



The Raw Materials Inventory Information System for E.Y.H. Co., Ltd.

by

Ms. Wiyada Worrawiriyaprasert

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 The Raw Materials Inventory Information System for E.Y.H.
Co., Ltd.

Name Ms. Wiyada Worrawiriyaprasert

Project Advisor Air Marshal Dr. Chulit Meesajjee

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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:



(Air Marshal Dr. Chulit Meesajjee)
Dean and Advisor



(Prof. Dr. Srisakdi Charmonman)
Chairman



(Asst. Prof. Dr. Vichit Avatchanakorn)
Member



(Assoc. Prof. Somchai Thayarnyong)
CHE Representative

November 2003

ABSTRACT

The raw materials inventory information system in this project is designed for “E.Y.H Co., Ltd.”. The Inventory system is one of the most important departments in operations. The system design will efficiently help to support the organizations operations and management. It provides various efficient input screens and output reports, which makes the staff in the organization work efficiently and quickly.

In the past, the manual could only support daily work, but at present, the manual system is not enough due to the expansion of business that increases more production and more items to satisfy the customer’s demands. With the manual system, the company could never know the exact amount of raw materials in the warehouse. Sometimes, the production is delayed because of unavailability of materials. Moreover, information inside the company is always lost because of a poor filing system. That is why many problems occurred in the past.

The proposed system is a relatively powerful system that can help all users inside the company to work efficiently. All information will be stored in one location. Various kinds of reports can be printed out directly from the system to support decision making in all departments. As a result, each department will perform the right job within a short period of time. With this new system, there is no need for the management level to deal with the daily jobs, thus they will have more time to concentrate on their own work.

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I. INTRODUCTION

1.1 Background of the Project

E.Y.H. Co., Ltd. is a company that produces many kinds of bicycles according to its customers orders and sells bicycle parts to the south of E-san. Due to poor inventory management, the company faces a lot of problems.

At present, even with the increasing number of materials, the company still uses manual systems in managing and controlling inventory. The system has proved to be inefficient when used with large amounts of stocks.

When executives want to know of the information of the remaining inventory for the month, the inventory staff has to count the amount of material in the warehouse. Sometimes if the counted amount is not balanced with the records, the materials are declared as lost.

Obviously, this problem is because of lack of daily inventory checks. Thus, the company requires a new system to solve the current problems and improve the effectiveness and efficiency in managing the inventory system of the company.

1.2 Objectives of the Project

The objectives of the project are to find out what the problems are and if the systems project would solve or what situation should be improved and what they expect from the new system.

The objectives of the Inventory Tracking System of E.Y.H. Co., Ltd. are as follows:

- (1) To study the existing inventory tracking system of E.Y.H. Co., Ltd.
- (2) To identify the problems and user requirements.

- (3) To design and develop a computer-based information system. The new system has to solve or eliminate the existing problems. The new database would support the daily operations.
- (4) To provide the management with timely, reliable information and to enhance the decision support system. The new system should help in generating report for monthly management.
- (5) To reduce redundancy or duplicate work and also to decrease the expenditures of the organization.
- (6) To make the system not depend on people but depend on the system itself by using a computerized system in order to reduce the size of the organization that is small but efficient.
- (7) To increase efficiency and effectiveness of the organization.

1.3 Scope of the Project

The project will cover major parts of the Inventory Tracking System for E.Y.H. Co., Ltd., which includes the following:

- (1) To analyze, design and develop a computerized system for inventory tracking system for E.Y.H. Co., Ltd.
- (2) To keep quantity of inventory up-to-date through adding or deleting.
- (3) To analyze the hardware and software to support the new system.
- (4) To analyze and design a database for the inventory tracking system for E.Y.H. Co., Ltd.
- (5) To generate a variety of reports for serving other departments such as the yearly report of the stock for the Account Department, etc.

1.4 Deliverables

The project will be subjected to the following process strategies:

- (1) The computerized system will be developed by using CASE tools in order to reduce costs and development time.
- (2) In support of the strategic goals for the computerized system to obtain the system design phase by using Unified Modeling Language (UML) as its primary modeling tool. The existence of a consistent model across the stages makes the use of same object model possible to produce the tools, which are consistent and work together in prototyping.
- (3) The design will focused towards building applications with an appropriate database that supports; application code will assume a focus towards an Object-Oriented Programming Language (OOP).

1.5 Project Plan

The project plan of Inventory Tracking System is presented in Gantt chart which is showed in Figure 1.1

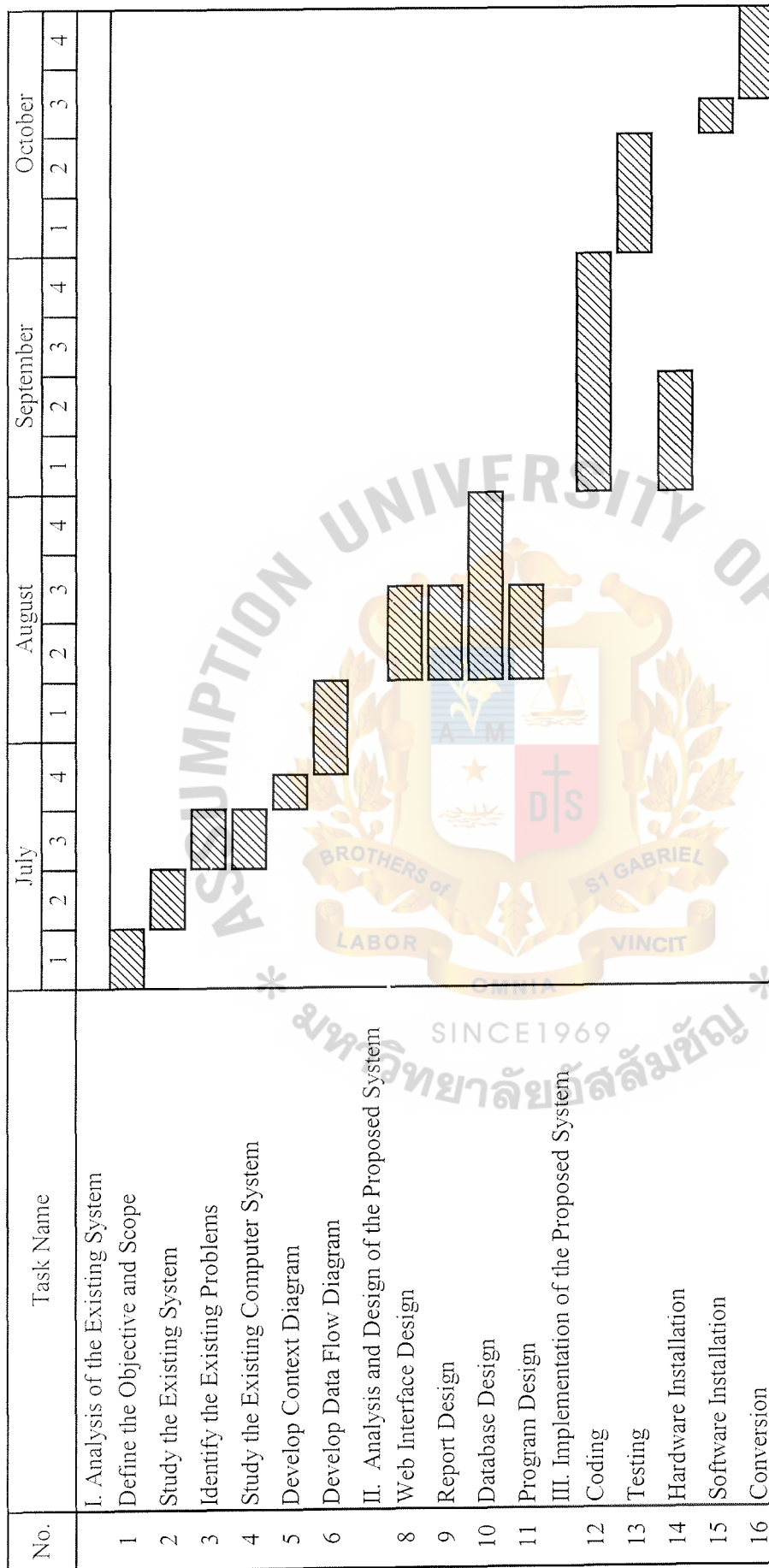


Figure 1.1. Project Plan of Inventory Tracking System.

II. THE EXISTING SYSTEM

2.1 Background of the Organization

E.Y.H. Co., Ltd. has been established since 1966. The company is both a retailer and a wholesaler. Head office of company is in Khon Kaen. The company assembles and sells many brands of bicycles such as LA, SIRIUS, MARAWUTI, Crocodile, TIGER, etc. Furthermore, the company also sells all parts of bicycles to its customers.

The old system is a manual system that consumes more investment when the company expands their market, and gives the company decreasing profits. Thus, they need to improve, to renovate their old systems by using a computerized system in order to reduce their operational costs, human costs, and other costs.

E.Y.H. Co., Ltd. consists of 4 departments. Each department performs different duties under the control of managing director as follows:

(1) Accounting Department

Accounting Department deals with all activities in the company such as keeping general accounting standards: payment for debt or tax, payroll for all staffs, and checking money received from selling products.

At the end of each month, the Accounts Department prepares reports and submits them to the managing director.

(2) Inventory Department

Inventory Department is responsible for all of the raw materials stored in the warehouse. The inventory Department will act as a purchasing department when some materials are out of stock. The inventory staff will place a purchasing order directly to the supplier. The managing director has

decided to give purchasing authority to the warehouse's staff. This staff will perform the tasks of the purchasing administrator of the company.

Moreover, the inventory staff will keep records by counting the amount of materials in the stock and will record to the stock card every week and after one month the staffs will summarize all information to be reported.

(3) Marketing Department

Marketing Department of E.Y.H. Co., Ltd. does not perform the same functions, like other companies. The marketing staff receives the orders from customer and then they make a production plan to match the orders. One of the marketing staff will perform the task of a shipping administrator.

(4) Production Department

The production department will produce the products form the production plan that marketing department has arranged. If some materials are out of stock, production staff will postpone that order and produce the next one. Sometimes, production does not match with the production plans. So, the marketing department has to adjust production plans.

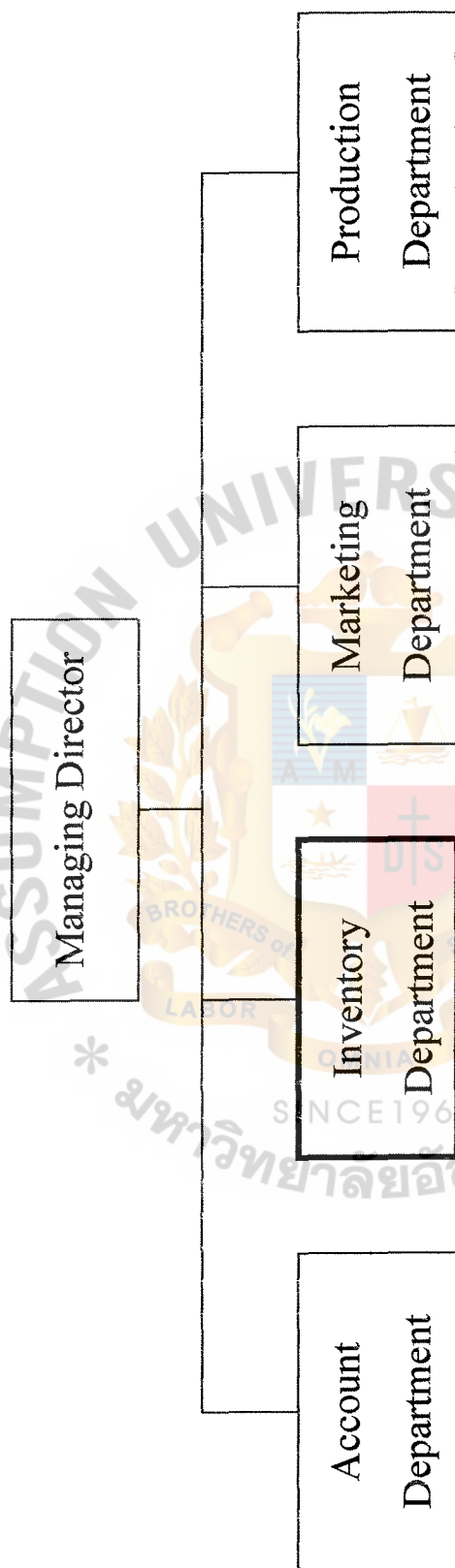


Figure 2.1. Organization Chart.

2.2 Current Problems and Areas for Improvement

2.2.1 Current Problems

The existing manual system always causes many problems as follows:

- (1) The amounts of material in the stock are not up to date.
- (2) Time consumed in updating stock. The inventory staff take much time in calculating the stock available from stock cards.
- (3) The staff performs several mistakes in counting as well as in recording stocks.
- (4) Inventory staffs refuse to check stock regularly because the task is time-consuming.
- (5) An inaccuracy of inventory data causes insufficient information for the management to make a forecast or a plan.
- (6) The documents require a large storage space and also there is no security in controlling.
- (7) The management have no information that they should increase or decrease the inventory level, no warning light for the management for the over or lower stock control.

2.2.2 Areas for Improvement

The areas for improvement are following:

- (1) The improvement in the inventory management system will help in updating the stock of material automatically. So, the staff do not waste the time in recording the amounts of material in the stock cards. It also reduces the redundancy data.
- (2) The computerized system will help staff in each department especially in the inventory department to perform their jobs effectively.

- (3) Reports will be generated in time. The management will receive the correct information.

2.3 Existing Computer System

The existing system of E.Y.H. Co., Ltd. is based on a manual system. The inventory staff cope with the inventory system by recording in the stock cards. The method is very slow and time-consuming.

The existing system starts when the staffs of marketing departments send the production plans and material orders of customers to the inventory staff. The inventory staff will check the amounts of raw material in the stock. If the materials are out of stock, the staff will prepare a purchase order manually. After that they will send it to the suppliers by FAX or sometimes through a phone call. Recently, the delivery of raw materials is not balance with the usage. Thus, raw materials are always out of stock.

For a few days, the supplier will send materials to the company with a delivery note that shows the details of material. The inventory staff will check the material with the delivery notes and then check the delivery notes with the purchase orders. The received amounts are always not balanced with the order amounts. This situation causes the production delays.

After receiving the materials, the inventory staff record in the stock cards. This process takes more time to update the amount of raw materials in the stock. The production department will check the amounts of material required by the inventory staff and send a request form to the inventory staff. The staff will check the availability of material again. If the materials are available, the inventory staff will issue a ticket to the production department. So, they can use this ticket to check-out the material.

Another task of the inventory staff is to prepare monthly reports and submit to the management where the reports are always late.

III. THE PROPOSED SYSTEM

3.1 System Specification

For the new system, I have conducted a survey in order to summarize the entire user requirements. After surveying the users who are working on the inventory system, we found several activities that needed improvement which could only be provided by the new system. As follows:

- (1) The inventory system must have an easy menu in each transaction or must be a user-friendly system in order to facilitate user to work easily.
- (2) It should take lesser time in generating information to support the manager in decision making.
- (3) It should reduce the material's loss.
- (4) The system should have a main menu that identifies the purpose of each menu and covers all the transactions of the inventory work process such as receive material.
- (5) The computerized system should help the inventory staff to control all information about safety stock and lead-time.
- (6) It should identify the user's access authority.
- (7) It should accurately show the current quantity of stock.
- (8) It should eliminate redundancy of data.
- (9) It should generate monthly reports of materials on hand.
- (10) It should generate purchase orders and the monthly purchasing order reports.
- (11) It should allow users to update, retrieve or delete data at any given time.

3.2 System Design

For a better understanding of the system, the system analyst uses structured analysis, which is a top-down method for defining system inputs, processes, and outputs. It also offers a logical graphic model of information flow, partitioning a system into subsystems or modules that show manageable levels of detail.

3.2.1 Candidate Solutions

System design deals with the physical or implementation-dependent aspects of a system or the system's technical specifications. After the business requirements are established in the definition phase of system analysis, a configuration phase will be conducted to identify, analyze candidate solutions and recommend a target system.

So, we should identify alternative candidate solutions generated from the ideas and opinions of system owners, system users and other such as system analyst, system designers, technical consultants and other information system professionals.

(1) Candidate Solution 1

The candidate solution uses the Microsoft Visual Basic 6.0 for application development because of its rapid application development (RAD) environment. With its visual style, it makes application development easier.

(2) Candidate Solution 2

In the second solution, the program will be written by in-house with Microsoft Access XP to support the user requirements. This program can provide high efficiency in customizing the usage of the proposed system.

(3) Candidate Solution 3

In the third solution, package software is purchased and the proposed system will satisfy inventory checking and prepare reports. The benefit of this solution is: it can be implemented easily.

After alternatives are identified, each candidate solution needs to be analyzed in more detail. Candidate system matrix is used to describe the characteristics of each alternative as show in table 3.1.

Table 3.1. Candidate System Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Portion of System Computerized	Software package would be purchased to serve the inventory tracking and purchasing control to satisfy the system	Same as candidate 1 and inventory control and warehouse operation in relation to order fulfillment	Same as Candidate 1
Benefits	Fully supports user required business process for company	Can be implemented quickly and provides more efficiency in accessing and generating reports.	This solution can support the user requirements but it is a little difficult to use a program in generating a report.
Servers and Workstations	Pentium 4 2.2 GHz. DDR-RAM 256 MB, MS Windows XP	Same as candidate 1	Pentium 4 2.66 GHz. DDR-RAM 256 MB, MS Window XP
Software Tools Needs	MS Visual Basic 6.0 for user interface	MS Access for user interface	JAVA Language.
Application Software	Custom Solution	Same as candidate 1	Same as candidate 1
Method of Data processing	Standalone	Same as candidate 1	Same as candidate 1
Output Devices and Implications	(1) HP LaserJet 3300 (2) Epson LQ-570+ dot matrix printer.	Same as candidate 1	Same as candidate 1
Input Devices and Implications	Keyboard & Mouse	Keyboard & Mouse	Keyboard & Mouse
Storage Devices and Implications	Seagate Hard Disk drive 40 GB	Same as candidate 1	Same as candidate 1

3.2.2 Feasibility Analysis Design

Feasibility analysis is the process or way used to measure the benefits or practicality of the information system development in an organization. There are 4 categories of feasibility analysis.

- (1) Operational feasibility (people oriented) : used to measure how well the solution performs in the organization and the feeling or acceptability of the users.
- (2) Technical feasibility (computer oriented): a measure of the practicality of a specific technical solution and also the availability of the technical resources and expertise.
- (3) Schedule feasibility: the measure of how long this project should be developed.
- (4) Economic feasibility: dealing with the cost and benefits of the information system.

The feasibility analysis matrix is an analysis and ranking of the candidate solutions matrix. But we cannot know which one is the best. Sometimes the solution is good for the operational but the cost is very high. Then the best way to get the final decision is to discuss with the end-users.

In analyzing economic feasibility, we have 2 additional analysis tools. They are payback analysis and net present value analysis of each candidate solution. They will give more information and a clear the picture of each solution which will be implemented analysis (See Appendix H).

In the first candidate solution, payback period is around

Table 3.2. Feasibility Analysis Matrix.

Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3
Operational Feasibility	30%	Fully supports user required functionality Score: 100	Fully supports user required functionality Score : 100	Only supports Inventory system requirements and current business processes would have to be modified to take advantage of computerized system Score: 60
Technical Feasibility - Technology - Expertise	30%	MS Visual Basic 6.0 helps customize the users' requirements and is much better user interface. It can be revised to be used through the internet for further development plan. Required programmer and training for the end user. Score: 100	Microsoft Windows XP with Microsoft Access can implement inventory and purchasing control easily and quickly. Required hardware specialist to set up the application. It requires a training and knowledge of database. Score: 100	For current system, we use manual system that is very slow. So, we change to standalone computerized system. Required hardware specialist to set up the application. It requires a training and knowledge of database. Score: 90
Economic Feasibility - Cost of development: - Payback period (discounted) - Net Present Value: - Detailed calculations:	30%	Approximately 201,800 Baht Approximately 1 year and 6 months. Approximately 542,255 Baht See Appendix H Score :95	Approximately 181,800 Baht Approximately 1 year and 1 month Approximately 619,913 Baht See Appendix H Score:100	Approximately 220,000 Baht Approximately 1 year and 9 months. Approximately 524,055 Baht See Appendix H Score:90
Schedule Feasibility	10%	5-7 months Score: 90	3 months Score: 100	6-8 months Score:85
Ranking	100%	97.5	100	80.5

3.2.3 Data Flow Diagram and Structure Chart

Data flow diagram is the primary tool in a structured analysis that graphically illustrates a system's component processes and the flow of data. Thus, the system analyst uses data flow diagrams to show how the data flows to, from, and within the information system and the process that transforms the data.

However, a logical data flow diagram is, it should indicate the flow of the requirement and the data type to develop or design the program to support the new system. After finishing structured analysis of the system, the next step is to prepare a structure design, which is basically software design, which encompasses a set of design rules and techniques for designing a system from the top down in a hierarchical fashion.

The design should first consider the main functions of the program or system, and then break this function into sub-functions and decompose each sub-function until the lowest level of detail is reached. The system analyst derives the structure chart which is derived by studying flow of data through the program.

Structure chart is the primary tool used in the structure design that is a top-down chart, showing each level of design, its relationship with other levels and the overall place in the design structure.

The following details of system analysis and design of the Inventory information system is represented to you in a graphical form as follows:

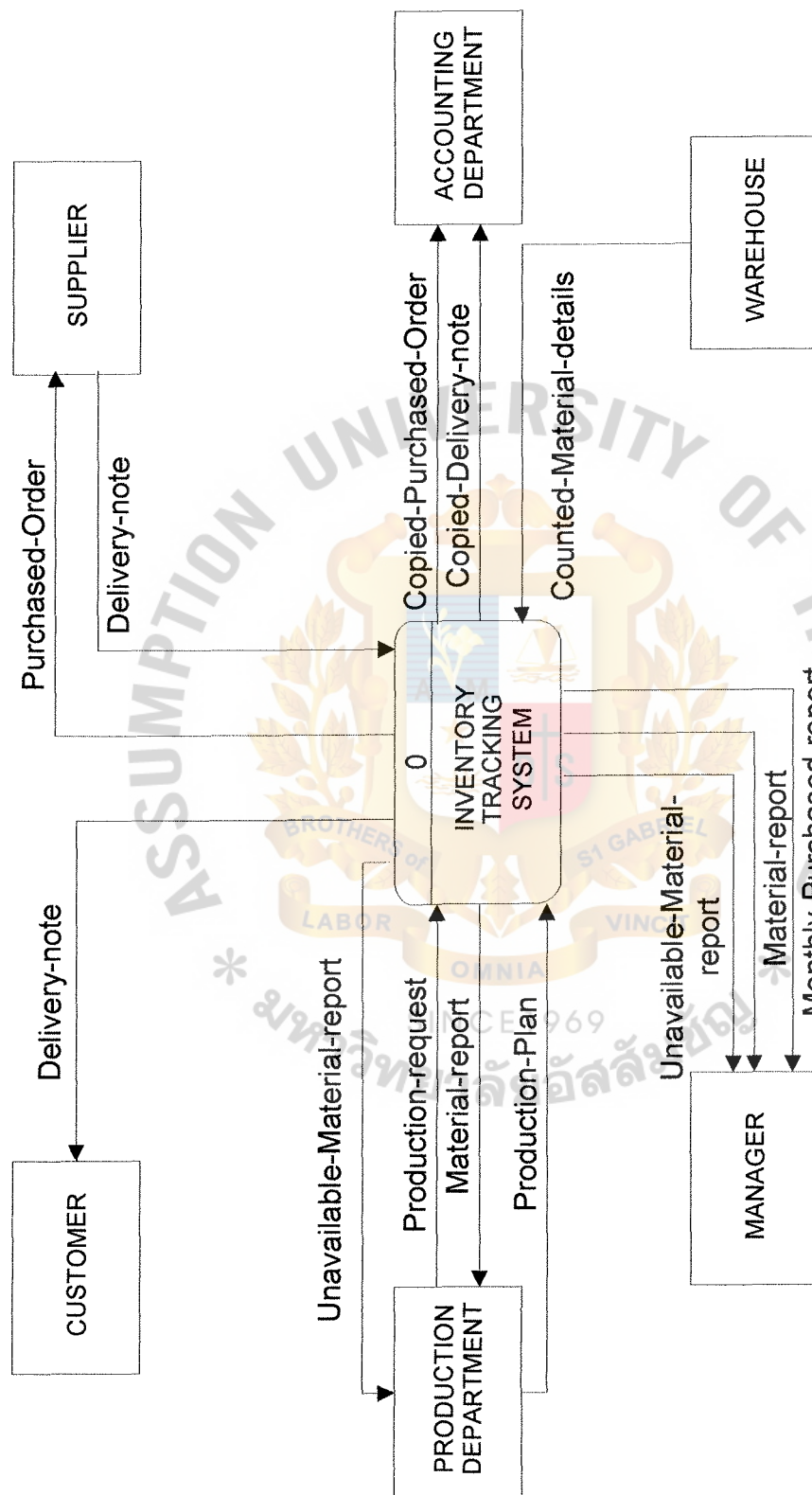


Figure 3.1. Context Level Data Flow Diagram of Proposed System.

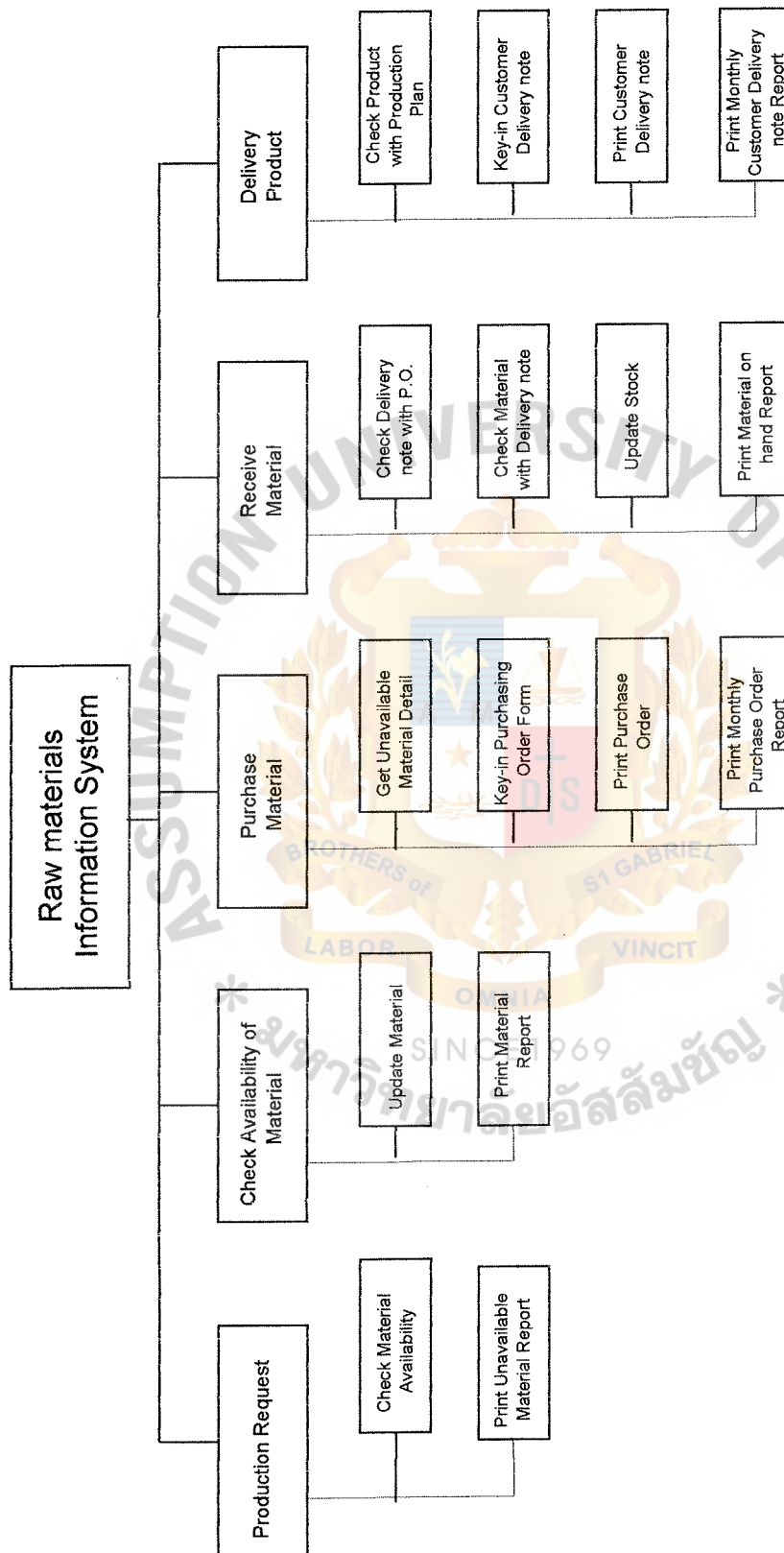


Figure 3.2. Functional Composition Diagram.

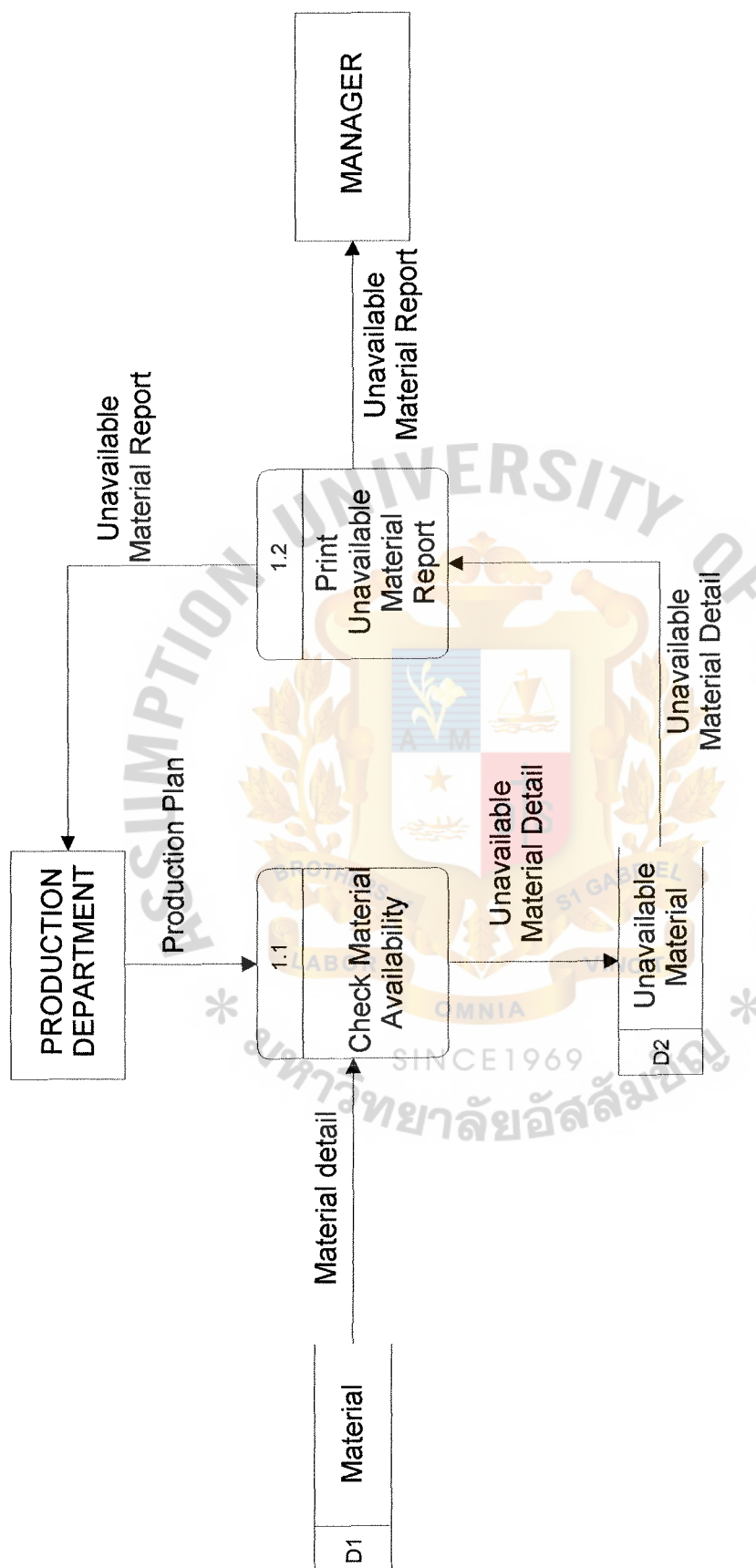


Figure 3.3. Data Flow Diagram Level 1 Process 1 (Production Request).

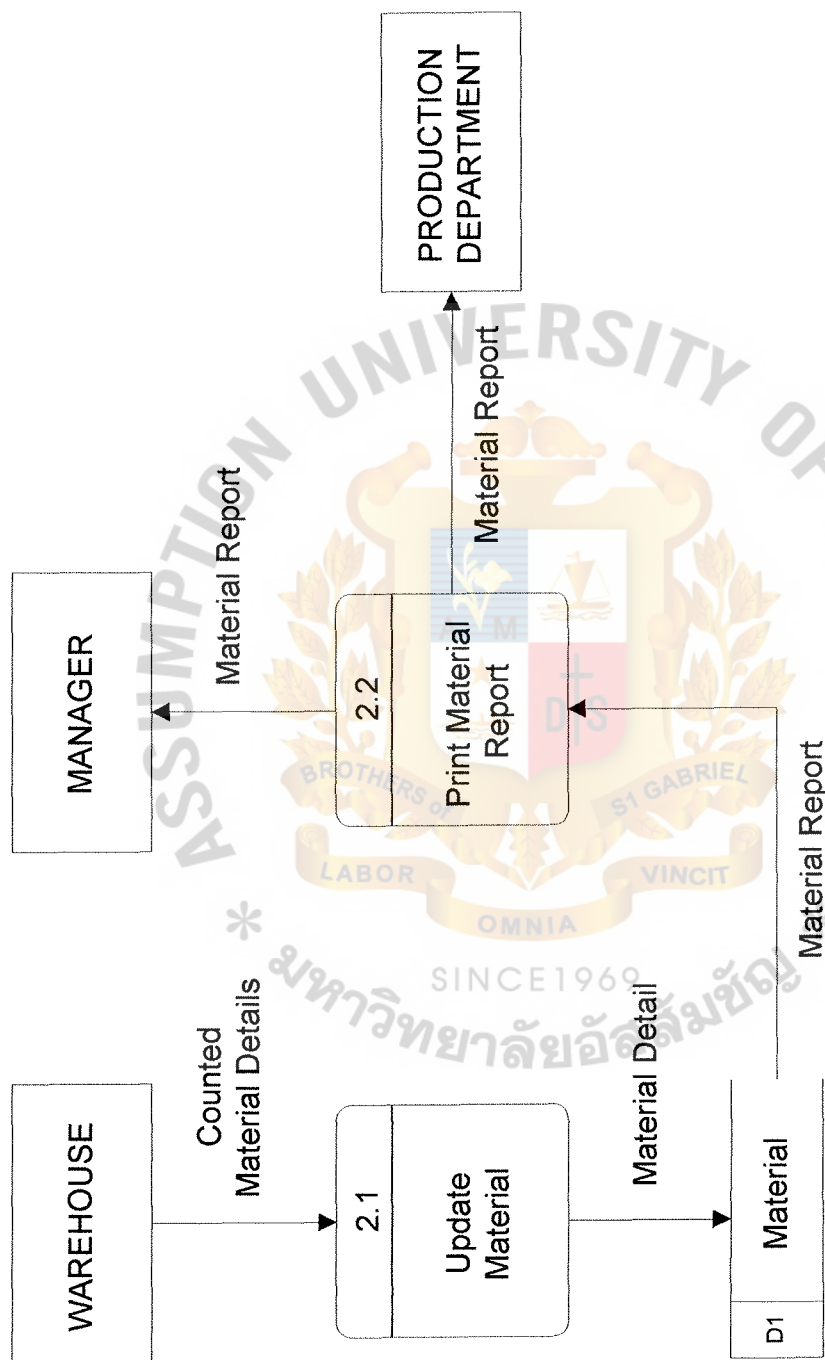


Figure 3.4. Data Flow Diagram Level 1 Process 2 (Check Availability of Material).

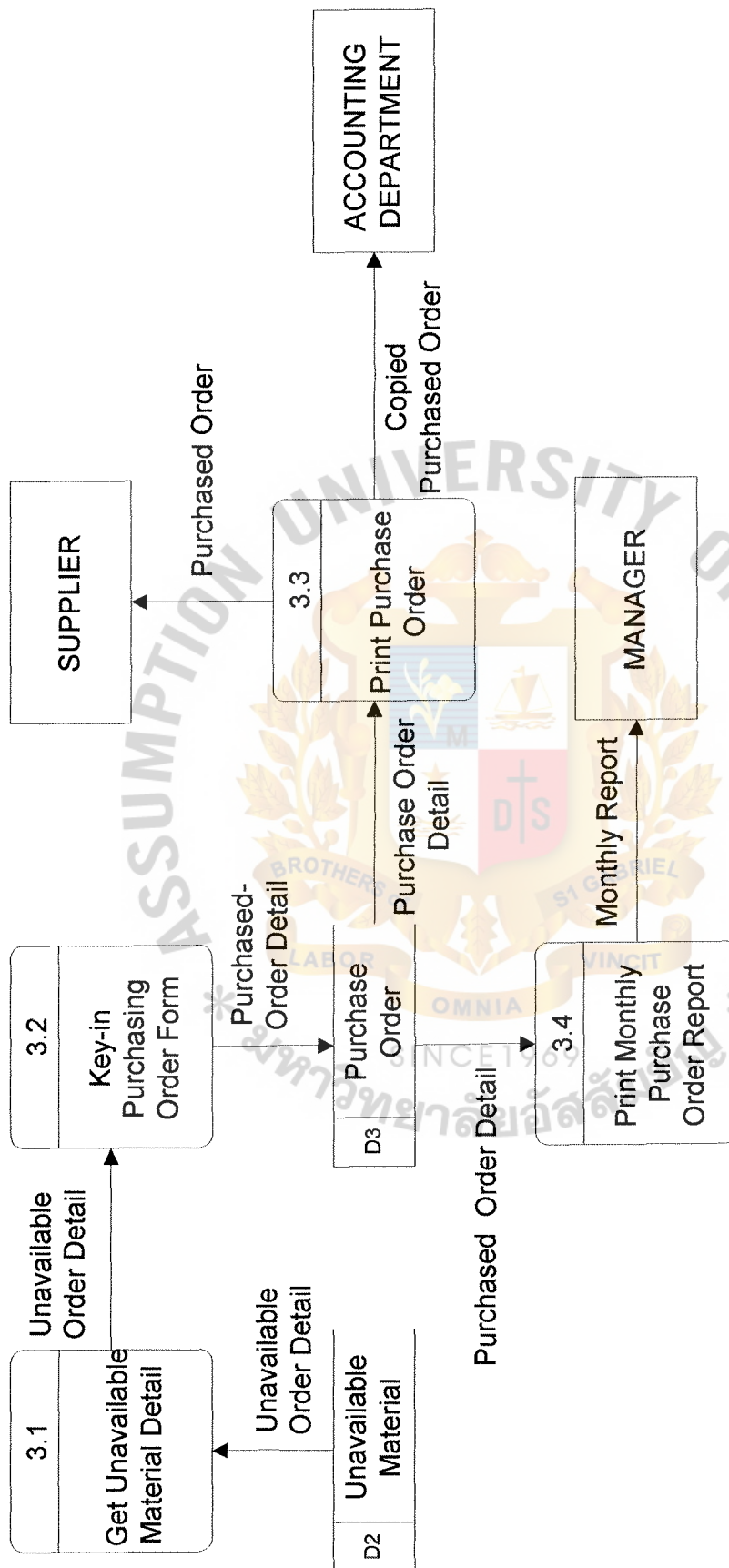


Figure 3.5. Data Flow Diagram Level 1 Process 3 (Purchase Material).

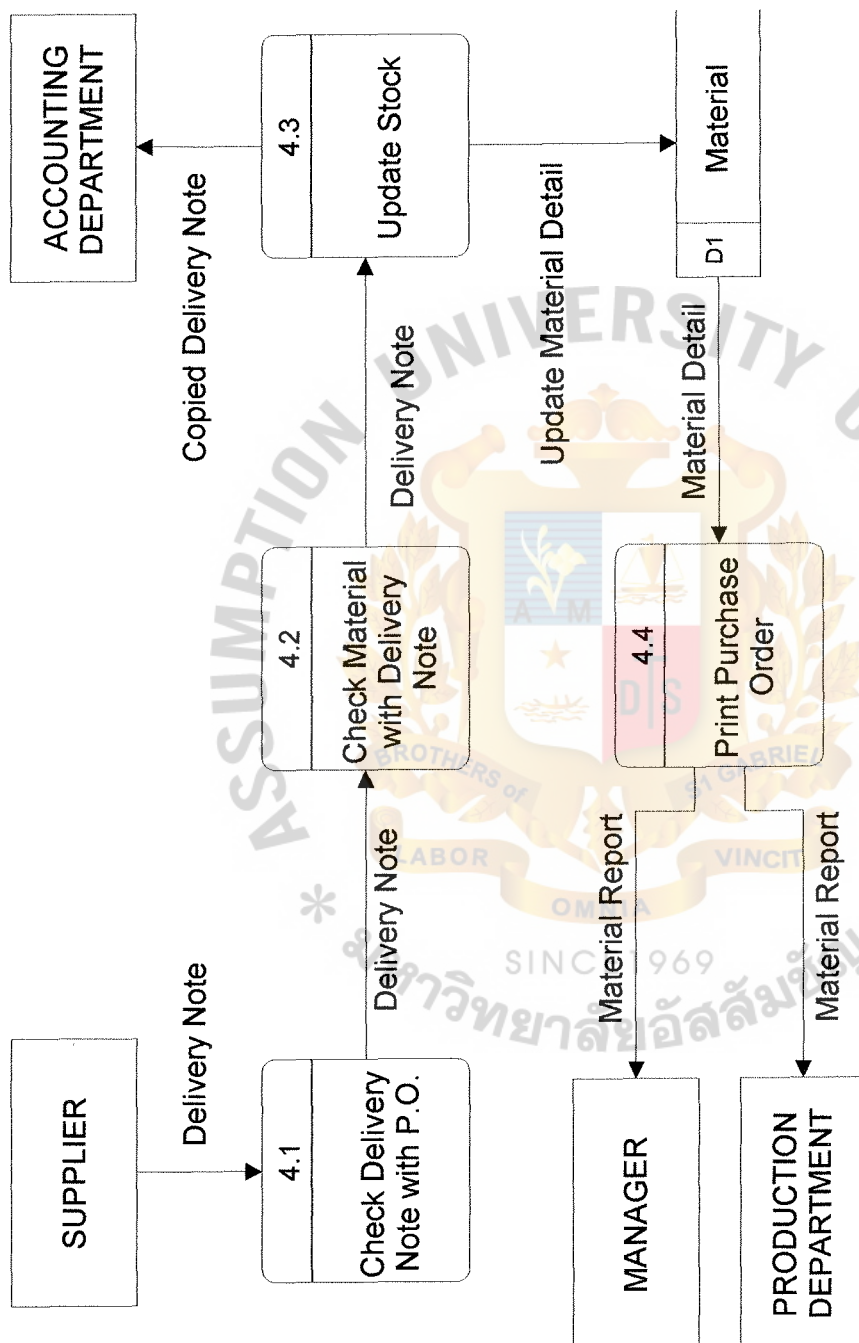


Figure 3.6. Data Flow Diagram Level 1 Process 4 (Receive Material).

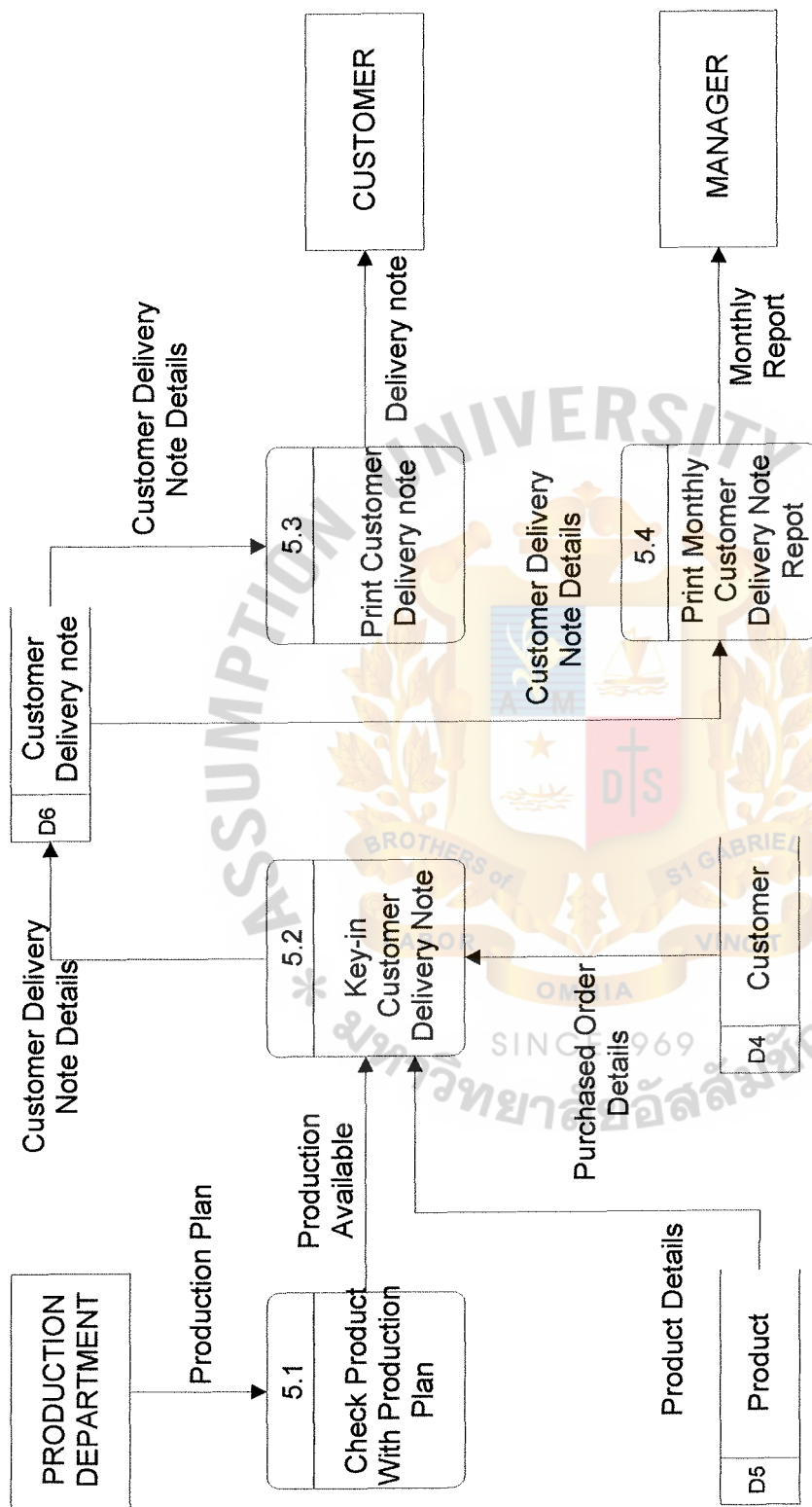


Figure 3.7. Data Flow Diagram Level 1 Process 5 (Delivery Product).

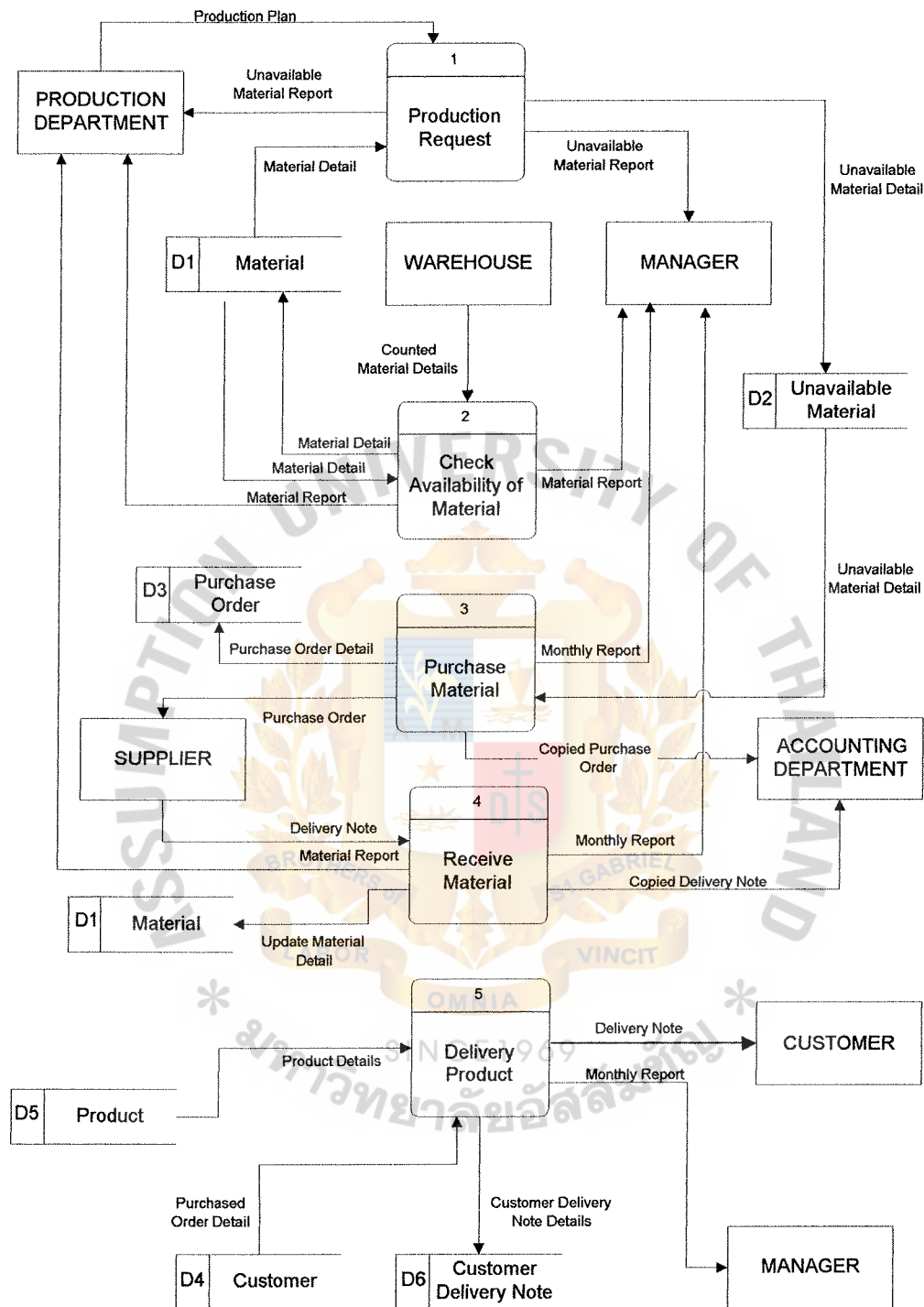


Figure 3.8. Data Flow Diagram Level 0.

3.2.4 Data Dictionary

Data dictionary contains all information about the data and procedures of the proposed system. In database management system, data dictionary is an automated or manual file that stores the definitions of data elements and data characteristics, authorization and security information.

The details are presented in Appendix E.

3.2.5 Reports Design

The output is the reports that are generated by the computer system. It presents information to the system users. The output report can be monthly or yearly which will assist management in planning and controlling.

The report design is presented in Appendix B.

3.2.6 User Interface Design

In the system user's points of view, interface is an important factor that helps users to work with the technology. So, the user interface defines how the system users directly interact with the information system to provide inputs and queries and receive outputs and help.

However, user interface should be designed to match the organization and to satisfy the users' needs. User interface design is the specification of a conversation between system users and the computer. This conversation can result in a form of input and outputs.

The user interface design is presented in Appendix D.

3.2.7 Database Design

In the database design, the relational model has been chosen to design the database of E.Y.H. Inventory Tracking System because of the increasing use of

Relational Database Management System or RDBMS to develop computer-based information system.

Actually, the relational data model is a type of logical database model that treats data as if they are stored in two-dimensional tables. It can relate data stored in one table to data stored in another as long as the two tables share a common data element. All values in a relation are atomic or scalar (no repeating groups).

The details are presented in Appendix C.

3.3 Hardware and Software Requirement

The followings are the hardware and software requirements for the proposed system.

3.3.1 Hardware and Software Specification

Table 3.3 The Hardware and Software Specification for Workstation

Hardware	Specification
CPU	Intel Pentium 4 2.2 GHz
RAM	256 MB DDR-RAM
Hard Disk	40 GB
CD-ROM Drive	48x12x48x CDRW
Floppy Drive	1.44 MB
Display	17" CRT Monitor
Printer	Dot Matrix or Laser
Operating System	Microsoft Windows XP
Application Software	Microsoft Office XP

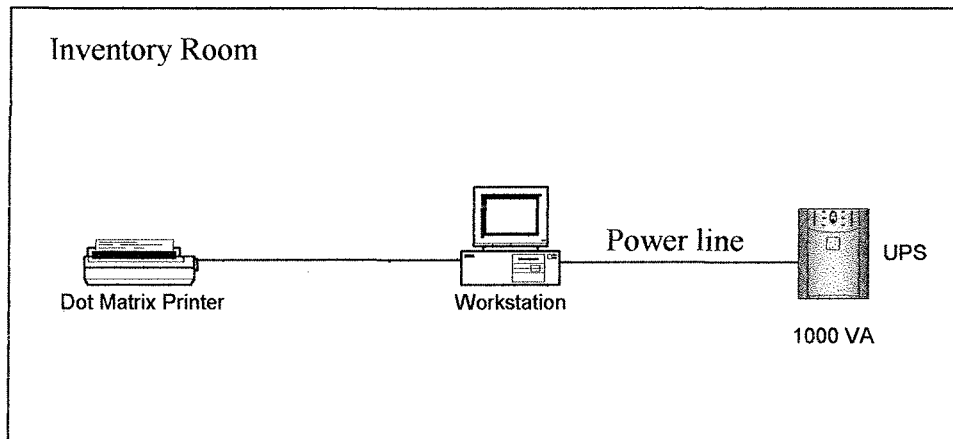


Figure 3.9. Hardware Configuration of the Proposed System.

3.4 Security and Control

Information in the inventory tracking system is very important for many departments of the company. Then the master file must be available to the system users to be accessed whenever they need. Not only accessible but also the prevention of unauthorized users must be performed by the computerized system. There are 2 kinds of security controls that the company will use to prevent unauthorized users as follows:

3.4.1 Application Access

Username and passwords are assigned to authorized users. Both of these are the first levels of security. Every user will have a unique username. When they have a username, the system administrator can assign the amount of access necessary for each user. Each user can perform only his or her functions.

3.4.2 Physical Security

In the physical security, the inventory tracking system does not allow the system user to use suspicious diskettes infected with any computer viruses. The diskettes must

not be moved out of the computer room except for backup diskettes. There will be no permission to eat, drink and smoke while operating a computer.

For the database backup, we will have 3 backups as follows:

- (1) Daily backup, we will just have information or a database table that is changed everyday by backing up information into diskettes and stored in the head office.
- (2) Weekly backup, we will perform this back up because some information does not require daily updating.
- (3) Monthly backup, we have to back up all information in the database to prevent unexpected events.

3.5 Cost and Benefit Analysis

3.5.1 Cost Analysis

- (1) Investment Cost
 - (a) Hardware Cost
 - (1) 1 set of Workstation 29,900 Baht
 - (2) 1 set of Dot Matrix Printer 10,000 Baht
 - (3) 1 set of UPS, 1000 VA 15,000 Baht
 - Total Hardware Cost 81,800 Baht
 - (b) Software Cost
 - (1) Microsoft Windows XP 30,000 Baht
 - (2) Microsoft Office XP 25,000 Baht
 - Total Software Cost 55,000 Baht
 - (c) Development Cost
 - (1) Software Development & Training Cost 40,000 Baht
 - (2) Installation Cost 5,000 Baht

Total Development Cost 45,000 Baht

Total Investment Cost 181,800 Baht

(2) Annual Operating Cost

(1) Diskettes (HD 3.5", 6 boxes @ 150) 900 Baht

(2) Handy Drive 128 MB (for backup) 3,000 Baht

(3) Paper 6,000 Baht

(4) Toner 2,000 Baht

(5) Ribbon 2,100 Baht

(6) Maintenance Cost 5,000 Baht

Total Annual Operating Cost 19,000 Baht

3.5.2 Benefit Analysis

The proposed system provides both tangible and intangible benefits as follows:

Tangible Benefits

Table 3.4. The Tangible Benefit of the Proposed System, Baht.

Benefit items	Year 1	Year 2	Year 3	Year 4	Year 5
1. Personnel Reduction Inventory Staff 1 Person @ 7,000 Baht / Month	84,000	92,400	101,640	111,804	122,984
2. Operating Time Saving Overtime Saving 2 Persons @ 2 Hours / Day	62,400	62,400	62,400	62,400	62,400
3. Office Supplies & Miscellaneous Cost Reduction					
Stationary	10,000	11,000	12,100	13,310	14,641
Office Supplies	12,000	13,200	14,520	15,972	17,569
Utility	18,000	19,800	21,780	23,958	26,354
Miscellaneous	10,000	11,000	12,100	13,310	14,641
Annual Office Supplies & Miscellaneous Cost Reduction	50,000	55,000	60,500	66,550	73,205
Total Benefits from implementing computerized system	196,400	209,800	224,540	240,754	258,589

Intangible Benefits

- (1) Improving the decision process by providing fast access to information.
- (2) Providing better managerial control for the inventory.
- (3) Providing better information to support the managers in decision-making.
- (4) Improving efficiency and effectiveness of inventory operations.
- (5) Smooth operation flows.
- (6) Reducing the volume of paper produced and handled.
- (7) Information is accurately updated.

Table 3.5. Cost Comparison between the Existing System and Proposed System, Baht.

Cost Items	Years				
	1	2	3	4	5
Existing System					
Manpower Cost					
- 2 Officer (7,000x2)	168,000	176,400	185,220	194,481	204,205
- O.T. Payment 2 persons @ 2Hours/Day (Increase 5% per year)	62,400	65,520	68,796	72,236	75,848
Supplies Cost (Paper, etc.) (Increase 10% per year)	13,000	14,300	15,730	17,303	19,033
Utility Cost (Increase 10% per year)	5,000	5,500	6,050	6,655	7,321
Total Cost	248,400	261,720	275,796	290,675	306,406
Cumulative Cost	248,400	510,120	785,916	1,076,591	1,382,997
Proposed System:					
Hardware Cost	16,360	16,360	16,360	16,360	16,360
Software Cost	11,000	11,000	11,000	11,000	11,000
Development Cost	45,000	-	-	-	-
Manpower Cost - 1 Officer (12,000 x 1) (Increase 5% per year)	144,000	151,200	158,760	166,698	175,033
Supplies Cost (Paper, etc.) (Increase 10% per year)	17,500	19,250	21,175	23,293	25,622
Maintenance Cost (Increase 10% per year)	5,000	5,500	6,050	6,655	7,321
Utility Cost (Increase 10% per year)	12,000	13,200	14,520	15,972	17,569
Total Cost	250,860	216,510	227,865	239,978	252,904
Cumulative Cost	250,860	467,370	695,235	935,213	1,188,117

3.5.3 Payback Period

The payback period method determines the length of time by operating the proposed system will pay back the costs of the investment and becomes profitable.

Table 3.6. Payback Period for the Proposed System, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	181,800					
Annual Operating Cost	-	19,000	20,900	22,990	25,289	27,818
Discount factor for 8%	1.000	0.926	0.857	0.794	0.735	0.681
Time-Adjusted Costs (Adjusted to Present Value)	181,800	17,594	17,911	18,254	18,587	18,944
Cumulative time-adjusted costs over lifetime:	181,800	199,394	217,305	235,559	254,147	273,091
Benefits derived from operation of New System	-	196,400	209,800	224,540	240,754	258,589
Discount factors for 8%	1.000	0.926	0.857	0.794	0.735	0.681
Time-Adjusted benefits (Adjusted to Present Value)	-	181,866	179,799	178,285	176,954	176,099
Cumulative Time-adjusted benefits over lifetime	-	181,866	361,665	539,950	716,904	893,003
Cumulative Lifetime time- adjusted Costs + Benefit	-181,800	-17,528	144,360	304,390	462,757	619,913

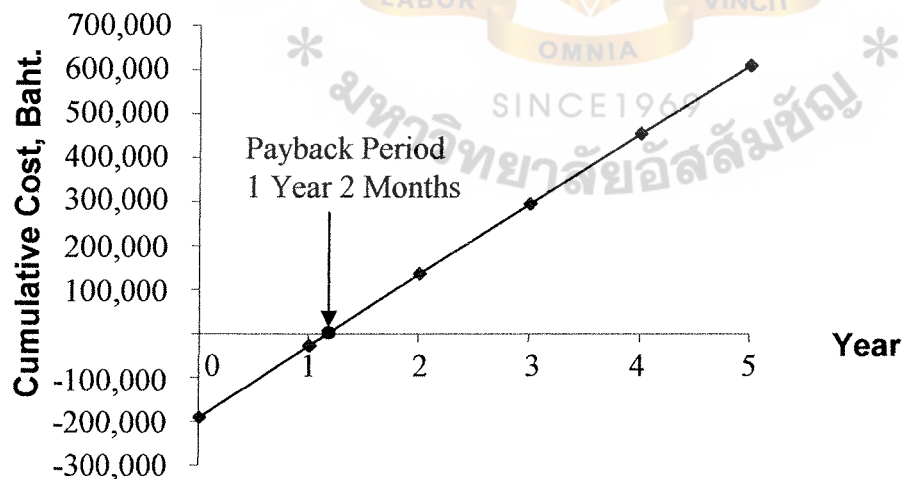


Figure 3.10. Payback Period for the Proposed System.

3.5.5 Calculations of Break Even Year

It is a method used to compare the current system and the proposed system. In this case, we use the cost of the new system to compare to the cost of the current system to determine the point at which the new system can cover the costs of the old one.

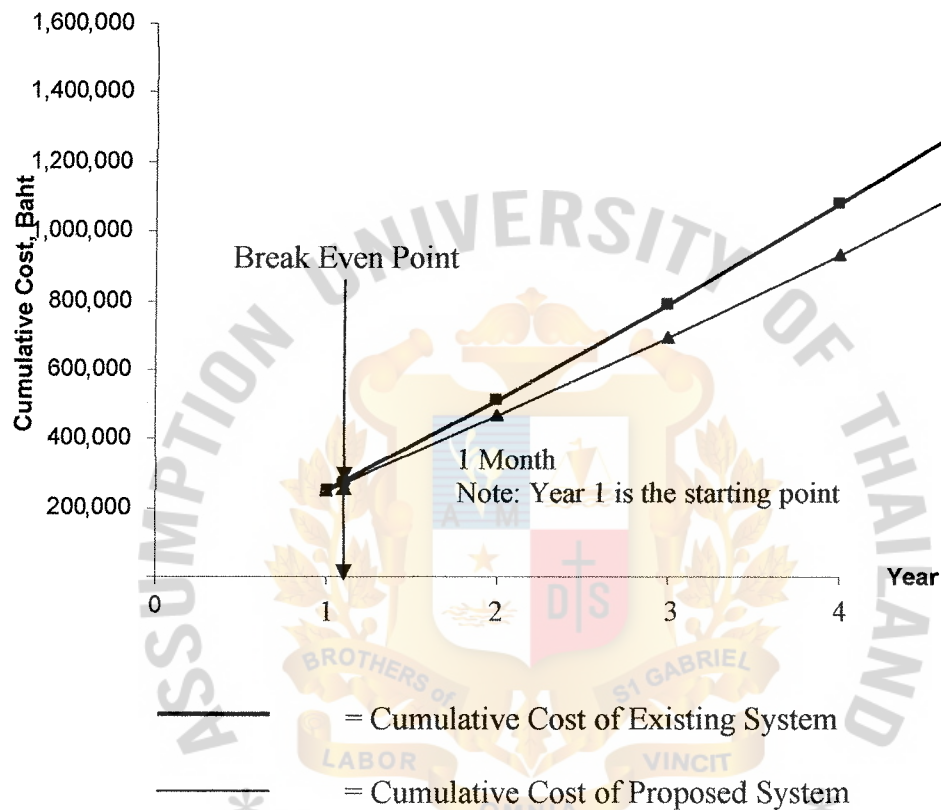


Figure 3.11: Break Even Chart.

IV. PROJECT IMPLEMENTATION

4.1 Implementation Plan

Implementation is the process of assuring that the information system is operational and allows user to take over its operation for use and evaluation. It will be developed after the management has accepted the proposed system. Cost versus benefits comparison is one of the significant factors in the decision making process.

Implementation includes many activities, which take place to convert the existing system to a new system. The activities in the implementation phase as follows:

4.1.1 Training

Training involves 2 groups of people in the organization. They are system operators and system users. Both of them will use the new system either by providing data, receiving information or actually operating the equipment. All the users will take a basic computer course which provides with basic knowledge.

4.1.2 Conversion

Conversion is the process of changing from the old manual system to the new one, and requires careful planning and executing. The conversion plan describes all the activities that will occur in implementing the new system and putting it into operation. In this case, we use parallel conversion.

Under this approach, both old and new systems will be operated together 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 cut over may be either abrupt or gradual, as portions of the new system are deemed adequate. This strategy minimizes the risk of major flaws in the new system causing irreparable harm to the business.

However, this method is time consuming; it doubles the workload of employees and increases the cost of the running systems.

4.1.3 Review of Implementation

This step should be conducted to determine whether the system is meeting with the expectation. If the system has something missing, we can improve it in time.

4.2 Test Plan

System testing is a very expensive but critical process: It can take as much as 50 percent of the budget for program development. Therefore, the most practical and useful approach is to understand that testing is the process of executing a program with the explicit intention to find the errors that cause the program to fail. So it is a must to locate such error causing failure.

Thus, the testing system is the final step before the new system is launched. There are some topics in testing that we should perform.

4.2.1 Hardware Testing

In hardware testing, we should check the PCs, printers and all equipment to ensure that all of them perform their tasks well in normal situations and also in times of peak workload to know the limits that the devices can handle.

4.2.2 Program Testing

The system of the whole program has to be tested to ensure that the application programs written in isolation work properly when they are integrated into the total system. This testing, includes the interface testing between the subsystems with sample data.

This sampling data will include everything with conditions like a real data. After testing, the programmer can check the outputs to find the errors. If the program does not

perform or produce the correct outputs, the programmer should rewrite or debug the program and test the program again until the program works correctly.

4.2.4 Security and Control Testing

In this step, the programmer will test the user log and system authentication, which allows the programmer to test the user groups profiles and the access level of each system user.

We should have a facility for testing which concerns the maintenance of some devices such as UPS, Air conditioning and so on. These devices will have some effect on the new system when they break down.

4.3 Conversion

The proposed system will use parallel conversion as mentioned earlier to replace the existing system with the proposed system. In parallel conversion, both systems will operate concurrently during the initial period for a specific time frame.

This is done to ensure that all major problems in the proposed system have been discovered and solved before the existing system is discarded. Once the time frame is reached, the existing system is then discarded and replaced by the proposed system.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The current situation with the manual system in the company is quite bad and it does not provide an easy way for the employees to work on their jobs. Then the proposed system is designed to replace the existing one. The new system would improve and solve some problems and at the same time provides a smooth and efficient work atmosphere.

In addition, the new system will provide many other things to support all users. The design of screen is easy to understand and work with for all kinds of users. The various reports, which can be printed out directly from the system, will help the top management in decision making.

After interviewing employees and other persons who deal with the system, we found that the requirements of the new system are well defined. All of them wanted have a better system, which is more reliable and easy to use. But it is very difficult to implement the computerized system to replace the manual system because of many things such as the high investment costs, the knowledge of employees, as well as the maintenance costs, and so on.

Table 5.1 shows the time performance on each process of the proposed system compared with the existing system.

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

Process	Existing System	Proposed System
Request for Production	2.30 hrs.	1.30 hrs.
Check Availability of Material	12 hrs.	1.30 hrs.
Purchase Material	4 hrs.	30 mins.
Receive Material	4 hrs.	1.30 hrs.
Delivery Product	1 hr.	30 mins.

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

(1) Request for Production: With the present system, the inventory staff take 2 hours and 30 minutes to respond to the requests for production. But the proposed system will decrease the response time to 1 hour and 30 minutes with the help of computers.

(2) Check Availability of Material: The existing system consumes 12 hours to check all available raw materials in the stock. The time is spent to count all raw materials in the stock. With the proposed system, it provides a graphical user interface to easily input/edit processes and check availability of material. The proposed system can complete this process in 1 hour and 30 minutes.

(3) Purchase Materials: The existing system uses a manual system to prepare purchase materials and send purchase orders to suppliers. It spends about 4 hours for this process. The proposed system will reduce the processing time to just 30 minutes.

(4) Receive Materials: The existing system spends too much time in updating stocks after checking raw materials. It spends about 4 hours to receive the material process. But the proposed system reduces processing time to 1 hour and 30 minutes.

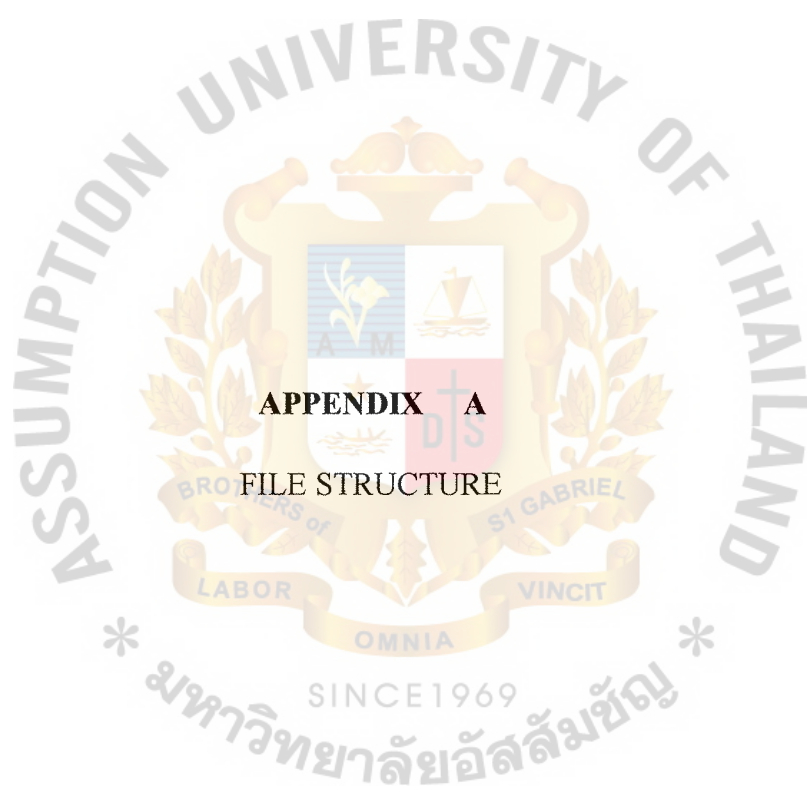
(5) Delivery Product: The existing system spends 1 hour for this process. With the proposed system, it will reduce processing time to just 30 minutes.

In conclusion, the new system, which requires a high budget, can be very effective for the company. Due to its speed and accuracy, the inventory system can reduce the cost and time and it also provides more security to keep the information in a system. In the future, the system may be further developed so that the employees can work more efficiently and smoothly and also they can easily handle the expansion of the company.

5.2 Recommendations

In order to make the proposed system more beneficial in the long run, there are some factors to be implemented for success as follows:

- (1) The user or system control should prepare a good plan in converting from the existing system to the new one. This plan should cover everything, which can help the company to save cost and increase efficiency in work.
- (2) The management of the system project is an important factor that will enhance the development of the system. If one step of the system is delayed, the system analyst has to make sure that no errors occur in that step and that the next step has to take place within a short time.
- (3) There should be a training course during the implementation process to make the employees know of the advantages of the new system. After launching the new system, there should be another training course, which giving details about the program and ways to handle some computer problems.
- (4) The new system should be easily adapted to the new technologies which are to come in the future such as multimedia. All of these technologies will make the system more user friendly and more attractive to the system users.



APPENDIX A

FILE STRUCTURE

Table A.1. File Structure: Raw Material Table.

File Structure				
Table Name:		RAW MATERIAL		
Seq.	Field Name	Type	Width	Decimal
1	Raw_Material_Number	Text	15	-
2	Raw_Material_Name	Text	30	-
3	Unit_on_Hand	Text	8	-
4	Unit_Price	Currency	10	2
5	Amount	Currency	10	2
6	Lead_Time	Text	8	-
7	Reorder_Unit	Number	8	-
8	Differentiation	Number	8	-

Table A.2. File Structure: Product Table.

File Structure				
Table Name:		PRODUCT		
Seq.	Field Name	Type	Width	Decimal
1	Product_Number	Text	15	-
2	Product_Name	Text	30	-
3	Product_Description	Text	50	-
4	Customer_Number	Text	15	-
5	Unit_Price	Currency	10	2
6	Outstanding_Balance	Number	10	-
7	Ship_Date	Date	10	-

Table A.3. File Structure: Supplier Table.

File Structure				
Table Name:		SUPPLIER		
Seq.	Field Name	Type	Width	Decimal
1	Supplier_Number	Text	15	-
2	Supplier_Name	Text	30	-
3	Contact_Name	Text	20	-
4	Address	Text	30	-
5	City	Text	10	-
6	Postal_Code	Text	10	-
7	Province	Text	15	-
8	Phone_Number	Text	10	-
9	Fax_Number	Text	10	-
10	Payment_Term	Text	10	-
11	Email_Address	Text	20	-
12	Product_Supplied	Text	25	-
13	Last_Date_Purchased	Date	10	-
14	Last_Date_Payment	Date	10	-
15	Discount	Number	10	-
16	Credit Balance	Number	10	-

Table A.4. File Structure: Purchase Order Table.

File Structure				
Table Name:		PURCHASE ORDERS		
Seq.	Field Name	Type	Width	Decimal
1	PO_Number	Text	15	-
2	Customer_Name	Text	15	-
3	Supplier_Name	Text	15	-
4	Raw Material_Number	Text	15	-
5	Order_Date	Date	10	-
6	Delivery_Date	Date	10	-
7	Date_Required	Date	10	-
8	Unit_Price	Currency	10	2
9	Quantity_Purchased	Number	10	-
10	Amount	Currency	10	2
11	Total_Amount	Currency	15	2

Table A.5. File Structure: Customer Delivery Note Table.

File Structure				
Table Name:		CUSTOMER DELIVERY NOTE		
Seq.	Field Name	Type	Width	Decimal
1	Delivery_Note_Number	Text	15	-
2	Purchase_Order_Number	Text	15	-
3	Supplier_Name	Text	15	-
4	Raw Material_Number	Text	15	-
5	Delivery_Date	Date	10	-
6	Unit_Delivery	Number	10	-
7	Unit_Price	Currency	10	2
8	Amount	Currency	10	2

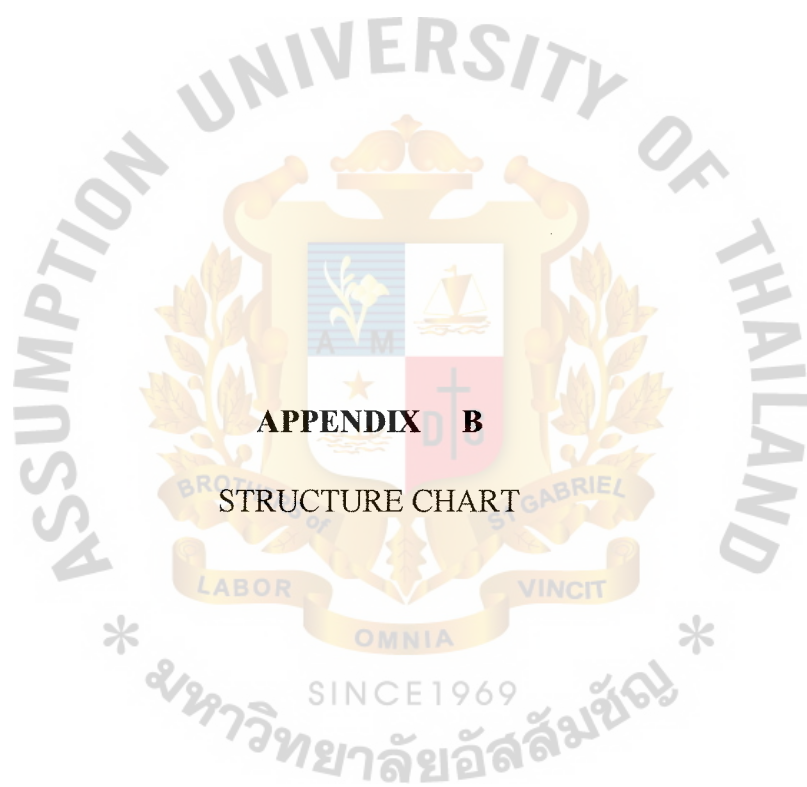
Table A.6. File Structure: Customer Table.

File Structure				
Table Name:		CUSTOMER INFORMATION		
Seq.	Field Name	Type	Width	Decimal
1	Customer_Name	Text	15	-
2	Company_Name	Text	25	-
3	Contact_First_Name	Text	20	-
4	Contact_Last_Name	Text	20	-
5	Contact_Title	Text	20	-
6	Billing_Address	Text	30	-
7	City	Text	10	-
8	Province	Text	10	-
9	Postal_Code	Text	15	-
10	Country	Text	15	-
11	Phone_Number	Text	10	-
12	Extension	Text	10	-
13	Fax_Number	Text	10	-
14	Email_Address	Text	20	-
15	Last_Date_of_Sales	Date	10	-
16	Last_Payment_Date	Date	10	-
17	Balance	Number	10	2
18	Discount	Number	10	2
19	Credit Term	Text	5	-
20	Payment Type	Text	10	-

Table A.7. File Structure: Unavailable Material Table.

File Structure				
Table Name:		UNAVAILABLE MATERIAL		
Seq.	Field Name	Type	Width	Decimal
1	Raw_Material_Number	Text	15	-
2	Raw_Material_Name	Text	30	-
3	Unit_on_Hand	Text	8	-
4	Lead_Time	Text	8	-
6	Unit_Price	Currency	10	2





APPENDIX B
STRUCTURE CHART

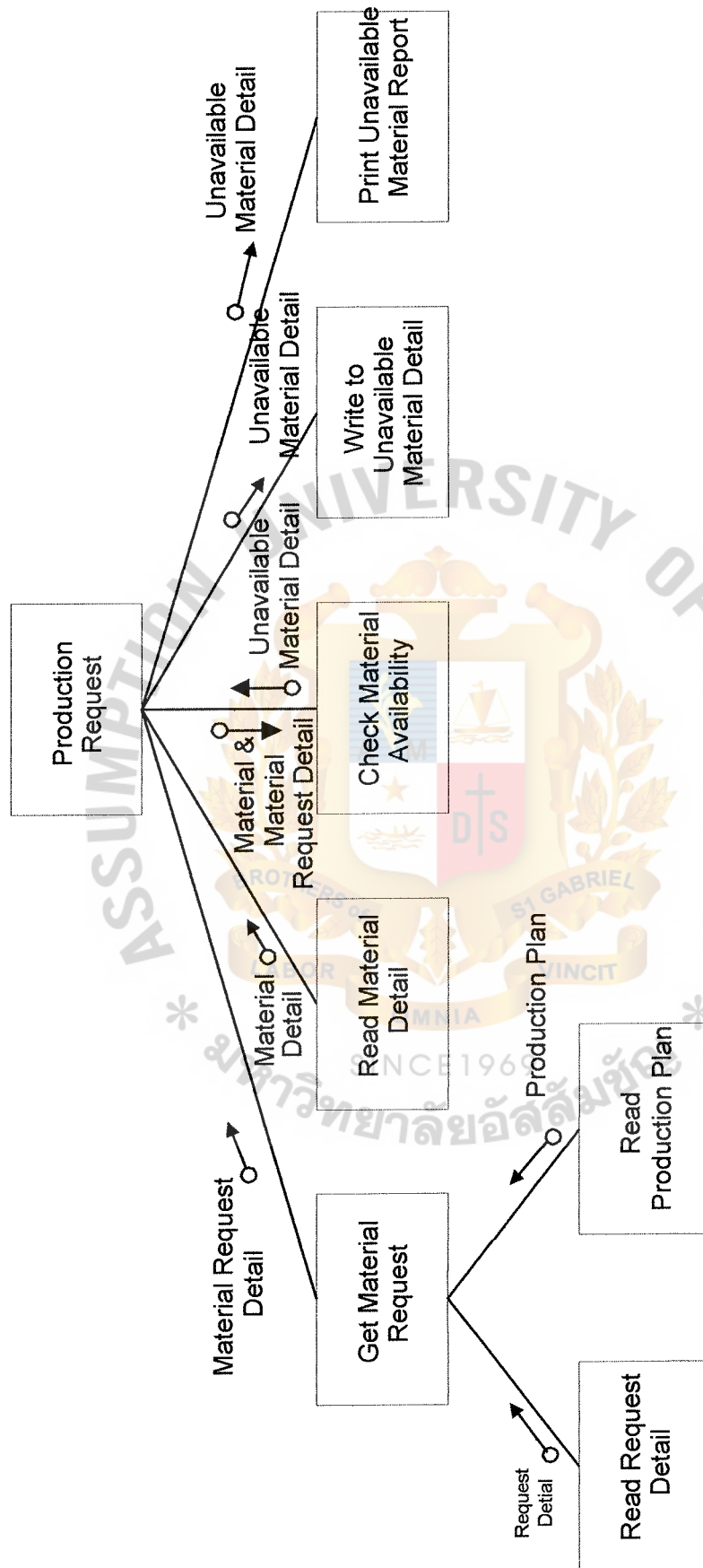


Figure B.1. Structure Chart in Production Request.

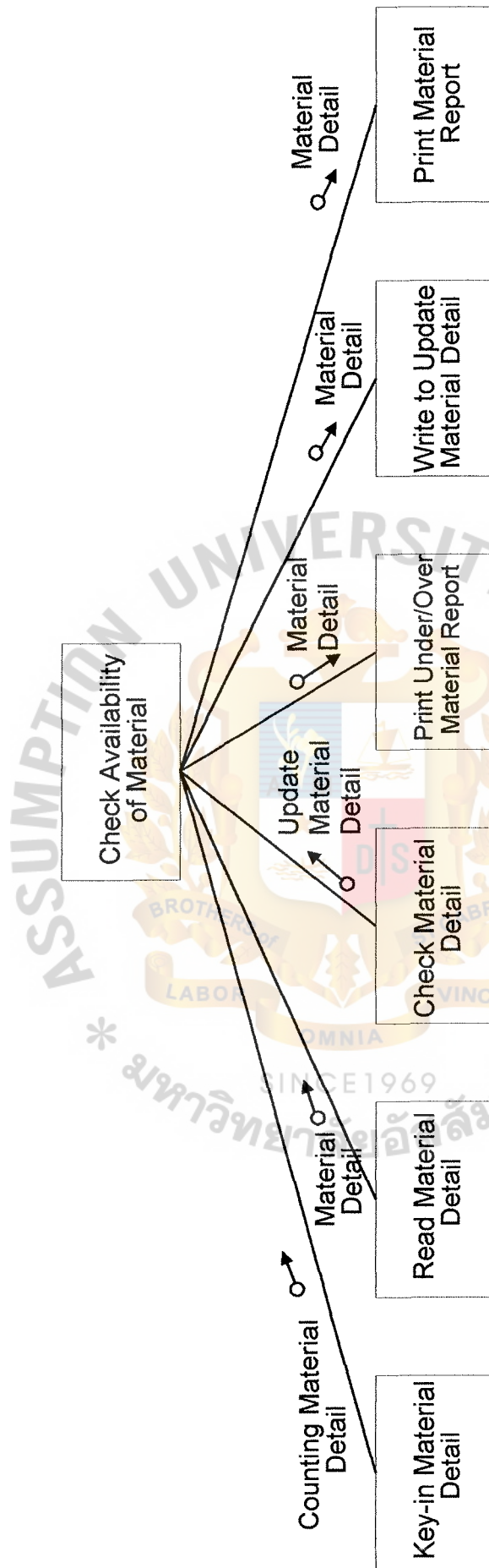


Figure B.2. Structure Chart in Check Availability of Material.

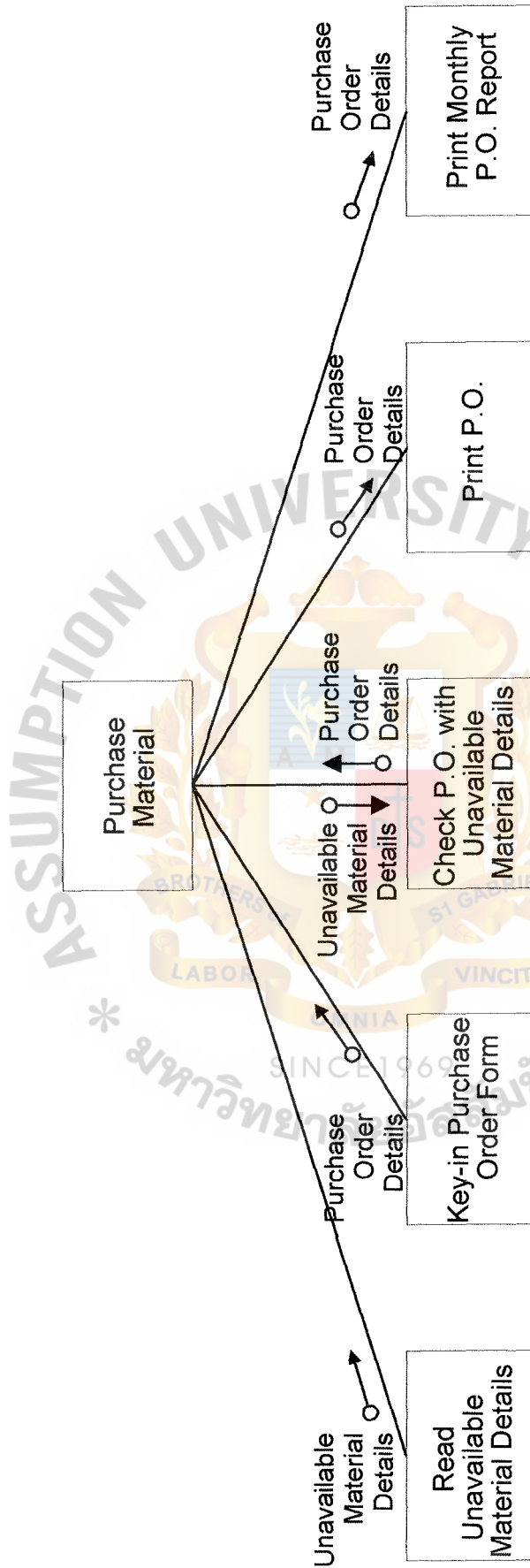


Figure B.3. Structure Chart in Purchase Material.

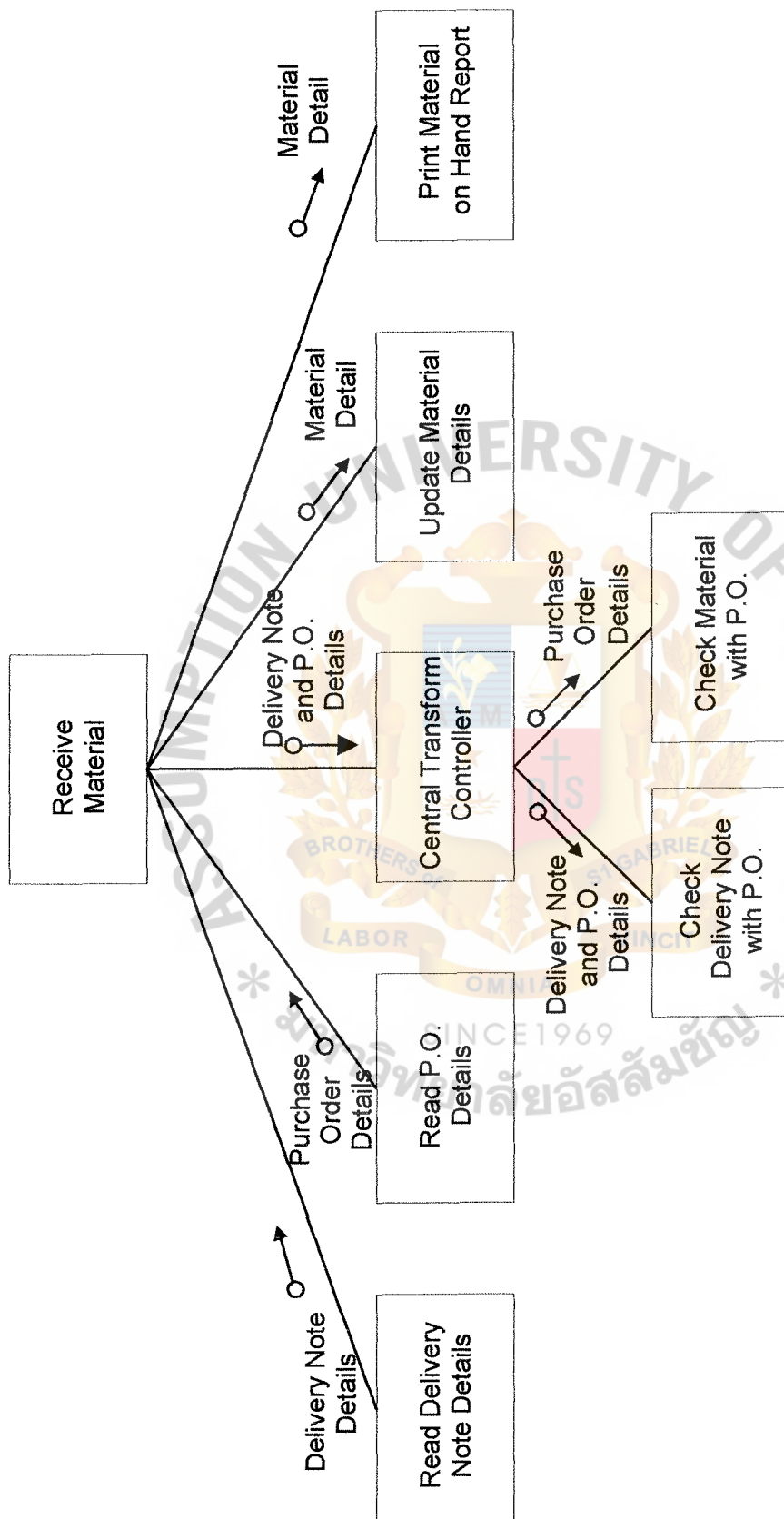


Figure B.4. Structure Chart in Receive Material.

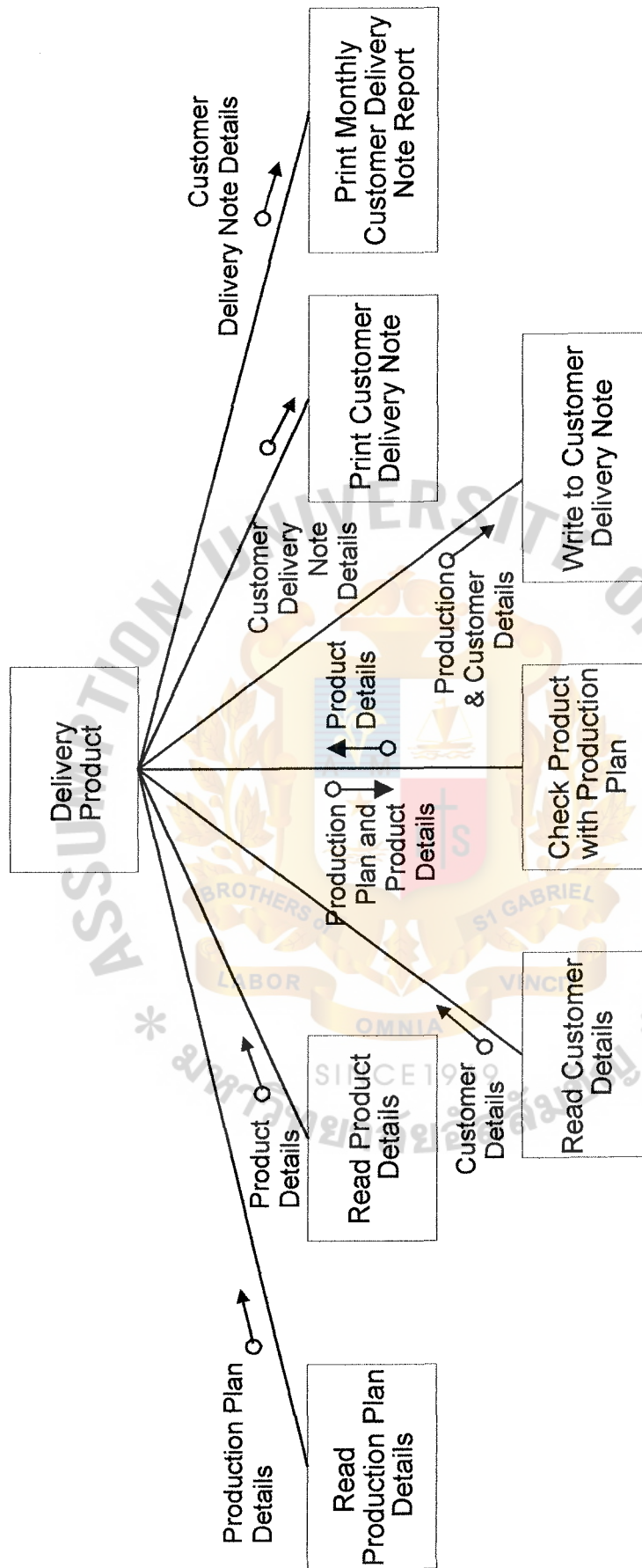
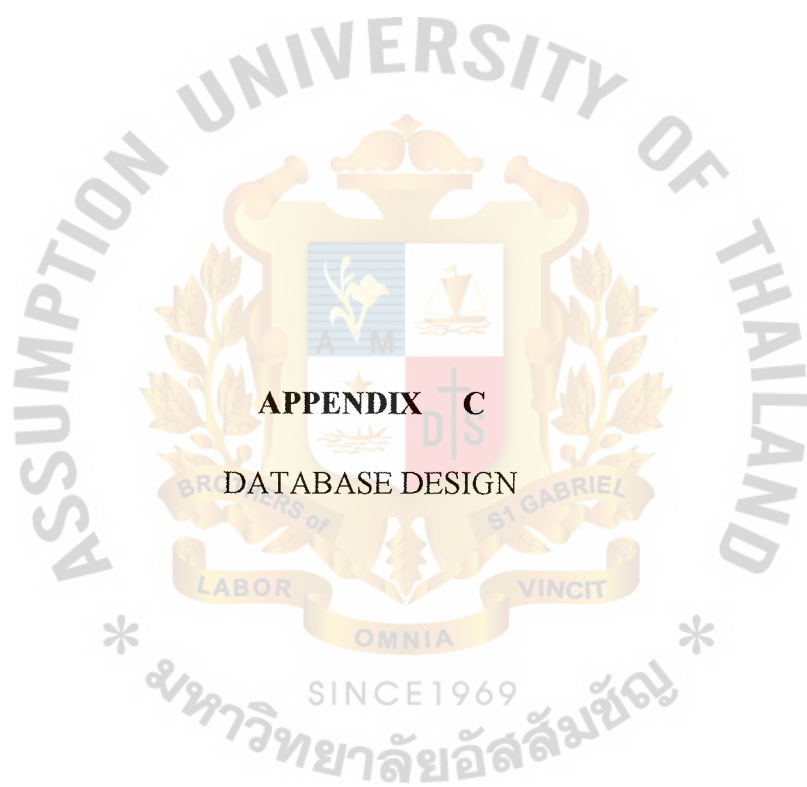


Figure B.5. Structure Chart in Delivery Product.



APPENDIX C

DATABASE DESIGN

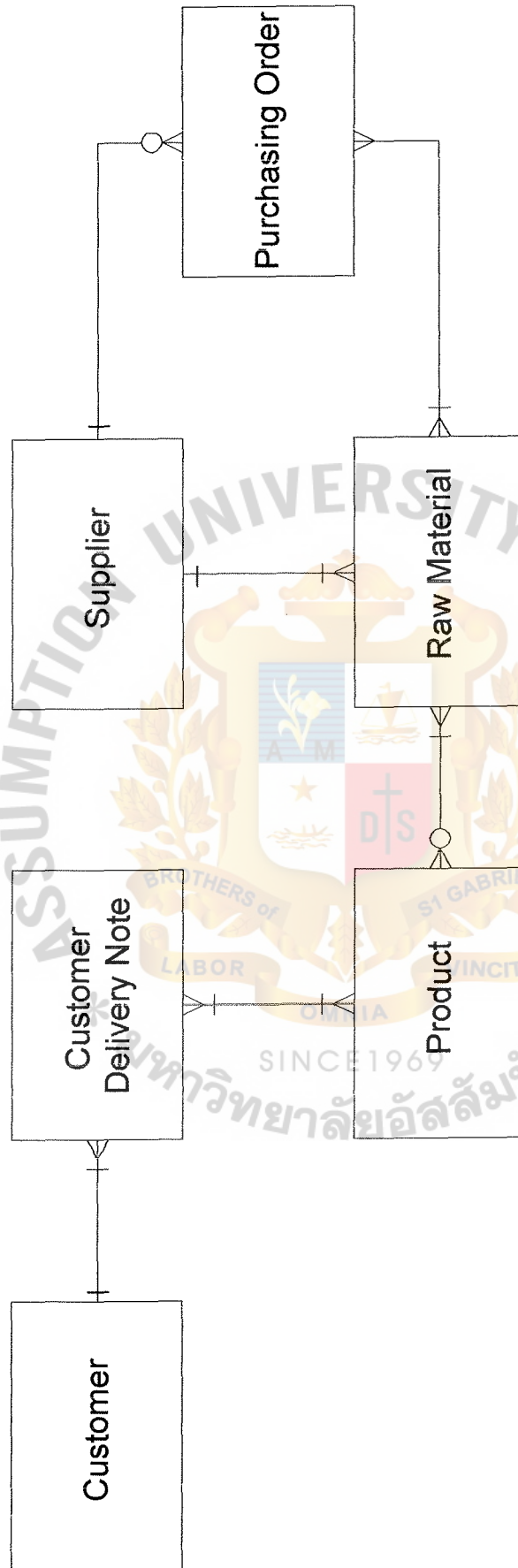


Figure C.1. Context Data Model.

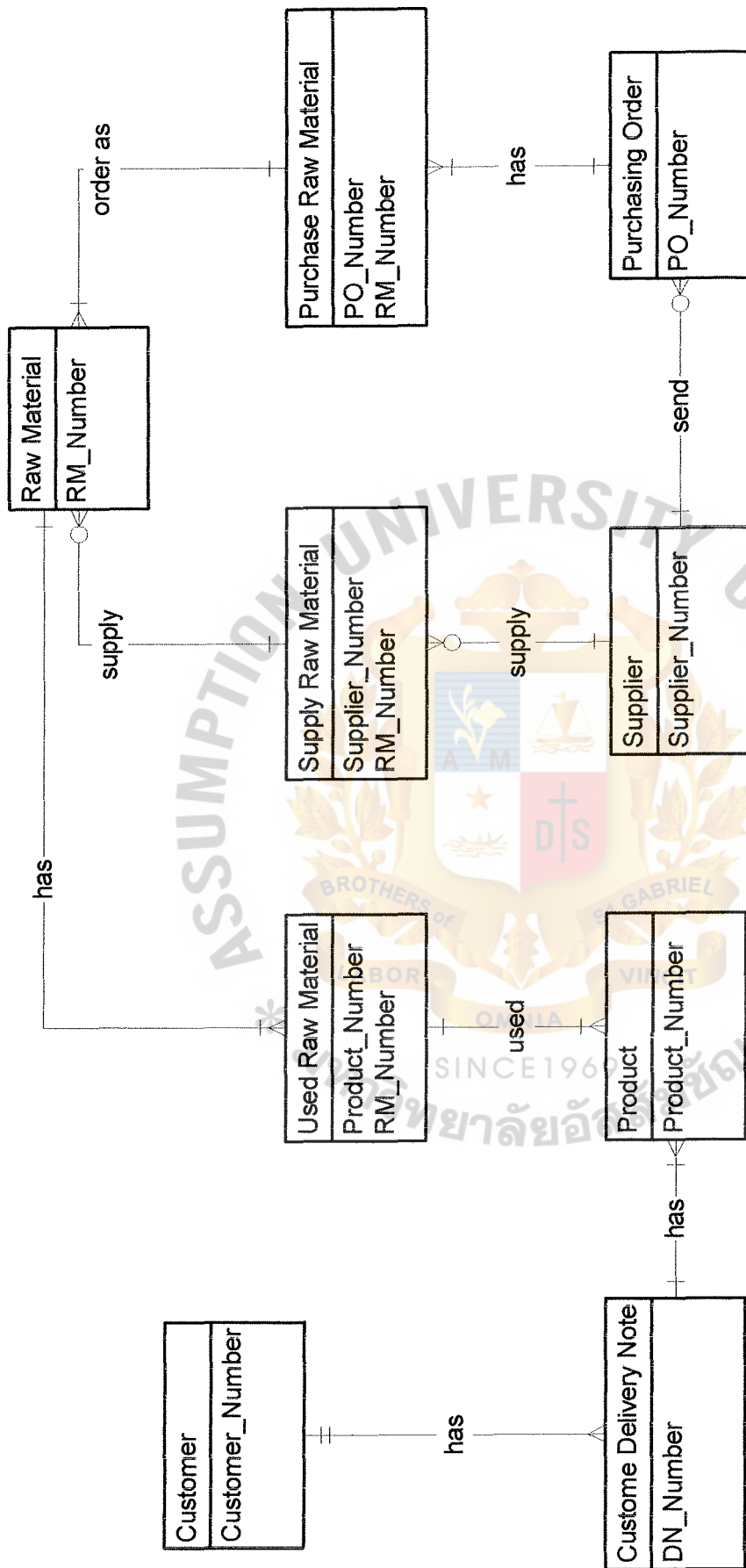


Figure C.2. Key-Based Data Model.

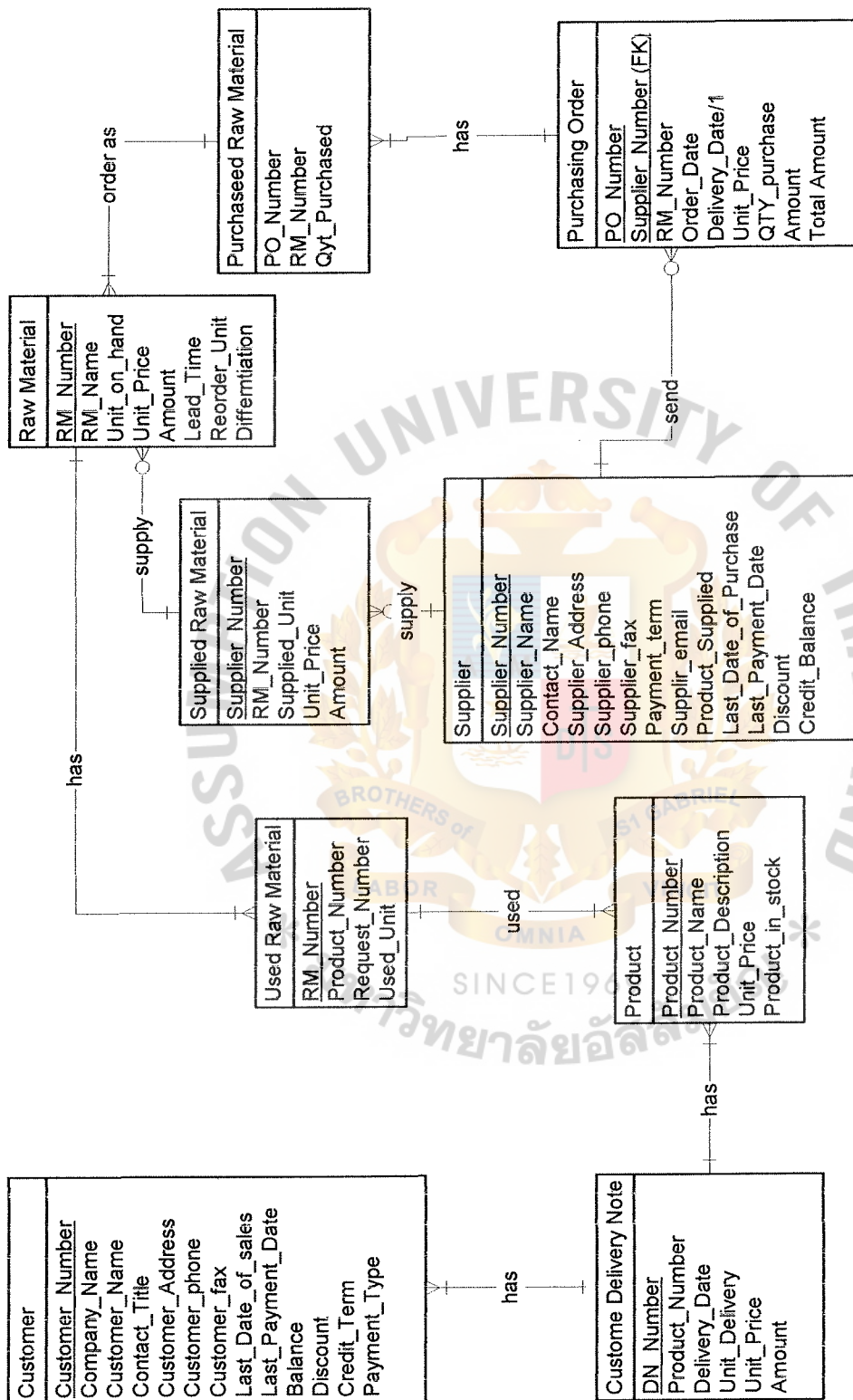


Figure C.3. Fully Attribute Data Model.

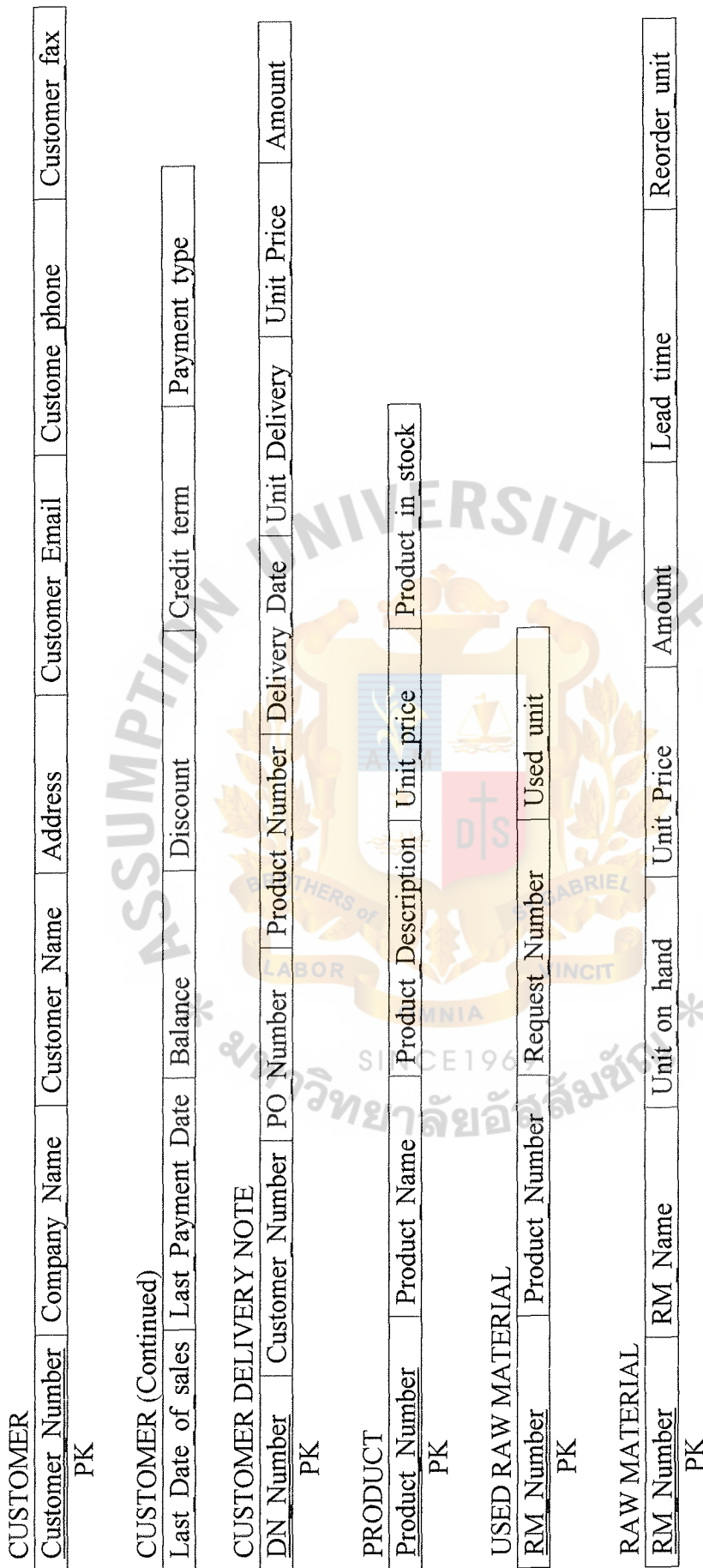


Figure C.4. Database Schema.

PURCHASED RAW MATERIAL

<u>PO Number</u>	<u>RM Number</u>	<u>QTY Purchased</u>
PK		

PURCHASING ORDER

<u>PO Number</u>	<u>Supplier Number</u>	<u>RM Number</u>	<u>Order Date</u>	<u>Delivery date</u>	<u>Unit Price</u>
PK		FK			

PURCHASING ORDER (Continued)

<u>QTY Purchase</u>	<u>Amount</u>	<u>Total Amount</u>
---------------------	---------------	---------------------

SUPPLIER

<u>Supplier Number</u>	<u>Supplier Name</u>	<u>Contact Name</u>	<u>Supplier address</u>	<u>Supplier phone</u>	<u>Supplier fax</u>	<u>Payment term</u>
PK						

SUPPLIER (Continued)

<u>Supplier_email</u>	<u>Product Supplied</u>	<u>Last Date of purchased</u>	<u>Last Payment Date</u>	<u>Discount</u>	<u>Credit Balance</u>
-----------------------	-------------------------	-------------------------------	--------------------------	-----------------	-----------------------

SUPPLIED RAW MATERIAL

<u>Supplier Name</u>	<u>RM Number</u>	<u>Supplied Unit</u>	<u>Unit Price</u>	<u>Amount</u>
PK				

Figure C.5. Database schema (Continued).



APPENDIX D

DATA DICTIONARY

Table D.1. Data Dictionary of Customer Node.

Field Name	Meaning
Customer_Name	The name of the customers company
Customer_Number	The identification number used as customer reference number
Address	The address of customer of the company
Telephone	The work telephone number
Fax_Number	The facsimile number
Email_Address	The electronic mail address
Last_Date_of_Sales	The last date that customer purchased our product
Last_Payment_Date	The last date that customer paid the bill

Table D.2. Data Dictionary of Customer Delivery-note.

Field Name	Meaning
DN_Number	The customer delivery note number
PO_Number	The identification number used as purchase order reference number
RM_Number	The identification number used as raw material reference number
Delivery_Date	The date that the company will deliver the product to the customer
Unit_Delivery	The units of product ordered by customer
Unit_Price	The price of the product by unit
Amount	The value (baht) of all products delivered to the customer

Table D.3. Data Dictionary of Product.

Field Name	Meaning
Product_Number	The identification number used as product reference number
Product_Name	The name of product that the company can supply to the customer
Product_Description	The description of product details shown in the product information records.
Unit_Price	The price of the product by unit
Outstanding_Balance	The number of product available in stock.
Delivery_Date	The date that products are delivered to the customer

Table D.4. Data Dictionary of used Raw Material.

Field Name	Meaning
RM_Number	The identification number used as raw material reference number
Product_Number	The identification number used as product reference number
Used_Unit	The amount of raw material used in production

Table D.5. Data Dictionary of Raw Material.

Field Name	Meaning
RM_Number	The identification number used as raw material reference number
RM_Name	The name of raw material used to produce the product
Unit_on_Hand	The amount of raw material available in the stock
Unit_Price	The price of the raw material by unit
Amount	The value (baht) of all raw materials
Lead_Time	The duration of the delivery from the order date to the delivery date
Reorder_Unit	The amount of raw material that must remain in the stock
Differentiation	The amount of raw material required – the amount of raw material in stock

Table D.6. Data Dictionary of Purchased Raw Material.

Field Name	Meaning
PO_Number	The identification number used as purchase order reference number
RM_Number	The identification number used as raw material reference number
QTY_Purchase	The amount of raw material purchased

Table D.7. Data Dictionary of Purchasing Order.

Field Name	Meaning
PO_Number	The identification number used as purchase order reference number
Supplier_Number	The identification number used as supplier reference number
Order_Date	The date that company ordered raw material
Delivery_Date	The date that the company will deliver the product to the customer
Unit_Delivery	The units of product ordered by customer
Unit_Price	The price of the product by unit
QTY_Purchase	The amount of raw material purchased
Amount	The value (baht) of all raw materials purchased
Total Amount	The total value (baht) of all raw materials purchased

Table D.8. Data Dictionary of Supplier.

Field Name	Meaning
Supplier_Number	The identification number used as supplier reference number
Supplier_Name	The name of the supplier
Contact_Name	The full name of the contact person
Address	The address of supplier
Telephone	The work telephone number
Fax_Number	The facsimile number
Payment_Terms	The duration allowed before executing the company or the supplier's payment processes
Email_Address	The electronic mail address
Product_Supplied	The name of the product that supplier supplied to the company
Last_Date_of_Purchased	The last date that company purchased raw material
Last_Payment_Date	the last date that company paid the bill
Discount	The discount rate for the raw materials offered to the company
Credit_Balance	The amount of money that company did not pay to the supplier

Table D.9. Data Dictionary of Supplied Raw Material.

Field Name	Meaning
Supplier_Number	The identification number used as supplier reference number
RM_Number	The identification number used as raw material reference number
Supplied_Unit	The amount of raw materials that supplier can supply to the company
Unit_Price	The price of the raw material by unit
Amount	The value (baht) of all raw materials

APPENDIX E

PROCESS SPECIFICATION



Table E.1. Process Specification of Process 1.1.

Item	Description
Process Name:	Check Material Availability
Data In:	Production Plan
	Material Detail
Data Out:	Unavailable Material Detail
Process:	(1) Receive production plan from Production department. (2) Calculate quantity of Material request. (3) Read material detail from Material file. (4) Check Material availability. (5) Record unavailable Material details to unavailable material files Record.

Table E.2. Process Specification of Process 1.2.

Item	Description
Process Name:	Print unavailable material report
Data In:	Unavailable material detail
Data Out:	Unavailable Material Detail
Process:	(1) Read unavailable material details from unavailable material files. (2) Print unavailable material report. (3) Send report to manager and production department.

Table E.3. Process Specification of Process 2.1.

Item	Description
Process Name:	Update material
Data In:	Counted material details
Data Out:	Material Details
Process:	(1) Receive counted material details from warehouse. (2) Update Material file.

Table E.4. Process Specification of Process 2.2.

Item	Description
Process Name:	Print material report
Data In:	Material Detail
Data Out:	Material Report
Process:	(1) Read material details from material files. (2) Print material report.

Table E.5. Process Specification of Process 3.1.

Item	Description
Process Name:	Get unavailable material details.
Data In:	Unavailable material details.
Data Out:	Unavailable material details.
Process:	(1) Read unavailable material details from unavailable material files.

Table E.6. Process Specification of Process 3.2.

Item	Description
Process Name:	Key-in purchasing order form
Data In:	Unavailable material details
Data Out:	Purchase order detail
Process:	(1) Receive unavailable material detail. (2) Key-in unavailable material detail in purchase order form. (3) Record purchase order detail in purchase order file.

Table E.7. Process Specification of Process 3.3.

Item	Description
Process Name:	Print purchase order
Data In:	Purchase order detail
Data Out:	Purchase order
Process:	(1) Read Purchase order detail from purchase order files. (2) Print purchase order (3) Send purchase order to supplier and send copied of purchase order to Account department.

Table E.8. Process Specification of Process 3.4.

Item	Description
Process Name:	Print Monthly Purchase order report
Data In:	Purchase order detail
Data Out:	Monthly purchase order Report
Process:	(1) Read purchase order detail from purchase order files. (2) Print Monthly purchase order report. (3) Send monthly purchase order report to manager.

Table E.9. Process Specification of Process 4.1.

Item	Description
Process Name:	Check Delivery Note with purchase order
Data In:	Delivery note
Data Out:	Delivery note
Process:	(1) Receive delivery note from supplier (2) Check delivery note with purchase order.

Table E.10. Process Specification of Process 4.2.

Item	Description
Process Name:	Check material with delivery note.
Data In:	Delivery note
Data Out:	Delivery note
Process:	(1) Receive delivery note (2) Check material quantity with delivery note.

Table E.11. Process Specification of Process 4.3.

Item	Description
Process Name:	Update stock
Data In:	Delivery note
Data Out:	Delivery note
	Material detail
Process:	(1) Receive delivery note from process check material with delivery note. (2) Update stock in material file. (3) Send copied delivery note to account department.

Table E.12. Process Specification of Process 4.4.

Item	Description
Process Name:	Print Material on hand report.
Data In:	Material detail
Data Out:	Material detail
Process:	(1) Read material details from material files (2) Print material report (3) Send report to manager and production department.

Table E.13. Process Specification of Process 5.1.

Item	Description
Process Name:	Check product with production plan
Data In:	Production plan
Data Out:	Product available detail
Process:	(1) Receive production plan from production department. (2) Check product quantity with production plan.

Table E.14. Process Specification of Process 5.2.

Item	Description
Process Name:	Key-in customer delivery note
Data In:	Product available detail Product detail Order detail Customer detail
Data Out:	Customer delivery note detail
Process:	(1) Receive product available detail from process check product with production plan. (2) Receive product detail from product file. (3) Receive order detail from order file. (4) Receive customer detail from customer file. (5) Key-in customer delivery note form. (6) Update customer delivery note file.

Table E.15. Process Specification of Process 5.3.

Item	Description
Process Name:	Print customer delivery note
Data In:	Customer delivery note detail
Data Out:	Delivery note
Process:	(1) Read customer delivery note detail from customer delivery note file. (2) Print customer delivery note. (3) Send customer delivery note to customer.

Table E.16. Process Specification of Process 5.4.

Item	Description
Process Name:	Print Monthly customer delivery note report
Data In:	Customer delivery note details.
Data Out:	Monthly customer delivery note report.
Process:	<ol style="list-style-type: none"> (1) Read customer delivery note detail from customer delivery note file. (2) Print monthly customer delivery note report. (3) Send Monthly customer delivery note report to manager.





APPENDIX F
REPORT DESIGN

EUNG-YU-HA-HENG CO., LTD.
Unavailable Raw Material Report

Date: dd/mm/yyyy

No.	RM No.	RM Name	Unit in Stock	Unit Price	Lead Time
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					

Figure F.1. Unavailable Raw Material Report.

EUNG-YU-HA-HENG CO., LTD.

Raw Material Report

Date: dd/mm/yyyy

No.	RM No.	RM Name	Unit in Stock	Unit Price	Lead Time
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					

Figure F.2. Raw Material Report.

Purchase Order Report

[illegible]

Figure F.3. Purchase Order Report.

Monthly Purchase Order Report

[illegible]

Figure F.4. Monthly Purchase Order Report

Raw Material on Hand Report

[illegible]

Figure F.5. Raw Material on Hand Report

Customer Delivery Note Report

[illegible]

Figure F.6. Customer Delivery Note Report

[illegible]

Figure F.7. Monthly Customer Delivery Note Report



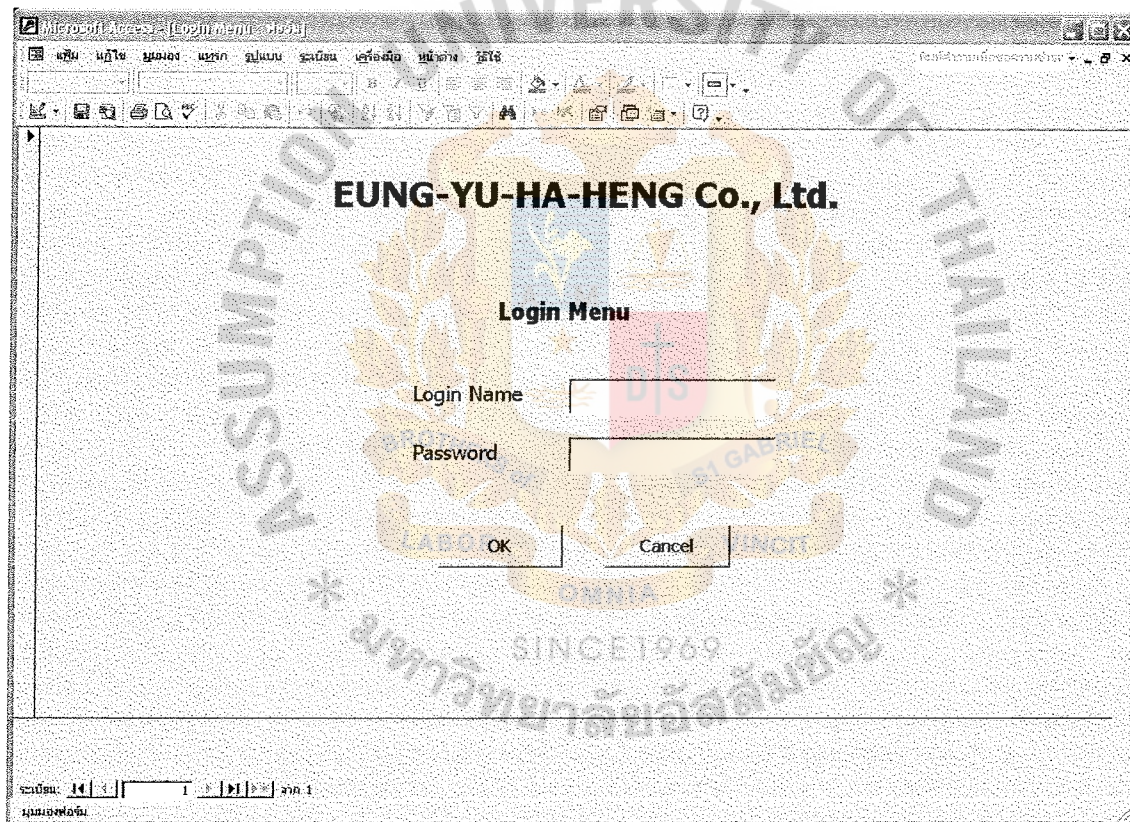


Figure G.1. Login Menu Screen.

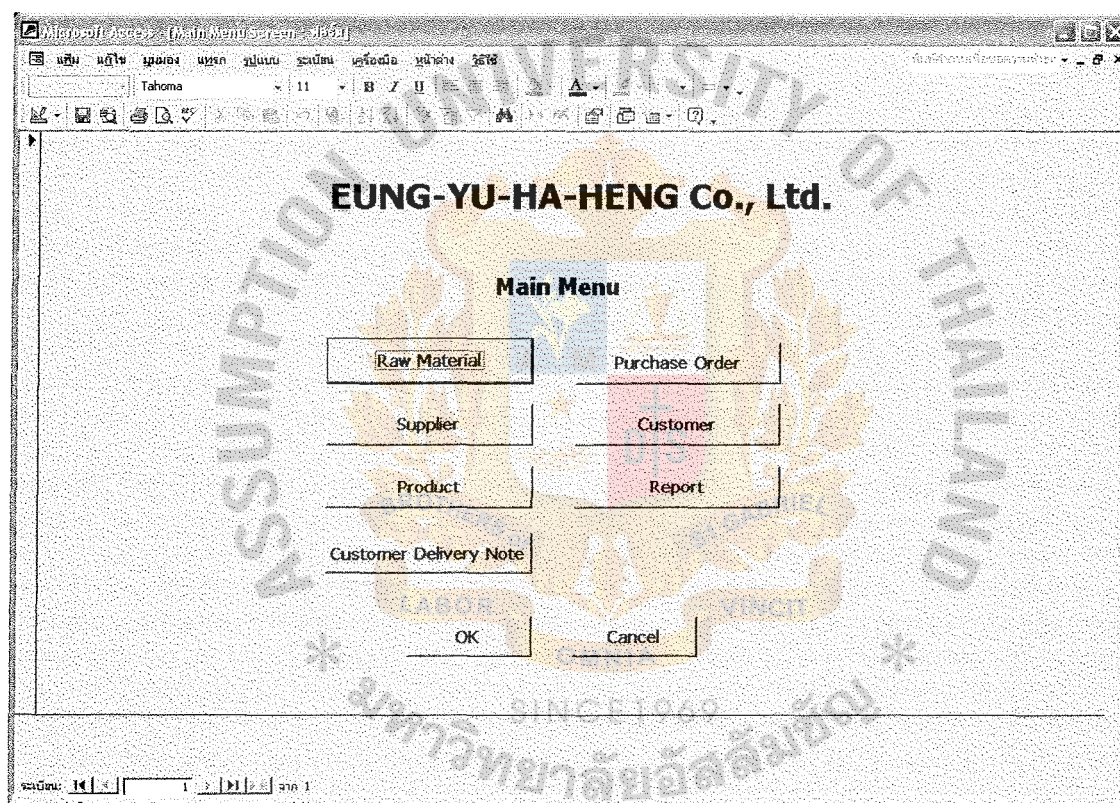


Figure G.2. Main Menu Screen.

Microsoft Access - [RawMaterial1]

MS Sans Serif 8 B U

EUNG-YU-HA-HENG Co., Ltd.

Raw Material Information

Raw Material No.	<input type="text"/>	Picture (If available)	<input type="text"/>
Raw Material Name	<input type="text"/>	Raw Material Description	<input type="text"/>
Unit Price	<input type="text"/> Baht		
Amount	<input type="text"/> Baht		
Unit on Hand	<input type="text"/> Unit (s)		
Reorder Unit	<input type="text"/> Unit (s)		
Lead Time	<input type="text"/> Day (s)		
Supplier Name	<input type="text"/>		

SINCE 1969

หน้า: 14 จาก 1

รายละเอียดเพิ่มเติม

Figure G.3. Raw Material Information Screen.

Microsoft Access - [Ray/Material]

File Edit View Database Window Help

Tahoma 10

EUNG-YU-HA-HENG Co., Ltd.

Purchase Order Information

Purchase Order No:

Customer No:	<input type="text"/>	Raw Material No:	<input type="text"/>
Unit Price:	<input type="text"/>	Supplier No:	<input type="text"/>
Quantity Purchased:	<input type="text"/>	Order Date:	<input type="text"/>
Amount:	<input type="text"/> Baht	Delivery Date:	<input type="text"/>
Total Amount:	<input type="text"/> Baht	Date Required:	<input type="text"/>

SINCE 1969

Figure G.4. Purchase Order Information Screen.

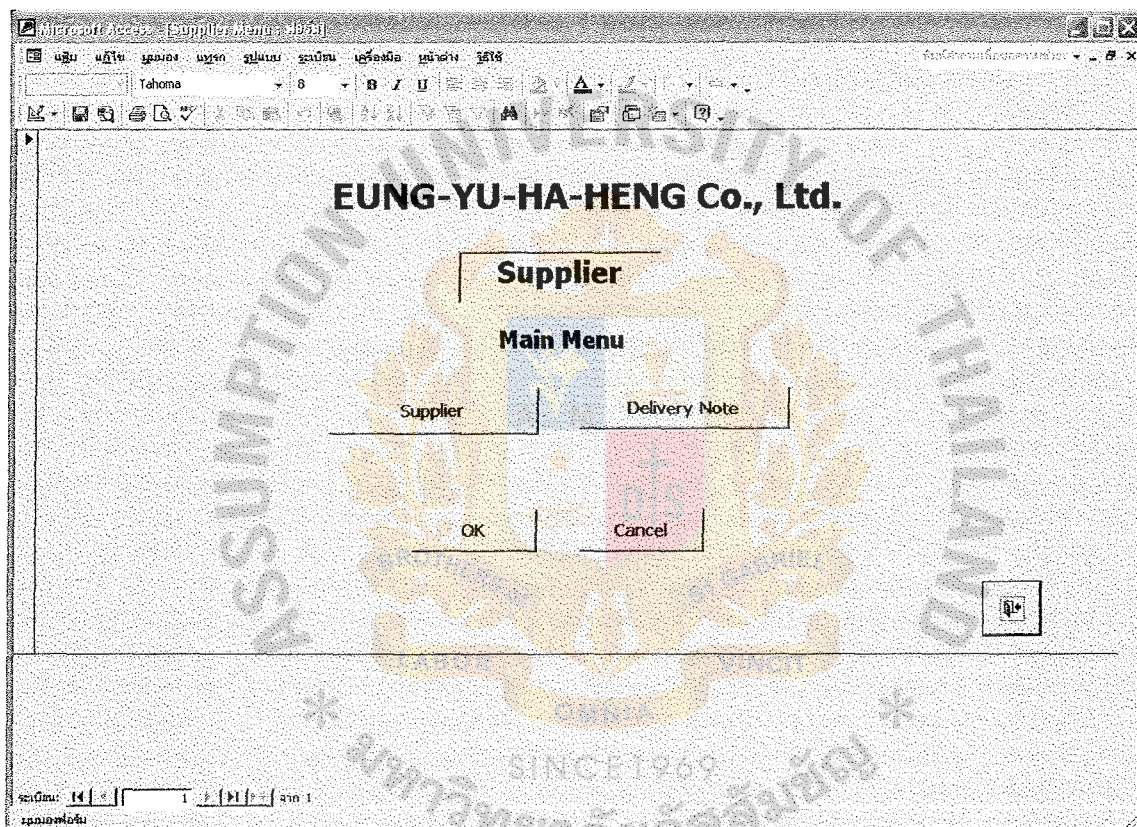


Figure G.5. Supplier Menu Screen.

Microsoft Access - Product Form - 1/1/01

Product Form

MS Sans Serif

EUNG-YU-HA-HENG Co., Ltd.

Product Information

Product No.

Product Name

Unit Price

Unit Price Box

Customer No.

Customer No.

Picture (if available)

Product Description

Edit Add Preview

สถานะ: 1/1/01

Figure G.8. Product Information Screen.

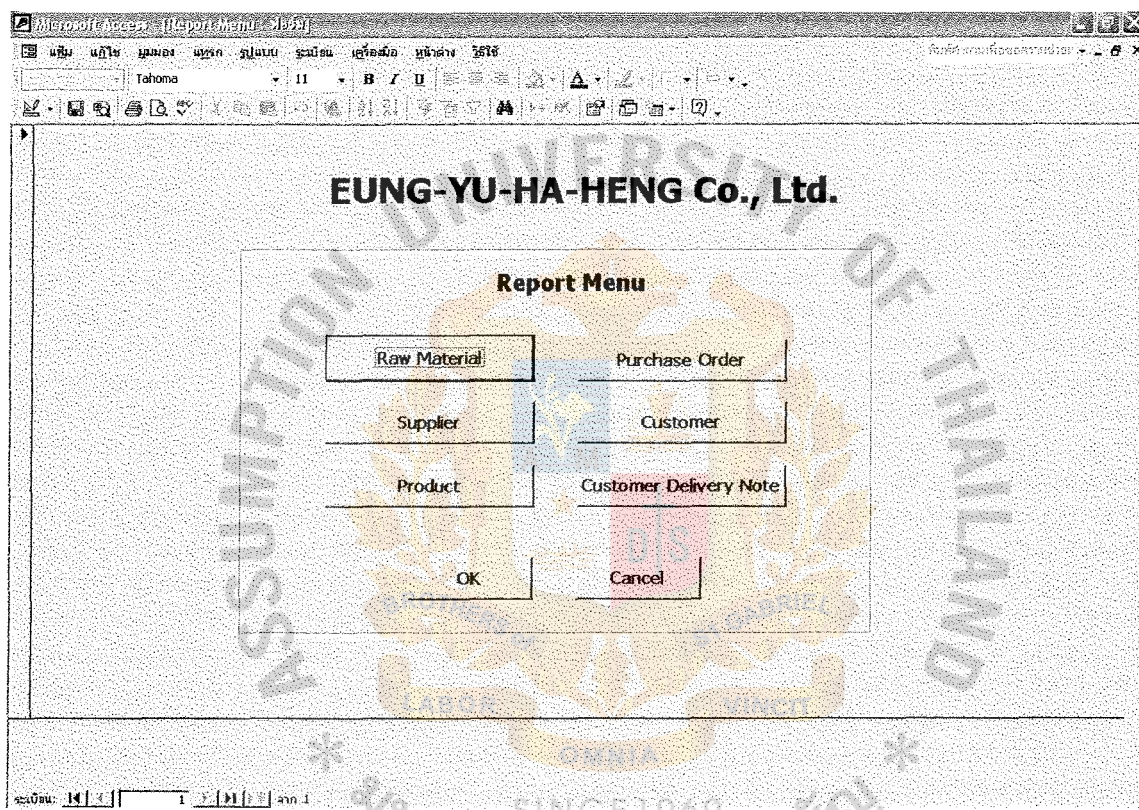


Figure G.10. Report Menu Screen



Table H.1. Payback Analysis for Candidate Solution 1, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	201,800					
Annual Operating Cost	-	19,000	20,900	22,990	25,289	27,818
Discount factor for 8%	1.000	0.926	0.857	0.794	0.735	0.681
Time-Adjusted Costs (Adjusted to Present Value)	201,800	17,594	17,911	18,254	18,587	18,944
Cumulative time-adjusted costs over lifetime:	201,800	219,394	237,305	255,559	274,147	293,091
Benefits derived from operation of New System	-	184,400	196,600	210,020	224,782	241,020
Discount factors for 8%	1.000	0.926	0.857	0.794	0.735	0.681
Time-Adjusted benefits (Adjusted to Present Value)	-	170,754	168,486	166,756	165,215	164,135
Cumulative Time-adjusted benefits over life time	-	170,754	339,241	505,996	671,211	835,346
Cumulative Lifetime time-adjusted Costs+Benefit	- 201,800	- 48,640	101,935	250,437	397,064	542,255

Table H.2. Payback Analysis for Candidate Solution 2, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	181,800					
Annual Operating Cost	-	19,000	20,900	22,990	25,289	27,818
Discount factor for 8%	1.000	0.926	0.857	0.794	0.735	0.681
Time-Adjusted Costs (Adjusted to Present Value)	181,800	17,594	17,911	18,254	18,587	18,944
Cumulative time-adjusted costs over lifetime:	181,800	199,394	217,305	235,559	254,147	273,091
Benefits derived from operation of New System	-	196,400	209,800	224,540	240,754	258,589
Discount factors for 8%	1.000	0.926	0.857	0.794	0.735	0.681
Time-Adjusted benefits (Adjusted to Present Value)	-	181,866	179,799	178,285	176,954	176,099
Cumulative Time-adjusted benefits over life time	-	181,866	361,665	539,950	716,904	893,003
Cumulative Lifetime time-adjusted Costs+Benefit	- 181,800	- 17,528	144,360	304,390	462,757	619,913

Table H.3. Payback Analysis for Candidate solution 3, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	220,000					
Annual Operating Cost	-	19,000	20,900	22,990	25,289	27,818
Discount factor for 8%	1.000	0.926	0.857	0.794	0.735	0.681
Time-Adjusted Costs (Adjusted to Present Value)	220,000	17,594	17,911	18,254	18,587	18,944
Cumulative time-adjusted costs over lifetime:	220,000	237,594	255,505	273,759	292,347	311,291
Benefits derived from operation of New System	-	184,400	196,600	210,020	224,782	241,020
Discount factors for 8%	1.000	0.926	0.857	0.794	0.735	0.681
Time-Adjusted benefits (Adjusted to Present Value)	-	170,754	168,486	166,756	165,215	164,135
Cumulative Time-adjusted benefits over life time	-	170,754	339,241	505,996	671,211	835,346
Cumulative Lifetime time-adjusted Costs+Benefit	- 220,000	- 66,840	83,735	232,237	378,864	524,055

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