุญาต ....

สถานที่ผลิตยาชื่อ ....

Ja

ในตำรับการผลิตยาแผนปัจจุบัน

ในสถานที่ผลิตยาแผนปัจจุบัน

ในใบสำคัญการขึ้นทะเบียนยอมตำรับยา

ลำดับ	วัน เดือน ปี	ปริมาณยาที่ผลิต	
PARACETAMOL 500 M			11A1112199r1T114111
652398	/15/1999	๐๐๐ ๐๐	฿65.00
643790	/31/1999	๒๐๐ ๐๐	฿120.00

ยกขึ้นา   ยกเว้น

.... ผู้รับอนุญาต

.... ผู้แทนทั่วไปปฏิบัติการ

.... ผู้แทนทั่วไปปฏิบัติการ

Production Monthly Formal Report.

CNI

PROCESS SPECIFICATION

Table C.1. Process Specification of Process 1.1.

Items	Descriptions
Process Name:	Raw Material Transaction
Data In:	Purchase Order Form
Data Out:	Raw Material Order Record
Process:	(1) Receive the purchase order from Sales & Marketing Department (2) Send the purchase order to Purchasing Department
Attachment:	(1) Purchase Order (2) Raw Material Information (3) Data Store D1 (4) Data Store D3

Table C.2. Process Specification of Process 1.2.

Items	Descriptions
Process Name:	Improve Raw Material
Data In:	Raw Material Information
Data Out:	Raw Material Approve Information
Process:	(1) Send raw material to QC Department (2) Send raw material quarantine to quarantine area and wait for QC Department approval (3) Receive QC Department approval when raw material passes from QC inspection
Attachment:	(1) Raw Material (2) Data Store D3

Table C.3. Process Specification of Process 1.3.

Items	Descriptions
Process Name:	Delivery Raw Material to Stock
Data In:	Raw Material Approved
Data Out:	Delivery to Raw Material Stock
Process:	(1) Retrieve raw material inventory in database (2) Send raw material report to Production Department
Attachment:	(1) Raw Material

Table C.4. Process Specification of Process 1.4.

Items	Descriptions
Process Name:	Raw Material Issue
Data In:	Raw Material Approved
Data Out:	Query Raw Material Balance
Process:	(1) Query raw material in stock (2) Decrease raw material information in the database
Attachment:	(1) Raw Material (2) Data Store D3

Table C.5. Process Specification of Process 2.1.

Items	Descriptions
Process Name:	Receive Raw Material
Data In:	Raw Material Issue Raw Material Information
Data Out:	Raw Material Issue Form
Process:	(1) Check raw material information (2) Receive QC report
Attachment:	(1) Raw Material

Table C.6. Process Specification of Process 2.2.

Items	Descriptions
Process Name:	Mixing Transaction
Data In:	Raw Material Issue Raw Material Information Confirmation
Data Out:	Production Information Chemical Compound Detail
Process:	(1) Receive raw material issue (2) Receive raw material information confirmation (3) Record production information in the database (4) Send production information to R&D Department
Attachment:	(1) Data Store D3 (2) Data Store D4

Table C.7. Process Specification of Process 2.3.

Items	Descriptions
Process Name:	Production Quality Control
Data In:	Semi-Product Information
Data Out:	Production Information Confirmation
Process:	(1) Receive semi-product information (2) Check and correct by QC Department (3) Record product information in the database
Attachment:	(1) QC Department (2) Data Store D4

Table C.B. Process Specification of Process 2.4.

Items	Descriptions
Process Name:	Packaging Product
Data In:	Finished Product Information
Data Out:	Product Package
Process:	(1) Receive finished product information (2) Pack the finished product including pasting the description
Attachment:	Production Department

Table C.9. Process Specification of Process 3.1.

Items	Descriptions
Process Name:	Document Production Transaction
Data In:	Finished Product Information
Data Out:	Product Detail
Process:	(1) Receive Finished Product Information (2) Send to Sales & Marketing Department
Attachment:	Data Store D5

Table C.10. Process Specification of Process 3.2.

Items	Descriptions
Process Name:	Receive Data
Data In:	Finished Product Data Raw Material Data Customer Data Supplier Data
Process:	(1) Receive list of Finished Product data (2) Receive list of Raw Material data (3) Receive Customer data (4) Receive Supplier data
Attachment:	(1) Data Store D2 (2) Data Store D3 (3) Data Store D5 (4) Data Store D6

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Table C.11. Process Specification of Process 3.3.

Items	Descriptions
Process Name:	Store Data
Data In:	Supplier Data Customer Data Raw Material Rata
Process:	(1) Record Supplier Data list (2) Record Customer Data list (3) Record Raw Material data list
Attachment:	(1) Data Store D2 (2) Data Store D3 (3) Data Store D6

Table C.12. Process Specification of Process 3.4.

Items	Descriptions
Process Name:	Update Information
Data In:	Customer Data Raw Material Data Finished Product
Data Out:	Customer Data Update Finished Product Data Update Raw Material Data Update
Process:	(1) Receive Customer data (2) Receive Raw Material Data (3) Receive Finished Product (4) Update Customer data (5) Update Raw Material Data (6) Update Finished Product Data
Attachment:	(1) Data Store D2 (2) Data Store D3 (3) Data Store D6

Table C.13. Process Specification of Process 4.1.

Items	Descriptions
Process Name:	Generate Monthly Production Report
Data In:	Production Information
Data Out:	Generate Monthly Production Report
Process:	(1) Receive Production Information Summary (2) Submit to Regulator Affair Department
Attachment:	(1) Regulator Affair Department (2) Data Store D4

Table C.14. Process Specification of Process 4.2.

Items	Descriptions
Process Name:	Generate Raw Material Balance Report
Data In:	Raw Material Information
Data Out:	Generate Raw Material Balance Report
Process:	(1) Receive Raw Material Information Summary (2) Submit to Production Department
Attachment:	(1) Production Department (2) Data Store D3

Table C.15. Process Specification of Process 4.3.

Items	Descriptions
Process Name:	Generate Product Balance Report
Data In:	Finished Product Information
Data Out:	Generate Product Balance Report
Process:	(1) Receive Finished Product Information Summary (2) Submit to Production Department
Attachment:	(1) Production Department (2) Data Store D5

Table C.16. Process Specification of Process 4.4.

Items	Descriptions
Process Name:	Generate Product after QC Process
Data In:	Finished Product Information Production Information
Data Out:	Generate Product after QC Process Report
Process:	(1) Receive Finished Product Information Summary (2) Submit to Production Department
Attachment:	(1) Production Department (2) Data Store D4

Table C.17. Process Specification of Process 4.5.

Items	Descriptions
Process Name:	Generate Finished Product Below MIN Rate Report
Data In:	Finished Product Data
Data Out:	Generate Finished Product Below MIN Rate Report
Process:	(1) Receive Finished Product Information Summary (2) Submit to Production Department
Attachment:	Production Department

APPENDIX D

DATA DICTIONARY

DATA DICTIONARY

Table D.I. Data Dictionary of Customer Database.

Field Name	Meaning
Customer_ ID	Identification number of customer
Customer_Name	First name of customer
Customer_ Surname	Last name of customer
Company Type	Kind of company
Customer_Gender	Gender of customer
Customer_ Address	Address of customer
Customer_Tel	Telephone number of customer
Customer Fax	Fax of customer
Customer E-mail Address	E-mail address of customer

Table D.2. Data Dictionary of Order Detail Database.

Field Name	Meaning
Order_ID	Identification number of order
Finished Product_ID	Identification number of finished product
LOT_No.	Lot number for each production
Quantity	Quantity of raw material
Unit Price	Unit price of raw material
Discount	Discount price of raw material

Table D.3. Data Dictionary of Order Database.

Field Name	Meaning
Order_ID	Identification number of order
Customer ID	Identification number of customer
Date_Shipped	Date of shipping

Table D.4. Data Dictionary of Raw Material Issue Database.

Field Name	Meaning
Production Code	Identification code of production
Raw_Material_ID	Identification number of raw material
Raw_Material_Date	Date of distribution
Raw_Material_Quantity	Quantity of raw material
Control_No	Control number of raw material after QC process
LOT_No.	Lot number for each production
Department	Department of each raw material distribution

Table D.5. Data Dictionary of Finished Product Database.

Field Name	Meaning
Finished Product_ID	Identification number of finished product
Finished Product_Name	Name of finished product
Tab Bot_Ouantity	Quantity of tablet per bottle
Tab_Weight	Weight of tablet
Sol_Bot_Quantity	Quantity of solution per bottle
Cream Tube_Quantity	Quantity of cream per tube
Pack_Size	Package size of finished product
Unit_Price	Unit price of finished product
Description	Description of each finished product type
License_Date	Registration date of finished product
MIN Rate	Minimum rate of finished product in stock
End Of Product Life	End of finished product life

Table D.6. Data Dictionary of Production Database.

Field Name	Meaning
Production_Code	Code number of production
Finished_Product_ID	Identification number of finished product
LOT_No.	Lot number of product
Manu_Date	Manufacturing date of product
Expire_Date	Expiry date of product
WT LOT	Weight per lot number of product
Wet_Granule WT	Wet granule weight
Dried Granule_ WT	Dried granule weight
Core Tab WT	Core tablet per weight
SOL_Quantity	Solution quantity
Cream_WT	Cream weight
Finished Quantity	Finished product quantity
Control_No.	Control number of raw material after QC process
Approved	Approval from QC department for production process

Table D.7. Data Dictionary of Supplier Database.

Field Name	Meaning
Supplier_ID	Identification number of supplier
Supplier Name	First name of supplier
Supplier Surname	Last name of supplier
Company Type	Kind of company
Supplier_Gender	Gender of supplier
Supplier_Address	Address of supplier
Supplier_Tel	Telephone number of supplier
Supplier_Fax	Fax number of supplier
Supplier_E-mail_Address	E-mail address of supplier

Table D.8. Data Dictionary of Raw Material Quarantine Database.

Field Name	Meaning
Raw_Material_ID	Identification number of raw material
Supplier ID	Identification number of supplier
Raw_Material_Date	Date of distribution
Raw_Material_Quantity	Quantity of raw material
Control_No	Control number of raw material after QC process
LOT_No	Lot number for each production
Unit_Price	Price of raw material per Kg.
Raw_Material_Expire_Date	Expiry date of raw material
Approved	Approval from QC department for raw material checking process

Table D.9. Data Dictionary of User In-Put Database.

Field Name	Meaning
Employee_ID	Identification number of employee
Employee_Name	First name of employee
Employee_ Surname	Last name of employee
Employee_Gender	Gender of employee
Employee_Bdate	Birthday of employee
Employee Hire_Date	Hire date of employee
Employee_Birth_Address	Birth address of employee
Employee Address	Address of employee
Employee_Tel	Telephone number of employee
Employee_E-mail_Address	E-mail address of employee
Employee_Positon	Position of employee in the company
Employee_Department	Department, which each employee belongs to
Employee Salary	Salary of employee in the company

APPENDIX E

DATABASE DESIGN

Database D1

Structure of Customer Table.

No	Field Name	Field Type	P..	Unique	N	Nul	Foreign Key to Table	C..	H a)	a)
	Customer ID									Primary Key
	Customer_Name	varchar (20)								Attribute
	Customer Surname	varchar (20)								Attribute
	Customer_Gender	varchar (10)								Attribute
	Company_Type	varchar (30)								Attribute
	Customer_Tel	varchar (20)								Attribute
	Customer Address	varchar (50)								Attribute
	Customer_Tel	varchar (20)								Attribute
	Customer Fax	varchar (20)								Attribute
10	Customer Mobile	varchar (20)								Attribute
	Customer Email Address	varchar (40)								Attribute

Database D2

Table E.2. Structure of Order Detail Table.

Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
Finished_Product_ID	Varchar (30)				Finished Product		Foreign Key
Order LOT NO	Varchar (30)						Attribute
Order Quantity	Varchar (30)					>0	Attribute
Order_Unit_Price	Varchar (30)					A	Attribute
Order Discount	Varchar (30)					A	Attribute

Database D3

Structure of Order Table.

Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
Order_ID	int	Y	Y				Primary Key
Customer_ID	int	Y	Y		Customer		
Date_Shipped	date						Attribute

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Database D4

Structure of Raw Material Issue Table.

Field Name	Field Type		Unique	Nullable	Foreign Key to Table	Check	Primary Key / Attribute
Raw_Material_ID	ITTI						Primary Key
Raw Material Date						O A	Attribute
Raw_Material_Quantity	Varchar (100)						Attribute
Raw_Material_Contro l_NO	Varchar (100)						Attribute
Raw Material LOT NO	Varchar (50)						Attribute
Depaitinent	Varchar (200)						
Production Code					Production		Foreign Key

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Database D5

Structure of Finished Product Table.

No.	Field Name	Field Type	Unique	Nullable	Foreign Key to Table	Key Type
1	Finished Product ID					Primary Key
2	Finished Product Name	varchar (100)				Attribute
3	Finished_Product_Tab Bot_Quantity	varchar (20)				Attribute
4	Finished_Product_Tab _Weight	varchar (20)				Attribute
5	Finished_Product_Sol Bot Quantity	varchar (20)				Attribute
6	Finished Product_Cre am_Tube_Quantity	varchar (50)				Attribute
7	Finished_Product Pac k_Size	varchar (30)				Attribute
8	Finished_Product_Uni t Price	varchar (50)				Attribute
9	Description	varchar (50)				Attribute
10	Finished_Product_Lic ense Date					Attribute
11	Finished_Product_MI N Rate	varchar (30)				Attribute
12	End Of Product Life	varchar (80)				Attribute

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Database D6

Structure of Production Table.

ci	Field Name	Field Type	o	Unique	N	ct o	Foreign Key to Table	C' oe'i	Key Type
1	Production Code	varchar (20)							Primary Key
CA	Finished Product ID	varchar (50)							Foreign Key
crl	Production LOT NO	varchar (50)							Attribute
"7t	Production_Manufature Date								Attribute
kn	Production_Expire_Date								Attribute
.c:)	Production Weight_LOT	varchar (50)							Attribute
C--	Production_Wet_Granule Weight	varchar (30)							Attribute
oo	Production_Dried Granule Weight	varchar (30)						A	Attribute
CN	Production_Core_Tab Weight	varchar (30)							Attribute
O	Production Sol_Quantity								Attribute
1	Production_Cream_Weight	varchar (30)						20	Attribute
N	Production Finished_Quantity	varchar (80)							Attribute
cn	Production Control NO	varchar (80)							Attribute
14	Production Approved	varchar (20)							Attribute

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Database D7

Structure of Supplier Table:

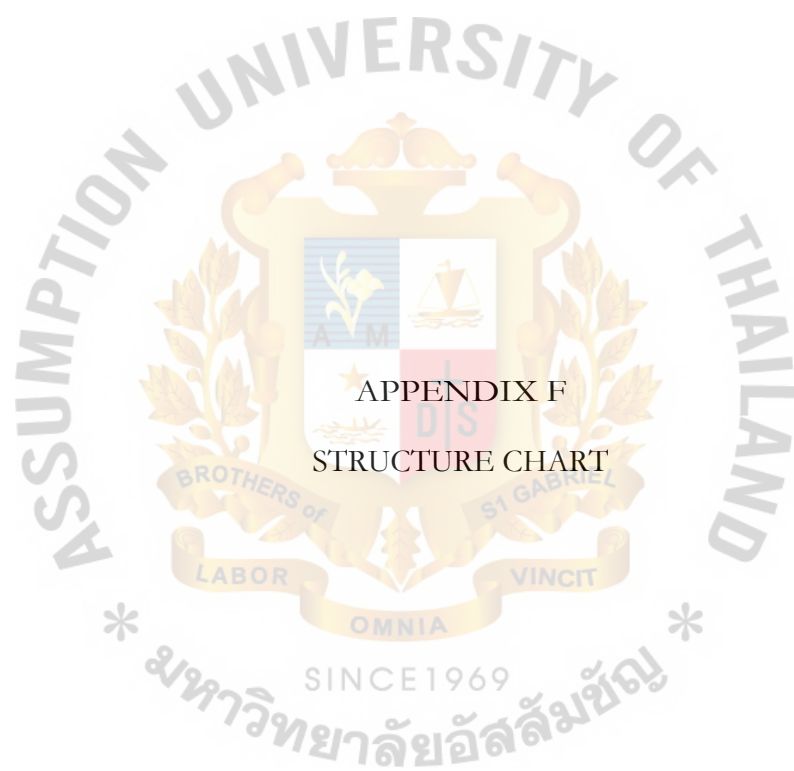| Field Name	Field Type	Unique	Foreign Key to Table	Key Type
Supplier_ID	:a			Primary Key
Supplier_Name	varchar (20)			Attribute
Supplier_Surname	varchar (20)			Attribute
Supplier_Gender	varchar (10)			Attribute
Company Type	varchar (30)			Attribute
Supplier_Tel	varchar (20)			Attribute
Supplier_Address	varchar (50)			Attribute
Supplier_Tel	varchar (20)			Attribute
Supplier_Fax	varchar (20)			Attribute
Supplier_Mobile	varchar (20)			2
Supplier_Email_Address	varchar (40)			Attribute

Database D8

Table E.B. Structure of RawMaterial Quarantine Table.

Field Name	Field Type	Unique	Null	Foreign Key to Table	Check	Key Type
Raw_Material_Quarantine_ID						Primary Key
Production Approved	varchar (20)			Production		Foreign Key
Raw_Material_Quarantine_Date	varchar (20)					Attribute
Raw_Material_Quarantine_Quantity	varchar (20)					Attribute
Raw_Material_Quarantine_Control No	varchar (10)					Attribute
Raw_Material_Quarantine LOT NO	varchar (30)					Attribute
Raw_Material_Quarantine_Unit Price	varchar (20)				A	Attribute
Raw_Material_Quarantine_Expire Date						Attribute
Supplier_ID						Attribute

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Database D9

Table E.9. Structure of User In-PutTable.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Employee_ID	int	Y	Y				Primary Key
2	Employee_Name	varchar (20)				Production		Attribute
3	Employee_Surname	date						Attribute
4	Employee_Gender	varchar (20)						Attribute
5	Employee_Bdate	date						Attribute
6	Employee_Hire_Date	date						Attribute
7	Employee_Birth_Addr ess	varchar (20)						Attribute
8	Employee_Tel	varchar (20)						Attribute
9	Employee_E-mail_Address	varchar (40)						Attribute
10	Employee_Positon	varchar (20)						Attribute
11	Employee_Departmen t	varchar (30)						Attribute
12	Employee_Salary	varchar (20)						Attribute

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APPENDIX F

STRUCTURE CHART

Create / Modify Supplier Record

Supplier

Check Existing Record

Create New Supplier Record

Modify Old Supplier Record

Structure Chart for Create/Modify Supplier Record.

Create/Modify Raw Materia Record

Modify Ol d Raw Material Record

Create New Raw Material Record

Check Existing Record

Read Raw Material

Raw Material Data

New record

Raw Material Flag

Raw Material Info

Raw Material Record
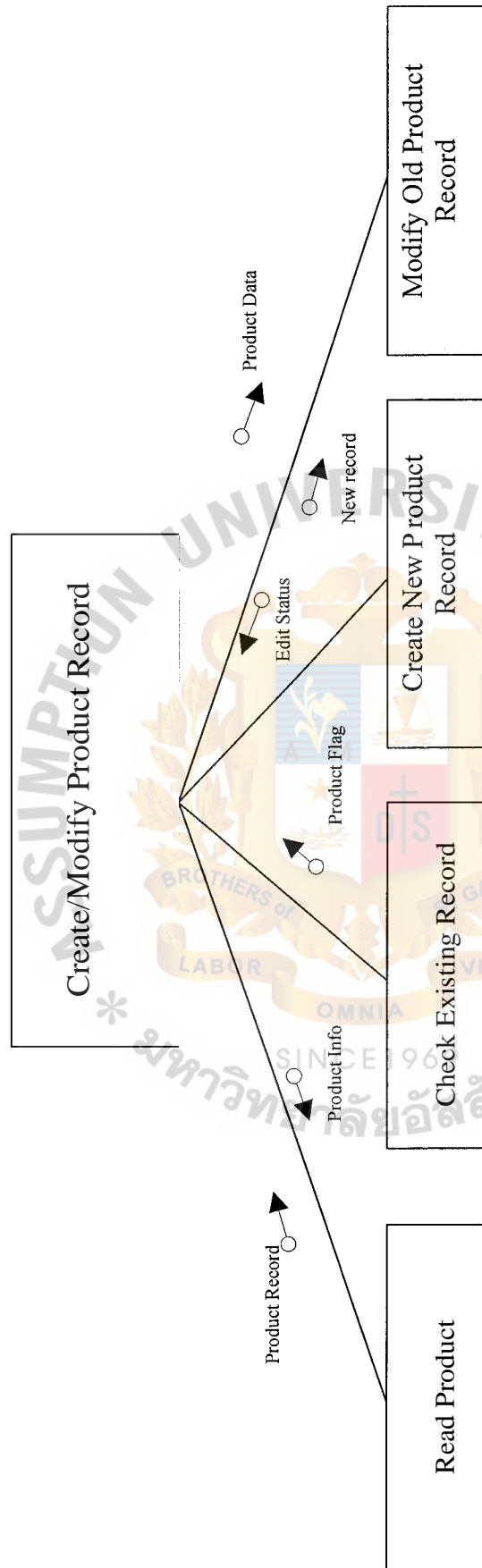
Structure Chart for Create/Modify Product Record.

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Structure Chart for Receipt Raw Material.

Create/Modify Receipt Raw Material Record

Verify Supplier

Verify Raw Material Name

Increase Raw Materi Quantity

Raw Material Code

Raw Material I

Raw Material Name

Purchase Order Recor

Receipt Raw Materi Record

bn

Raw Material Issue Record

Decrease Raw Materia Quantity

Raw Material Co

Check Raw Materia Balance Quantity

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Raw Material Name

Verify Raw Material Request Form

Supplier Info

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Receive Raw Material Order Form

Finished Product Record

oduction Information R

Mixing Transaction

Central Production

Finished Product
Information

QC Transaction
Information

Raw Material Compound

Structure Chart for Mixing Transaction.

Raw Material Quarantine
Information
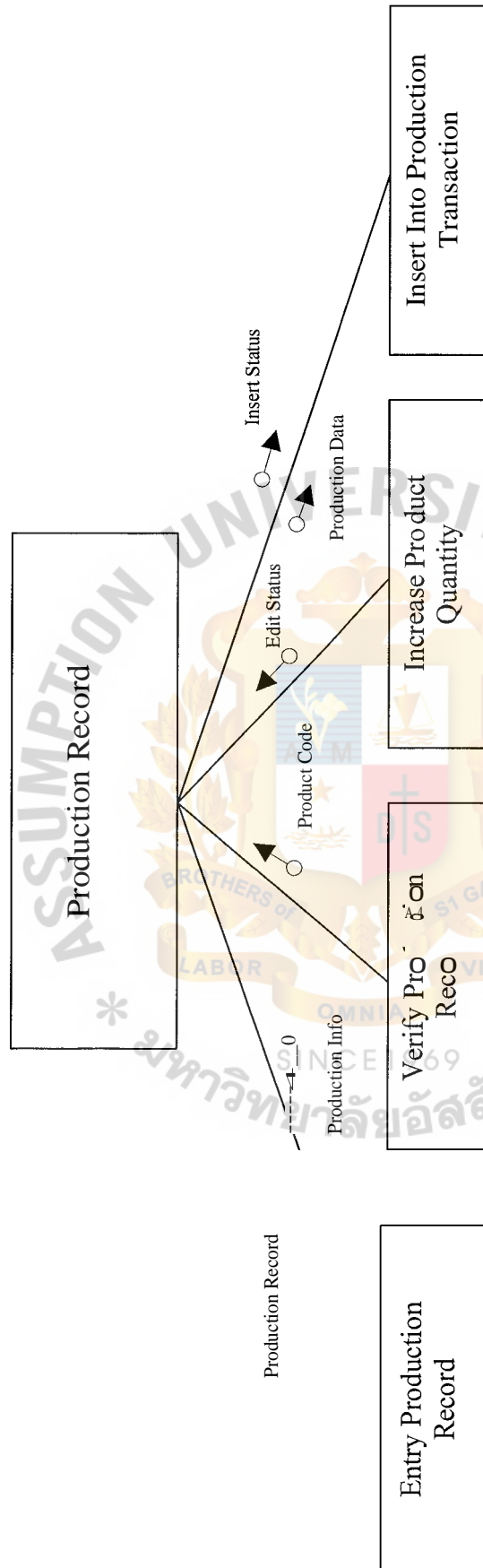
Figure F.7. Structure Chart for Production Record.

Present
Report

Generate Report

Retrieve a Relation form

Create Report
Condition

Structure Chart for Generate Re

Verify Report
Name

99
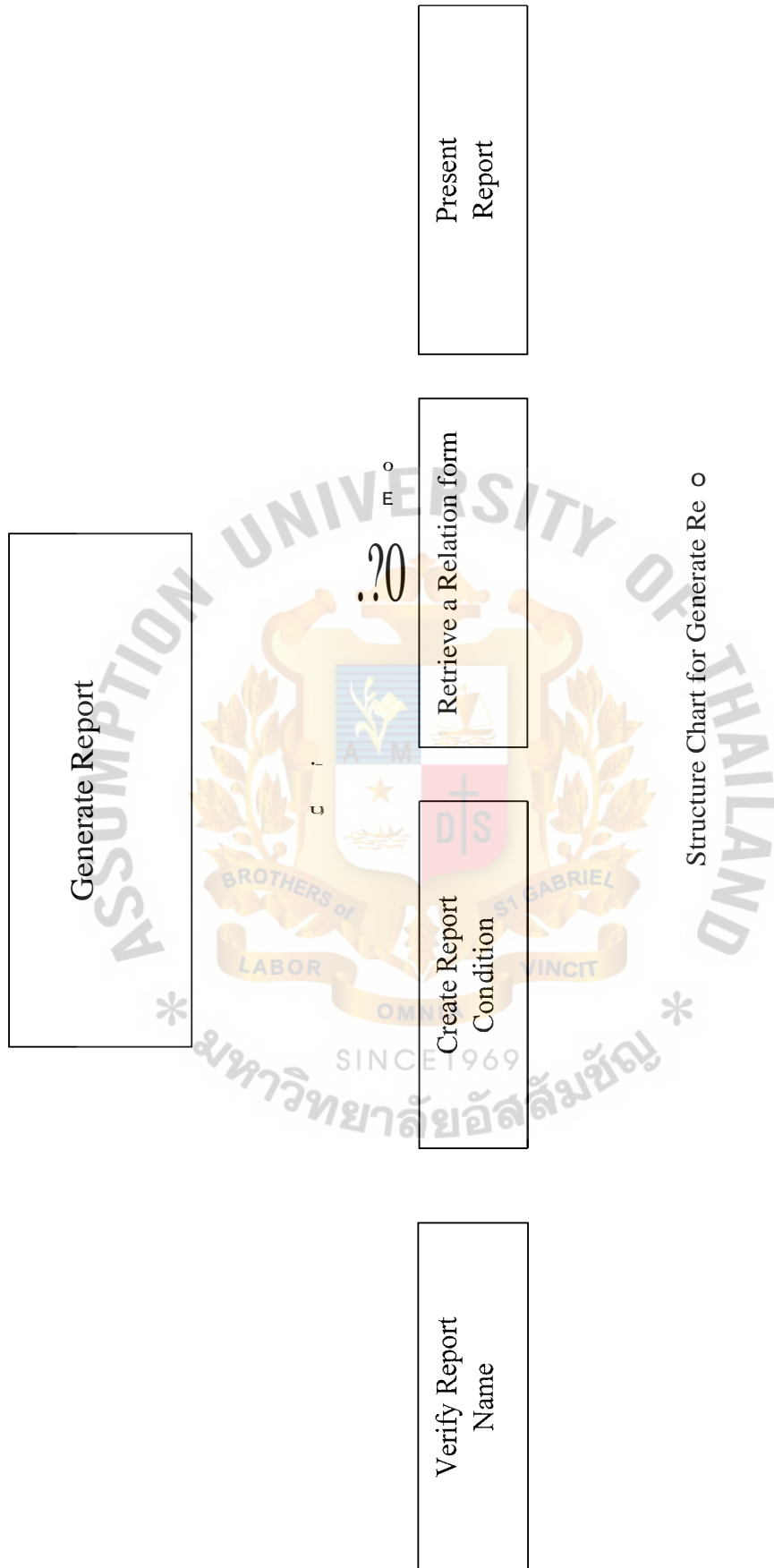
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