



Animal Feeds Production
Information System

by

Mr. Kitti Apikeeratikul

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

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

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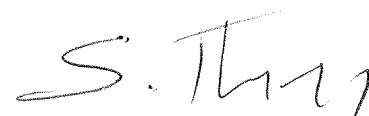
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ABSTRACT

Thai Feed Mills (Saraburi) Company Limited is an animal feed mills manufacturer, which provides high quality feed mills for the animal in Thailand. It is located in the Saraburi Province. The current production process of the company is based on a manual system. Most data are stored on papers. It requires a lot of staffs to deal with these papers. Also, the current system has problems with the time consumption and has to confront the general problems of a manual system which are human errors and high maintenance cost.

Automation is the best way to produce a consistent product and achieve a well-managed production facility. All receiving, weighing, mixing, pelleting and cooling processes are logical candidates for automation. The computerized system is one critical factor for improvement and it not only solves the current problems but also brings a more efficient and effective high performance of the high quality products. As time and service are the main considerations for the production process, a computerized system plays the role of a strong support to the company to gain a competitive advantage in the animal feeds industry.

The new proposed computerized system is developed to replace the existing manual system. After the study, the proposed system is designed to solve many problems resulting from manual operations. The Animal Feeds Production Information System discusses the user requirements, system design, hardware and software requirements, security and control and input and output reports. The new system helps reducing errors while providing a better solution for the controlling over the business processes and better management decision making.

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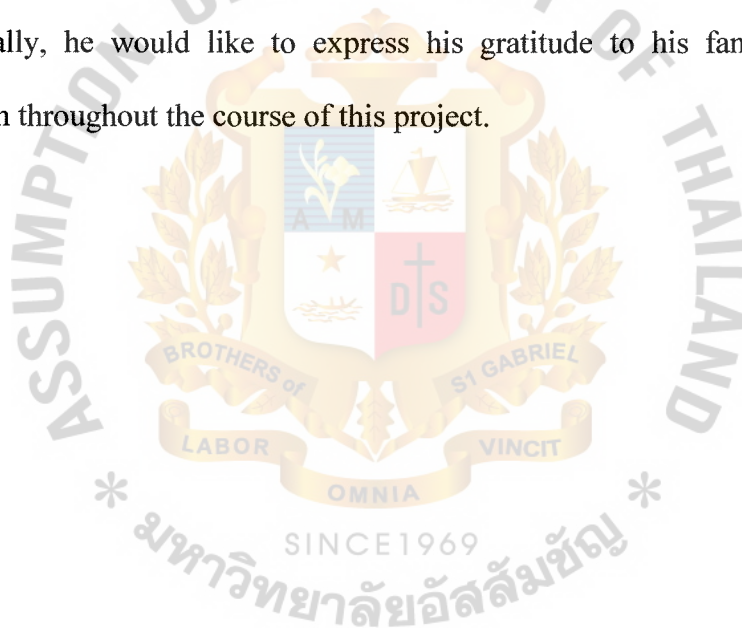


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I. INTRODUCTION

1.1 Background of the Project

Nowadays, the businesses especially in the animal feed mills industry are more competitive. High quality with the availability of the animal feeds is the major factors that directly affect the business. It should be provided to maintain the existing customers and at the same time to increase the number of the new customers. In addition to an over growing number of the animal feeds mill plants, several factors have to be combined to stress the capabilities of the animal feeds production such as shorten the production time.

The Animal Feeds Production Information System is provided for Thai Feed Mills (Saraburi) Company Limited regarding its problem of the current manual system. By using the manual system, it is subjected to the use of the operators to control the flow of the materials and the used of the documentation system. Human error is the main critical problem for the manual system because the operators have to work among the bad environment condition, especially in the control room where it is full of dust.

The computerized system is designed for the Animal Feeds Mill Production Information System for the Production Process in order to give the up-to-date information to management and workers in the system and to provide the effectiveness and efficiency of Animal Feeds Production Information System.

1.2 Objectives of the Project

The main objective of this development project is to provide new proposed Animal Feeds Production Information System that reduces repetitive manual work, operation time and also provide a good filing system.

Objectives of the project are as follows:

- (1) To analyze the existing Production Process System and to design a new system to improve the effectiveness and the efficiency of the process
- (2) To identify the current problems and user requirements of the new system
- (3) To reduce transaction cost mostly the documentation
- (4) To design and develop the computerized system that can reduce repetitive manual work and reduce the human error caused by the operators
- (5) To generate the reliability of the information via controlling procedures with completion of verification
- (6) To accelerate the period of time and minimize the response time of the system
- (7) To increase customer satisfaction by providing the availability of the products with high quality

1.3 Scope of the Project

The scope of the project covers the major parts of production process in Animal Feeds Production Information System, which can be categorized into the following functions:

- (1) Verifying User Information
- (2) Receiving Order
- (3) Verifying Formula
- (4) Production Process
- (5) Checking Product quality
- (6) Verifying Delivery Date
- (7) Report Management

1.4 Deliverables

The deliverables of the project on the new proposed Animal Feeds Production

Information System are as follows:

- (1) Data Modeling (ER Diagram)
- (2) Process Modeling (Context Diagram, Data Flow Diagram)
- (3) System Specification (Hardware and software specification)
- (4) Cost Benefit Analysis (Payback Period, Net Present Value)
- (5) Input Design (Input Screen of proposed system)
- (6) Output Design (Report from proposed system)
- (7) Process Specification (Detail of each process of proposed system)

1.5 Project Plan

This project focuses on the information system that supports Animal Feeds Production Information System to improve the effectiveness and the efficiency of the production process. The Gantt chart shows the development activities of this project with the estimated time that is assigned to each job. The total period required to develop this project is 6 months. The activities are divided into three phases and each phase consists of sub-activities as shown in Figure 1.1.

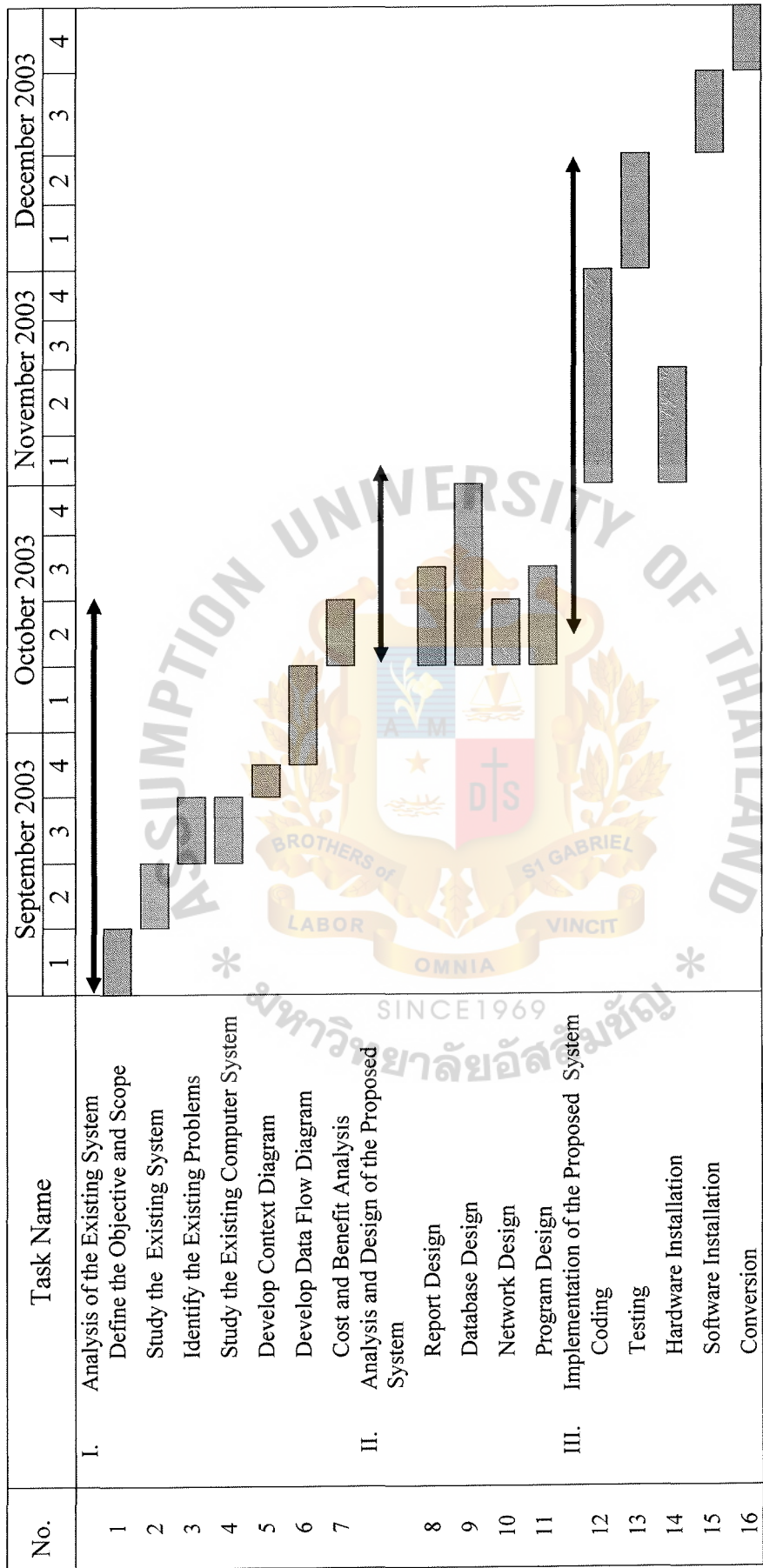


Figure 1.1. Project Plan of Animal Feeds Production Information System.

II. THE EXISTING SYSTEM

2.1 Background of the Organisation

Since 1998, Thai Feed Mills (Saraburi) Company Limited has been established in Saraburi Province. With the vision of providing customers with high quality feed mills with reasonable price.

At present, TFM still uses the manual system for the production process, which means that the entire system is not linked together and all the documentation is presented through paper work. However, for the future expansion, competition, the company decided to improve the existing system to become a computerized system.

There are totally 6 major departments in the TFM.

(1) Marketing Department

The Marketing department is mainly responsible for handling all transactions. Their responsibility is to make the production plans and the marketing strategies.

(2) Financing and Accounting Department

The major responsibility is to collect the payment of the customers and control all budgets involving the report generation. They also support the other departments by providing the useful information to them.

(3) Engineering Department

Engineering Department is subjected to design the production plan for the organization. The consideration of each machine with regards to its capacity to optimum the total production is provided to the production process such as machine selection, installation, maintenance, supportive of the technical solutions.

(4) Purchasing Department

Purchasing department is responsible for handling all of order processing and checking the status of the production. The use of the high technology machines in regards to this department. They also contact the suppliers for making the raw material order in case the raw material runs out.

(5) Inventory Department

Controlling the availability of the raw materials and the finished products is concerned with this department. They are linked directly through the Purchasing Department and the Finance and Accounting Department.

(6) Production Department

The major responsibility of this department is to produce the products according to customer's orders and formulas. This department is the major factor of the company. Quality Control (QC) and Formulation are sub-department of the Production Department.

(7) Delivery Department

This department is managing the finished products to be distributed to the customer according to the order.

(8) Nutrition Department

Generating the formula is the major responsibility for this department. Each customer has his own formula description. The company has to produce the animal feeds product according to the customer request.

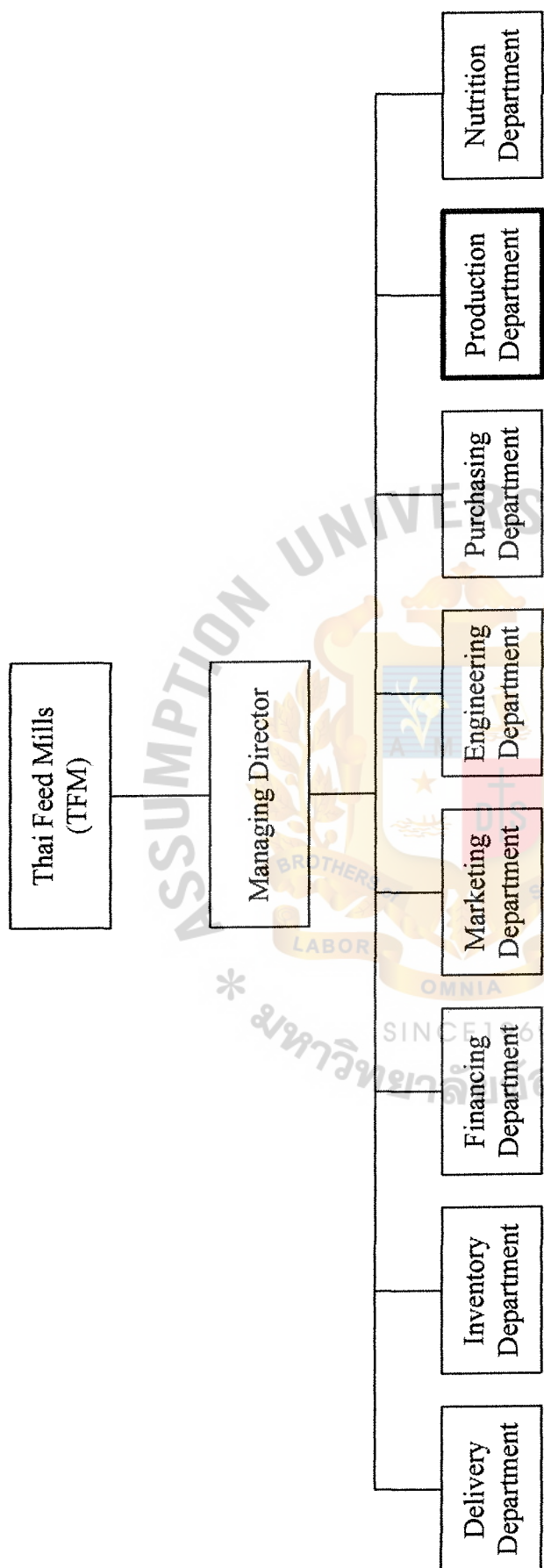


Figure 2.1. Organization Chart of Thai Feed Mills (TFM) Company.

2.2 Existing System and Business Functions

The main functions of the existing Animal Feeds Production are as follows:

(1) Checking User Process

Checking user process is concerning the checking User information.

For controlling the production process, the user has to make the identification towards the system such as username and password. The user information will directly be saved to the system. If it is the new user, he has to make new user information.

(2) Receiving Order Process

Staff will have to check for every order from the production manager whether it can be made, if not the request will be rejected. The staff will have to check for the availability of raw materials for producing the product. If there is not enough material for producing, the staff has to inform or postpone the customer about the order. If the order has been accepted, the staff will issue order receipt to formulation department and customer.

(3) Production Process

Operators in the control room will have to take the formulation slip with the number of the batch produced. They have to update the information of each step from the beginning of the production, weighing, through mixing, pelleting, and cooling until it becomes finished product. They have to write down the information into the form.

(4) Transferring Process

The finished products will be transferred to inventory. The information is kept in the paper form and sent to the inventory department for updating. Customers will bring the order receipt to check out their

product. Staff will use details on the order receipt to check for the order information.

All of these processes are done manually and the data is kept on paper.



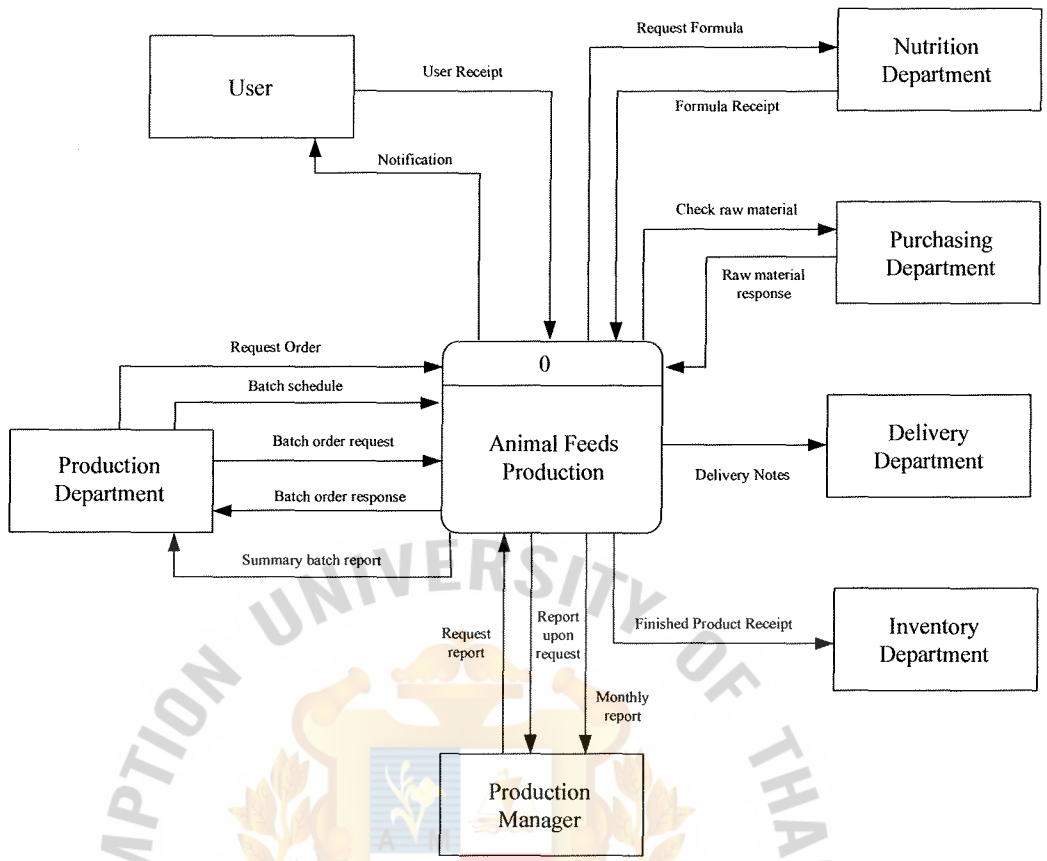


Figure 2.2. Context Diagram of the Existing System.

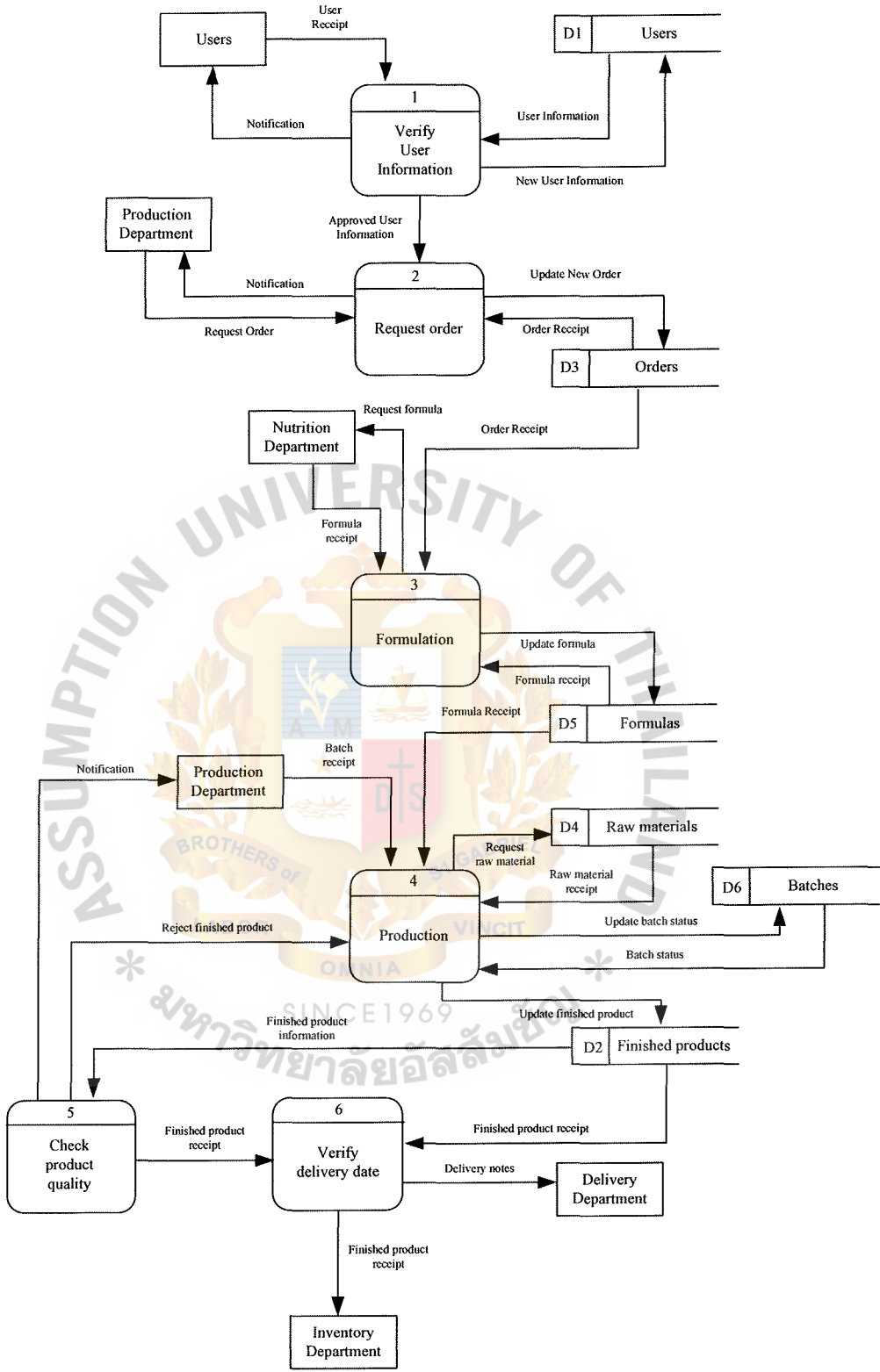


Figure 2.3. Data Flow Diagram of the Existing System.

2.3 Current Problems and Areas for Improvement

Most functions of the existing system are operated manually. Several problems have been found in the Animal Feeds Production system. All of the processes such as checking customer information, receiving order, production process, transferring process, and report management process are fully operated by humans and entirely made through paper work documentation.

The following problems are always found during the processes:

(1) Human Errors

Many human errors are the major critical problem being found during the production process in manual system. The operators are always tired due to the environment condition where it is full of dust and the bundle of paperwork load on their table and the overtime required to complete their repetitive work. Mistakes are mostly found such as operators input wrong information or check out the wrong request to the wrong formula or selecting wrongly of the raw material bins.

(2) Loss of important data and data inaccuracy

On the manual basis, data is stored on paper hence it may result in data inaccuracy. It can sometimes be damaged and destroyed. Sometimes formula data and batch receipts are lost. Those data are one of the company's assets, which should be kept securely and confidentially. They are related to other transactions, report generation and so on.

(3) Slow and inefficient information processing

Regarding to the human error and the loss of important data which occurred in the existing manual system, slow and inefficient for information processing is rather hard to quickly access useful information due to the

overwhelming amount of documents that have to be searched and referenced through the records keeping on paper. It causes a delay in the production process. As time and quality are main successful factors of the business, the manual system cannot provide the efficient use of time for the production. This problem may lead to the loss of competitive advantage over the competitors.

(4) Difficulty of making statistical reports

Since the production is completed manually, data is scattered, unmanaged and huge. It takes time for the collection to make the summary reports. Top management could not forecast for a long-term planning due to inaccurate and insufficient information. Decision making is made inefficiently.

The important areas of systems can be defined as changes that will result in incremental yet worthwhile benefits. All sections need to improve according to the company mission. The proposed system, a computerized system, will play a major part to develop the current manual system to be more efficient and effective. Moreover, the criteria for the improvement of the new computerized system can be specified as follows:

(1) Improvement of the data accuracy

To improve the accuracy of data, the computerized system can assist the operators by reducing the error of inputting data of production process. The incorrect information must show the error alarm through the system when the operators perform wrong transactions.

(2) High security of information

To improve the security of the information, the computerized system

will provide authorized access to the operators. Unauthorized access is definitely prohibited to the computerized system.

(3) Increasing in speed of the production process

Streamlining the processes is done to speed up the production process. Both unnecessary manual works and duplication of the processes will be eliminated. The proposed system can reduce the workload of the operators by using computerized technology.

(4) Centralized data storage

To improve storage of records and retrieve information by using the computerized technology. Since relevant information must be stored in a database, the operator can track as well as query any information from the database in less time by using My SQL Database. It is quite easy for updating and maintaining data because the necessary data will be centralized and kept in the main storage facility.

(5) Fast decision making with quick response

To improve inventory control, the proposed system must have a better stock control system. Hence, the staff can keep track of the products quickly. The computerized system must generate outputs and reports relating to data input in order to provide optimal accuracy of outputs. Moreover, the decision-making at the top management level will become more efficient and effective.

(6) Availability of the statistical reports

By using computerized system to provide statistical reports, the reports must be generated from the system. The statistical reports help top management to forecast the future production and planning the marketing.

III. THE PROPOSED SYSTEM

3.1 User Requirements

The conclusion is made after discussions with the concerned users. Major function of the company's business especially in production process should be replaced with the automation system, computerized system. Standard procedures of many processes should be defined in order to increase the efficiency and effectiveness of the company.

Statistical reports provided by the computerized system are given to the management to help forecasting the future production and planning the marketing strategies.

By replacing manual system with computerized system, the new system will revolutionize the company's reputation and competitive advantages over other animal feed mills companies in the future.

3.2 System Specifications

The proposed system is the new system that is created to solve many problems of the existing manual system. From the analysis of the existing system, both process and resources and the problems found, the key functions need to be a proposed system that has a well-designed database organization that easily retrieves valuable and analytical information. Furthermore, the proposed system also covers additional functions that enhance the high capability of the company. The system specifications are as follows:

- (1) To create a better quality of the products and to increase the effectiveness of the production process
- (2) To minimize or eliminate the number of human errors
- (3) To provide user-friendly interfaces
- (4) To speed up each transaction process

- (5) To enhance the efficiency and effectiveness of each process
- (6) To generate reliable information via control procedures
- (7) To create information in the various kinds of forms without doing duplication of work
- (8) To provide necessary information more rapidly
- (9) To provide more accurate information to all concerned users

3.3 System Design

Application architecture in terms of data, process, interfaces and networks has been designed, before specifying technical solution for system component.

(1) Network Architectures: Two Tier Client/Server Architecture

The company applies the local area network (LAN) to connect one server and three client computers under the two-tier client/server architecture. By using UTP CAT5E to connect the network, the data transfer is up to 100 Mbps. This architecture places the information system's stored data on a database server and the business logic and users interfaces on the clients.

(2) Data Architecture: Relational Database Technology

The company prefers to use the relational database technology, Relational Database Management Systems (DBMS). It applies the relational database. The benefits of a database that has been designed according to the relational model are numerous as follows

- (a) Data entry, updates and deletions is efficient.
- (b) Data retrieval, summarization and reporting is efficient.

- (c) Since the database follows a well-formulated model, it behaves predictably.
 - (d) Since much of the information is stored in the database rather than in the application, the database is somewhat self-documenting.
 - (e) Changes to the database are easy to make.
- (3) Interface Architectures: Online Processing and Graphical User Interface (GUI)

The company implements the client-server application, which is the on-line processing, that provides for a conversational dialogue between the user and computer. Business transactions and inquiries are well processed when they occur. Errors are identified and corrected more quickly. Data editing and output formatting occur on client computers.

- (4) Process Architectures: Software Development Environment for Two-Tier Client/Server

The company prefers Delphi Enterprise Studio v7.0 for developing software language and tools that is used to develop the business logic and application programs.

Delphi Enterprise Studio v7.0 is the most productive tool for creating high performance enterprise. Integrated Visual Data and RAD environment promote productivity while native code compilation provides fast application. It is GUI application, which associated system events, such as mouse-clicks.

- (5) Database Design

In designing the database, the detailed description of the database will be created to meet the current and the future needs of the company. So the

objectives of the database design are as follows:

- (a) The availability of the data to support the operation
- (b) The availability of data towards the management decision making
- (c) The accuracy and consistency of data
- (d) The data must be efficiently stored, updated and retrieved.

The proposed database system is created to provide accurate information, timely information to operators, whereby, they will be stored and managed with the most effective database technology, the relational database model.

The database of the proposed system consists of 6 tables to record all data for the system. Those tables include the following:

- (a) User Table
- (b) Finished Product Table
- (c) Order Table
- (d) Raw Materials Table
- (e) Formula Table
- (f) Batch Table

The detail of database design is shown in Appendix A.

(6) User Interface Design and Prototyping

Graphic User Interface (GUI) Screen Design is conducted. Data validation is considered. Before input data is getting through the database, internal control of GUI program is used to ensure that data input to the computer is accurate and that the system is protected against accidental and intentional errors and abuse, including fraud. See Appendix E for GUI Screen Design.

(7) Output Design and Prototyping

The output design is also important, the project team designs the output that follows business requirement such as a Printing reports.

There are two basic types of computer outputs, which are:

(a) External output: Notification: Displays the detail of information which provided to inform the customer.

(b) Internal output which are two types of reports for different purposes

(See Appendix F)

(1) Summary of Batch report: displays details of the number of batch being produced from the production process.

(2) Production monthly report: displays the details of raw material being used in the production process together with the number of finished products being produced.

(8) Software Design

After the project team designs the databases, inputs and outputs, software design can proceed. A popular strategy for determining a modular design for program is structured design. The details of process modeling are shown in Appendix B.

In order to provide the satisfaction system, three candidates of the system requirement are proposed for the solution of the system. The detail of those candidates and their various characteristics are shown as follows.

3.3.1 Candidate Solutions

(1) Alternative Candidate

Table 3.1. Candidate System Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
<u>Portion of system computerized</u> Brief description of that portion of the system that would be computerized in this candidate.	Developed own application software. Fully supports all user requirements in terms of both functionality and business process. This solution also provide more powerful and more flexibility to expand the portion of system to support other operation.	Hiring outsourcing company who provide all applications. Fully supports all user requirements in terms of both functionality and business process.	Beta Raven, Feeds Automation System. A Package application developed for specific purpose. Fully supports all user requirements in terms of both functionality and business process.
<u>Benefits</u> Brief description of the business that would be realized for this candidate.	Easy to develop and implement and fully support all user requirement	High technology & technical support	Quick implementation and meet business required
<u>Servers and workstations</u> A description of the servers and workstations needed to support this candidate.	Server : Dual 1.2 GHz Pentium III processor (2CPU), 40GB. HDD, Cache 1 GB., RAM 512MB ECC SDRAM , 1.44 MB Floppy Drive, With Windows 2000 Server Client : Pentium IV 1.8GHz, 20 GB HDD, Cache 1 GB, RAM 128 MB., 1.44 MB. Floppy Drive, with MS Windows XP Professional	Same as Candidate 1	Same as Candidate 1
<u>Software Tools needed</u> Software tools needed to design and build the candidate Not generally applicable if applications software packages are to be purchased.	Delphi Enterprise Studio v7.0 Microsoft Access 2000, Windows 2000	Developer 2000 Personal Oracle 8.0	Visual Basic 6 Microsoft Access 2000, Window 2000
<u>Application Software</u> A description of the software to be purchased, built, accessed, or some combination of these techniques.	Custom Solution	Custom Solution	Custom Solution

Table 3.1. Candidate System Matrix (Continued).

Characteristics	Candidate 1	Candidate 2	Candidate 3
<u>Output Devices and Implications</u> A description of output devices that would be used, special output requirements	Printer (dot matrix & laser jet)	Same as Candidate 1	Same as Candidate 1
<u>Storage Devices and Implications</u> Brief description of what data would be stored, what data would be accessed from existing stores, what storage media would be used.	MS Access 2000 DBMS with 20 GB storage capacity	Oracle DBME with 20 GB storage capacity.	MS Access 2000 with 40 GB storage capacity.
<u>Input devices and Implications</u> A description of input methods to be used, input devices (e.g., keyboard, mouse, etc), special input requirements (e.g., new or revised forms from which data would be input), and input considerations(e.g., timing of actual inputs).	Keyboard & mouse	Keyboard & mouse	Keyboard & mouse
<u>Method of Data Processing</u> Generally some combination of : on-line, batch, deferred batch, remote batch, and real-time.	Database stored on server and process on workstation	Oracle uses a two-tier Client/Server architecture with a powerful database server	Database stored on server and process on workstation

Table 3.2. Feasibility Matrix.

Characteristics	Weight	Candidate 1	Candidate 2	Candidate 3
Operational Feasibility	30%	<p>Fully supports user required functionality.</p> <p>Many users and management highly accept this solution. They are convinced that this solution will meet all their requirements by using not too long time of development and implementation. IT can also be expanded easily to support other functions in the future.</p> <p>SCORE : 90</p>	<p>Supports user required functionality only partially</p> <p>Many of users and management accept this solution, as it all supports their requirements. But they afraid that the system can not be expanded to support other functions in the future.</p> <p>SCORE : 75</p>	<p>Supports user required functionality only partially but more than Candidate 2</p> <p>Many of users and management accept this solution, as it all supports their requirements. But they afraid that the system can not be expanded to support other functions in the future.</p> <p>SCORE : 80</p>
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%	<p>Programmer is familiar with Microsoft products therefore this reduces development process.</p> <p>Ms Access 2000 for both client and server. This solution is using Ms-access, which has been understood by current system so it decreases software and training cost.</p> <p>SCORE : 90</p>	<p>Most of the application development is outsource. The problem with this approach is that expensive consultants must be hired to put the system into operation and for periodic checks. Also personnel have to be trained</p> <p>SCORE : 75</p>	<p>Package Application is a standardized application. When it is purchased, the development is to be made in order to adapt and increase the efficiency and the effectiveness of the system. Most of it is developed in-house leading to a high development cost.</p> <p>SCORE : 80</p>

Table 3.2. Feasibility Matrix (Continued).

Characteristics	Weight	Candidate 1	Candidate 2	Candidate 3
Schedule Feasibility An assessment of how long the solution will take to design and implement	10%	4 Months SCORE : 85	5-6 Months SCORE : 80	2-3 Months SCORE : 90
Economic Feasibility Cost to develop:	30%	1,099,000	2,070,500	1,149,832
Payback periods (discounted)		1 years and 6 months	3 years and 1 months	2 years and 3 months
Net present value		2,208,716	1,148,740	1,242,295
Detailed Calculations :		See Appendix D SCORE : 85	See Appendix D SCORE : 80	See Appendix D SCORE : 75
Ranking	100%	89	77	79

Candidate 1 is selected as a target system. The main purpose of this target system is to fully support the user required functionality and system owner satisfaction. The best candidate will be selected based on the cost, benefits, payback period, return on investment, and net present value. The selected system should provide the benefits to the present Animal Feeds Production Information System as follows:

- (a) The application for the new system can be easily obtained and there are varieties of choice to select from. The application such as Microsoft Access will lead to lower application expense than propriety application.
- (b) All the functions are displayed by GUI, which is ease of use and nice graphic display. The system users and system owner will be highly satisfied.
- (c) Some of training course is provided to the new system because all the information and system guide can be easily obtained or searched for. In addition, the new system can be learnt and understood by the users

themselves. Thus, the suggested system will not have any additional training cost incurred.

- (d) The new DBMS is located at the server. It is capable of calculating and selecting the best way to draw information from database. Therefore, all data are retrieved very quickly from the database without any traffic problem.
- (e) The DBMS at server supports and allows multi-user to retrieve information from database simultaneously. While the DBMS located at the client does not support multi user, there will be traffic jam at one terminal, and the work of Database Administrator will be more sophisticated to distribute the requested information from various users.



3.4 Hardware and Software Requirements

The proposed Animal Feeds Production Information System will be developed In the form of windows based. Delphi Enterprise Studio v7.0 and Microsoft Access 2000 is the major software tools used to develop the input and output design of the system.

The proposed system requires 1 set of computer server and 1 set of computer software which are comprised of Windows2000 Server Family, Microsoft Windows Access 2000, Microsoft Windows Office 2000 Professional and Borland Delphi Enterprise v7.0. The hardware & software specifications for the server are shown in the Tables 3.3 and 3.4 respectively.

Table 3.3. The Hardware Specification for the Server.

Hardware	Specification
CPU	Dual 1.2GHz Intel Pentium III Processor (2CPUs)
Memory	512 MB ECC registered SDRAM PC133
Cache	1 GB or Higher
Hard Disk	40 GB
CD-ROM Drive	54x CD-ROM Drive
Floppy Drive	1.44 MB diskette drive
Network Adapter	2 Intel 82550 LAN Built-in (10/100Mbps)
Display Screen	15" SVGA Monitor res. 1024x768 @85Hz
Display Adapter	SVGA Card
Keyboard	USB Internet Keyboard
Mouse	Internet Scroll Mouse
UPS	UPS 1000VA

Table 3.4. The Software Specification for the Server.

Software	Specification
Operating System	Microsoft Windows 2000 Server Family
Database Software	Microsoft Access 2000
Application Software	Microsoft Office XP Professional Edition
Developing Software	Borland Delphi Enterprise Studio v7.0

The proposed system requires 6 sets of computer client and 6 sets of computer software which are comprised of Microsoft Windows XP Professional Edition, Microsoft Windows Office 2000 Professional.

The client machines should be at least standard to support Microsoft Windows XP professional. The hardware & software specifications for each client machine are shown in the Tables 3.5 and 3.6 respectively.

Table 3.5. Hardware Specification for Client Machine.

Hardware	Specification
CPU	Intel Pentium IV Processor 1.8 GHz.
Memory	128 MB 100 MHz SDRAM
Cache	1 GB or Higher
Hard Disk	20 GB
CD-ROM Drive	54x CD-ROM Drive
Floppy Drive	1.44 MB diskette drive
Network Adapter	Intel LAN built-in (10/100 Mbps)
Display Screen	17" SVGA Monitor res. 1024x768@85Hz

Table 3.5. Hardware Specification for Client Machine (Continued).

Display Adapter	SVGA Card
Keyboard	USB Internet Keyboard
Mouse	Internet Scroll Mouse
UPS	UPS 700 VA

Table 3.6. Software Specification for Client Machine.

Software	Specification
Operating System	Microsoft Windows XP Professional
Application Software	Microsoft Office XP Professional Edition

Other important hardware required for the proposed system is switch, network printer and cable. The specification of this hardware is shown in Table 3.7.

Table 3.7. Other Hardware Requirement.

Hardware	Specification
Hub	1 set of 26-port switching hub (managed)
Cable	LAN Cable UTP CAT5E
Printer	2 set of Dot Matrix Printer, 1 set of Laser Printer

The network configuration of the proposed Animal Feeds Production Information System is shown in Figure 3.1.

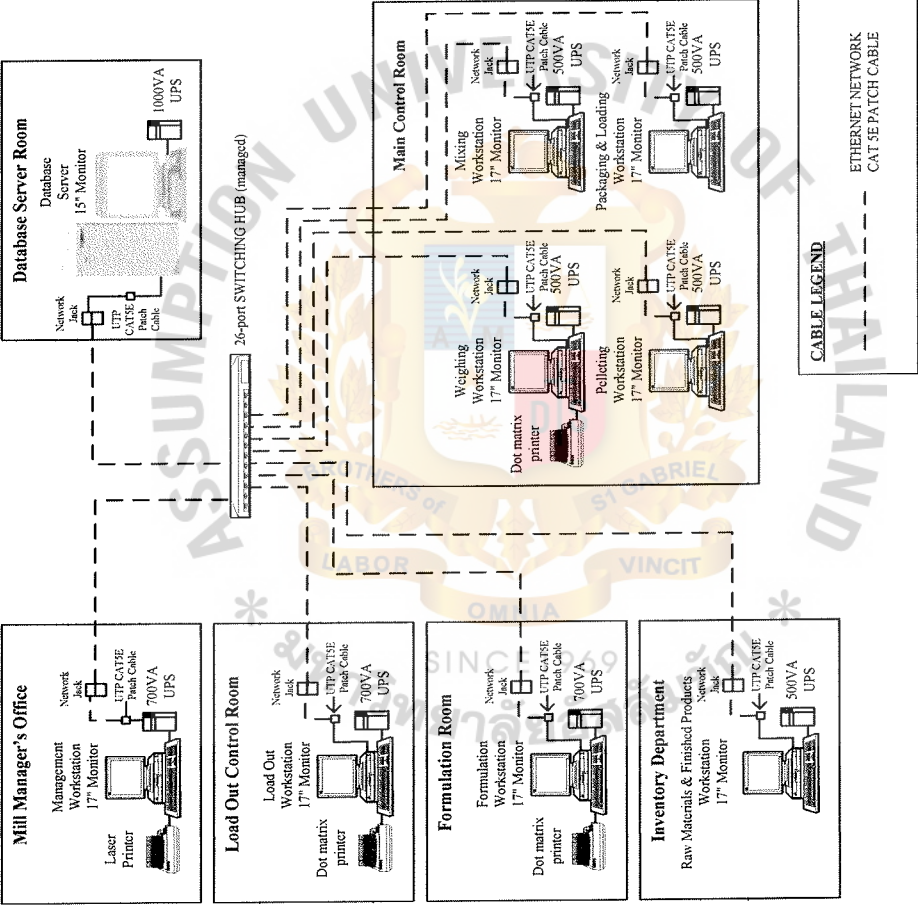


Figure 3.1. Network Configuration of the Proposed System.

3.5 Security and Control

System security is taken into consideration as an important factor in system design. Major objective of the information development is to gain the competitive advantage. Without good security control, the information system may backfire on the company. Computer downtime caused by the insider could lead to poor service. Or if the competitors could access the company information, it would lead to the loss of the company.

The aim of security control is to ensure that valuable business data will not be subject to unauthorized access, change or destruction. The controls are required for the data both at the time when they are in use and when they are being held for storage.

Following are the recommended practices to be implemented for the security control of the proposed system:

(1) To Protect against Unauthorized Access

In order to access the system, each operator must have their own login names and password, whereby passwords must be changed regularly to prevent the risk exposure. And fail to login for three times, the user login name will be automatically locked to prevent unauthorized access.

(2) Enforcement of Least Possible Privilege

This is to ensure that the system user can only access to the information that are required for their work with the appropriate access level. For example, operator could only select the request formula but unable to edit the formula. So each user will be able to access only certain information at the level appropriate to their job.

(3) Eliminate Computer Downtime

Computer downtime could accidentally damage the system. Hence,

the powerful tools such as UPS will be provided to the system in order to prevent the damage of the computer and the network.

(4) Control Configuration and Setting

Users should not be authorized to change the configuration and the setting of the system. System should be periodically (3-4 months) monitored and audited to prevent loss or damage that may be caused by the change of the configuration and setting.

(5) To Protect Against Physical Destruction

Physically, the computer server should be placed at a secure place in a room with authorized access in order to prevent the system from both physical destruction and unauthorized access. The database server should be well placed in a separate room in order to avoid any physical destruction.

(6) To Protect Against Loss of Data

The database backup procedure must be scheduled (once a week) and well placed at the safe place. This is to ensure that the database can be recovered anytime the damage occurred to the database. One of the good back up solution is to attach the CD-ROM writer into the database server.

3.6 Cost and Benefit Analysis

In Cost and Benefit Analysis step, the information concerning the cost and benefit of the proposed system will be estimated. This is to support the management decision.

(1) Cost of Manual System

Cost of the system could be classified into 2 categories: cost associated with system development and cost associated with system operation. Development cost occurred during the system development and is

being considered as sunk cost as it occurs only one time. It includes hardware, software and people used in setting up the system. System operation is the cost to be paid during the life of the system. It is the cost in running the system including staff, maintenance cost and other utility expense. The following table shows the cost of the Manual system.



Table 3.8. Manual System Cost Analysis, Baht.

Cost items	Years				
	1	2	3	4	5
Fixed Cost					
Hardware Cost :					
Radio Walkie Talkie					
2 units @ 13,400	5,360	5,360	5,360	5,360	5,360
Calculator					
2 units @ 680	272	272	272	272	272
Total Fixed Cost	5,632	5,632	5,632	5,632	5,632
Operation Cost					
Salary Cost:					
Production Manager					
1 person @ 20,000	20,000	22,000	24,200	26,620	29,282
Operator					
9 persons @ 8,000	72,000	79,200	87,120	95,832	105,415
Store Staff					
2 persons @ 7,000	14,000	15,400	16,940	18,634	20,497
Total Monthly Salary Cost	106,000	116,600	128,260	141,086	155,195
Total Annual Salary Cost	1,272,000	1,399,200	1,539,120	1,693,032	1,862,335
Office Suppliers and Miscellaneous Cost:					
Stationary Per Annual	12,300	13,530	14,883	16,371	18,008
Office Supplier Per Annual	12,000	13,200	14,520	15,972	17,569
Utility Per Annual	14,000	15,400	16,940	18,634	20,497
Miscellaneous Per Annual	16,000	17,600	19,360	21,296	23,426
Total Annual Office Supplies & Miscellaneous Cost	54,300	59,730	65,703	72,273	79,501
Total Annual Operating Cost	1,326,300	1,458,930	1,604,823	1,765,305	1,941,836
Total Manual System Cost	1,331,932	1,464,562	1,610,455	1,770,937	1,947,468

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

Year	Total Manual Cost	Accumulated Cost
1	1,331,932	1,331,932
2	1,464,562	2,796,494
3	1,610,455	4,406,949
4	1,770,937	6,177,886
5	1,947,468	8,125,354
Total	8,125,354	

(2) Cost of Proposed System

Table 3.10. Computerized System Cost Analysis, Baht.

Cost items	Years				
	1	2	3	4	5
Hardware Cost :					
Computer Server Cost					
1 Unit @ 78,000	15,600	15,600	15,600	15,600	15,600
Client Machine Cost					
6 Units @27,000	32,400	32,400	32,400	32,400	32,400
Printer: Laser printer					
1 Unit @ 11,000	2,200	2,200	2,200	2,200	2,200
Printer: Dot matrix					
2 Units @ 8,600	3,440	3,440	3,440	3,440	3,440
UPS 1000VA					
1 Unit @ 7,200	1,440	1,440	1,440	1,440	1,440
UPS 700VA					
6 Units @ 2,800	4,080	4,080	4,080	4,080	4,080
Total Hardware Cost	59,160	59,160	59,160	59,160	59,160
Software Cost:					
Windows 2000 Server					
(5 Clients) 1 Unit @ 34,000	6,800	6,800	6,800	6,800	6,800
Windows XP Professional					
6 Units @ 7,200	8,640	8,640	8,640	8,640	8,640
Windows Office XP					
7 Units @ 17,000	23,800	23,800	23,800	23,800	23,800
Delphi Enterprise Studio v7.0					
1 Unit @120,000	24,000	24,000	24,000	24,000	24,000
Network Cost					
	3,600	3,600	3,600	3,600	3,600
Total Software Cost	66,840	66,840	66,840	66,840	66,840
Implementation Cost:					
Training Cost	70,000				
Software Development Cost	200,000				
Total Implementation Cost	270,000				
People-Ware Cost:					
System analysis					
1 person @ 3 months @ 20,000	60,000				
Programmer					
1 person @ 2 months @ 22,000	44,000				
Database Specialist					
1 person @ 3 months @ 19,000	57,000				
Network Specialist					
1 person @ 2 months @ 19,000	38,000				
Total People-Ware Cost	199,000				
Total Development Cost	595,000	126,000	126,000	126,000	126,000
<u>Operation Cost</u>					
Maintenance Cost:					

Table 3.10. Computerized System Cost Analysis, Baht (Continued).

Cost items	Years				
	1	2	3	4	5
Server Maintenance cost 1 set @ 32,000		32,000	35,200	38,720	42,592
Workstation Maintenance cost 3 sets @ 6,000		18,000	19,800	21,780	23,958
Software Maintenance cost 3,500		3,500	3,850	4,235	4,659
Total Maintenance Cost		53,500	58,850	64,735	71,209
Salary Cost:					
Production Manager 1 person @ 22,000	22,000	24,200	26,620	29,282	32,210
Operator 3 persons @ 15,000	45,000	49,500	54,450	59,895	65,885
Store Staff 1 person @ 8,000	8,000	8,800	9,680	10,648	11,713
Total Monthly Salary Cost	75,000	82,500	90,750	99,825	109,808
Total Annual Salary Cost	900,000	990,000	1,089,000	1,197,900	1,317,690
Miscellaneous Cost Per Annual					
Stationary Per Annual	10,000	12,100	13,310	14,641	16,105
Office Supplier Per Annual	6,500	7,150	7,865	8,652	9,517
Utility Per Annual	11,000	13,200	14,520	15,972	17,569
Miscellaneous Per Annual	10,000	11,000	12,100	13,310	14,641
Total Miscellaneous Cost	37,500	43,450	47,795	52,575	57,832
Total Operating Cost	937,500	1,086,950	1,195,645	1,315,210	1,446,731
Total Computerized Cost	1,532,500	1,212,950	1,321,645	1,441,210	1,572,731

Table 3.11. Five Years Accumulated Computerized Cost, Baht.

Year	Total Computerized Cost	Accumulated Cost
1	1,532,500	1,532,500
2	1,212,950	2,745,450
3	1,321,645	4,067,095
4	1,441,210	5,508,305
5	1,572,731	7,081,036
Total	7,081,036	

Table 3.12. The Comparison between Computerized System Cost and Manual System Cost, Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,331,932	1,532,500
2	2,796,494	2,745,450
3	4,406,949	4,067,095
4	6,177,886	5,508,305
5	8,125,354	7,081,036

In order to make sure of candidate 1 to compare the system costs between manual system cost and computerized system cost in graph, see Figure.3.2. For other candidate you can see in Appendix G.

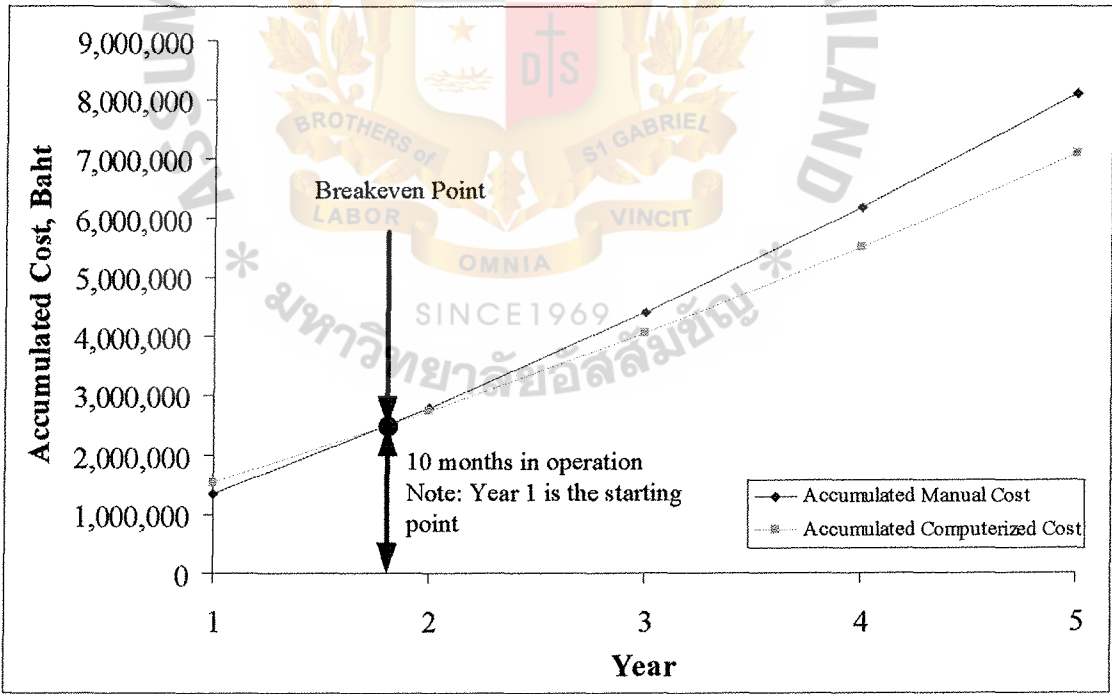


Figure 3.2. Break – Even Point Analysis.

Benefit Analysis

The proposed system could benefit the company in two ways; reduce operational costs and increase company performance. Benefits of the proposed system will be divided into two categories, which are tangible benefits and intangible benefits.

- (1) Tangible Benefits (Estimated amount on annual basis)

Table D.3. The Benefits of the Proposed System, Baht.

Items	Saving, baht	
Staffs and Operators	420,000	Baht
Office Suppliers & Miscellaneous	21,669	Baht
Opportunity Cost & Intangible Benefit	1,303,800	Baht
Total Saving	1,745,469	Baht

Intangible benefits are expected from this assignment as well. The cause of this problem is the lack of accuracy and the slow speed in serving. Therefore, after implementation of the new system with good training, these problems can be solved, which cannot be measured in monetary terms.

Service is a lot different from any other businesses. Speed and accuracy are the most significant factors, which now in the production system can increase the production time and high quality of product. The following intangible benefits are proposed to support the management to develop the proposed system for the company.

- (a) To better provide the information that supports the management in decision-making
- (b) To better respond to the customer needs
- (c) To better provide the information to the user
- (d) To facilitate further expansion in the future

(2) Payback analysis

Payback period is the commonly used technique to assess the value of investment. Generally, payback period is that cash inflows can recover the initial investment within a specified period. To reflect the real value of money, the time value of money concept is also applied in this analysis. This discount rate is required to calculate discount value of all costs and benefits after the second year to the present value at the present year. If the payback period is performed without time adjusting the costs and benefits (time value of money), non-time-adjusted paybacks tend to be over-optimistic and misleading.

As in Figure 3.2., the graph of commutative cost of computerized system cross the x-axis at 10 months or the payback period of the computerized system is 1 year and 10 months (See Figure D.1).

(3) Net Present Value

Net present value analysis is the discounted cash flow approach for evaluating the most effective investment alternatives. The cash flow includes both cash inflows and outflows from the system implementation.

With this technique, the discount rate must be set for calculating the present value of all cash flow in the project. The discount rate is the required rate of return on investment that generally equals interest rate that investment amount would receive if the investment is not made.

After all required parameters are collected, the calculation will be done. Then the calculation results will be used for ranking the investment alternatives. The project will be accepted only when its net present value is greater than zero. If all alternatives have the positive net present value,

whichever alternative gives the highest net present value, that alternative will be selected.

(See the full details of Net Present Value calculation in Appendix D)



IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

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

- (1) Software acquisition, development and installation
- (2) Hardware acquisition and installation
- (3) Personnel training
- (4) Data preparation
- (5) Testing
- (6) Conversion
- (7) Documentation

4.2 Installation

The installation of the proposed system is to combine 2 major processed, hardware installation and software installation.

- (1) Hardware Installation

By employing the proposed system, some new hardware that does not exist in the existing system must be installed. The establishment of the computer network is set by making an installation of the Database server and using LAN card interface to connect each client computer nodes.

(2) Software Installation

The proposed system had to install new software, which is designed for solving the current problems and increasing the ability of the system. The development team has designed to use Borland Delphi Enterprise Studio v7.0 for the development of Animal Feeds Production Information System. Only the executed file is installed on each client. Microsoft Access 2000 has been chosen to present as the database of the proposed system. As the system is designed to use the client-server based architecture, the database will be set up only in the server.

4.3 Test Plan

After the new application software has been installed and tested, the final system test must be conducted to ensure that it can work together with all other existing programs. The following steps are needed to complete the testing:

- (1) System data test must be prepared.
- (2) Ensure that all software packages and existing program have been installed and that unit testing has been completed.
- (3) Perform tests to check that all programs work properly together.
- (4) If there is any problem found, appropriate revision is needed and re-tested again.

4.4 Conversion

As the existing system, which is based on manual operations, has been used since the establishment of the company, the user is still familiar with the manual-working environment. Gradually changing the working environment from manually based to computerized based must be considered. Parallel conversion which is the approach that both the old and new systems are operated for some period is the approach in this

situation. This is done to ensure that all major problems in the new system have been solved before the old system is discarded. This approach minimizes the risk of major flaws in the new system causing irreparable harm to the business. The period for parallel run will take 3 months long and after that the new proposed system will run fully functionality.

4.5 Training

Conversion of a new system requires system users being trained and provided with documentation or user manuals that guide them through the steps of using the new computerized system. Staff training is an important step of the implementation of the computerized system. The user can use the system perfectly if they understand it well. The user must be instructed the operation of the equipment and the troubleshooting of the system. Training course will be provided to the users in groups and 30 hours of training time is provided for the system users.

The management should be instructed briefly with regards to the new system.

4.6 Documentation

Documentation of the proposed system is separated into 2 documents. First is the user guide, which describes how to access and use the program, how to correct the problems and how to use interface screens. The second is the flow of the system and data dictionary. Both documents can help the users whenever they need.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

With more competitive environment nowadays, most of the companies should recognize the importance of new technology. Information should be treated as one of the most important tools in the business area. The information system must be developed not just to replace the old manual system, but to increase the speed of the service, to discover the analysis that were never discovered using the old manual system. This is to increase the competitiveness of the business either by increasing the number of sales or reducing costs of the production or doing both.

This proposed system aims at increasing the competitiveness of the business. The system will be able to facilitate the users for providing the necessary tools, and facilitate the management with the necessary information. Table 5.1 will provide the comparison of the proposed system to the existing system.

Table 5.1 shows the time performance on each process of the proposed system compared with the existing system. It shows that each process of the proposed system performs in less time than each process of the existing system, which has to operate with many work steps in the manual system. So, it can be concluded that the proposed system is more efficient and effective than the existing system. Examples of cycle time reduction in various processes are as follows:

Table 5.1. Comparison of Degree of Achievement between the Proposed System and the Existing System.

Process	Existing	Proposed System
Checking User Information	15 minutes	5 seconds
Request Order	10 minutes	2 seconds
Formulation	30 minutes	10 seconds
Production	15 minutes	2 minutes
Checking Product Quality	10 minutes	2 seconds
Verify Delivery Date	5 minutes	2.5 seconds
Print Report	15 days	2 seconds

From Table 5.1, the proposed system can save amount of time in the operating process. The system can reduce the process time for the production process. For example, by spending 15 days to summarize the amount of the production and raw material which is made by operator, the computer is replaced instead to help managing and calculating.

Furthermore, the proposed system can generate more precise and timely information than the existing system for management to make decisions.

The proposed system has several expected benefits as follows:

- (1) Accuracy: As it uses computers to control production it can guarantee accuracy more than human control.
- (2) Speed: As it uses computers to control production it can guarantee faster than human control.
- (3) Low costs: From cost and benefit analysis, it shows the proposed system costs less than the manual system.
- (4) High quality: Since it uses computers to control operations it has high a

quality of service.

- (5) Less problems: As it uses computers to control operation it has less problems.

5.2 Recommendations

The Information System is just one of the examples where computerization can be applied to ease daily business operations especially the production process which is the major factor of the business. Given its simplicity, reliability, availability the system can be modified and adapted to suit other types of business.

Further development of the Animal Feeds Production Information System can be made to increase the efficiency and the effectiveness in a system that can be separated to 2 steps as follows:

- (1) Extending the information system to cover other departments to be fully integrated information system.
- (2) Developing the system to be an Enterprise Application Integration (EAI) by integrating all systems together.



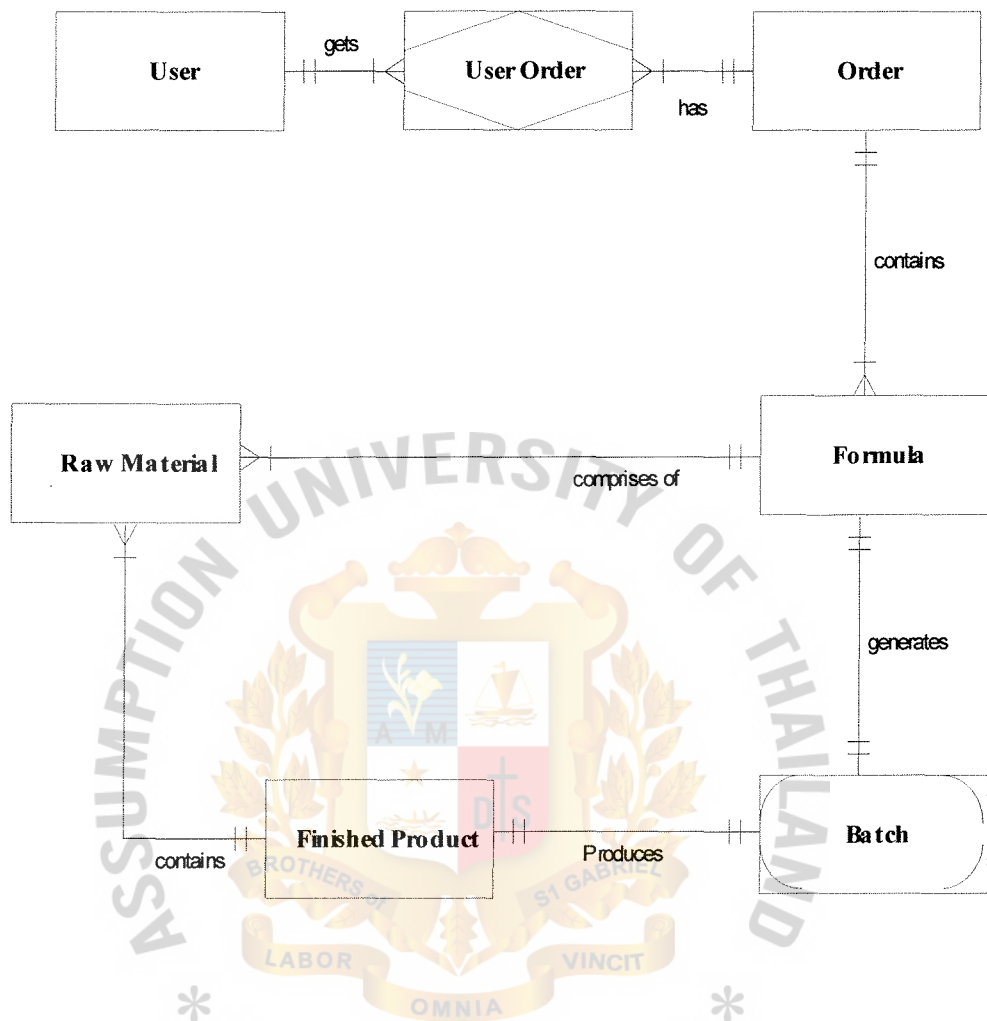


Figure A.1. Context Entity Relationship Diagram of Proposed System.

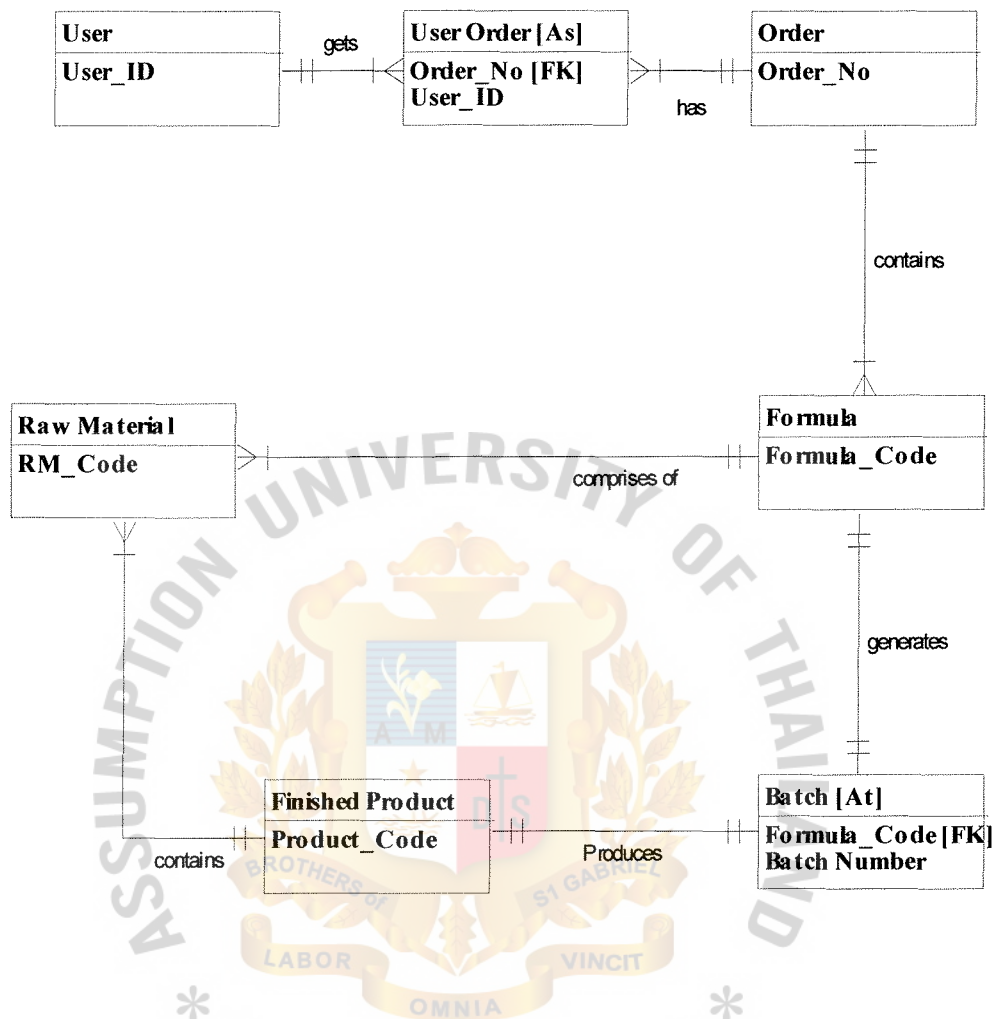


Figure A.2. Key Based Entity Relationship Diagram.

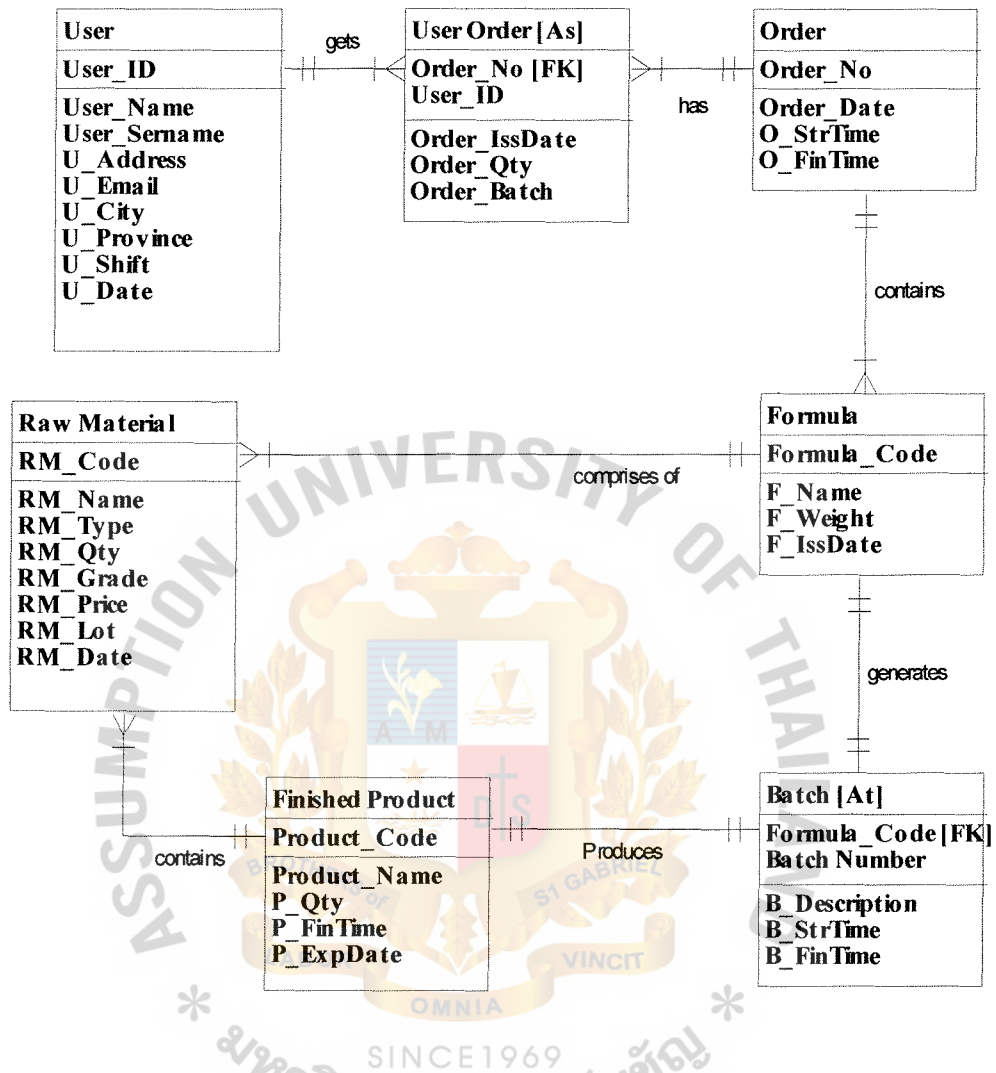


Figure A.3. Fully Entity Relationship Diagram.

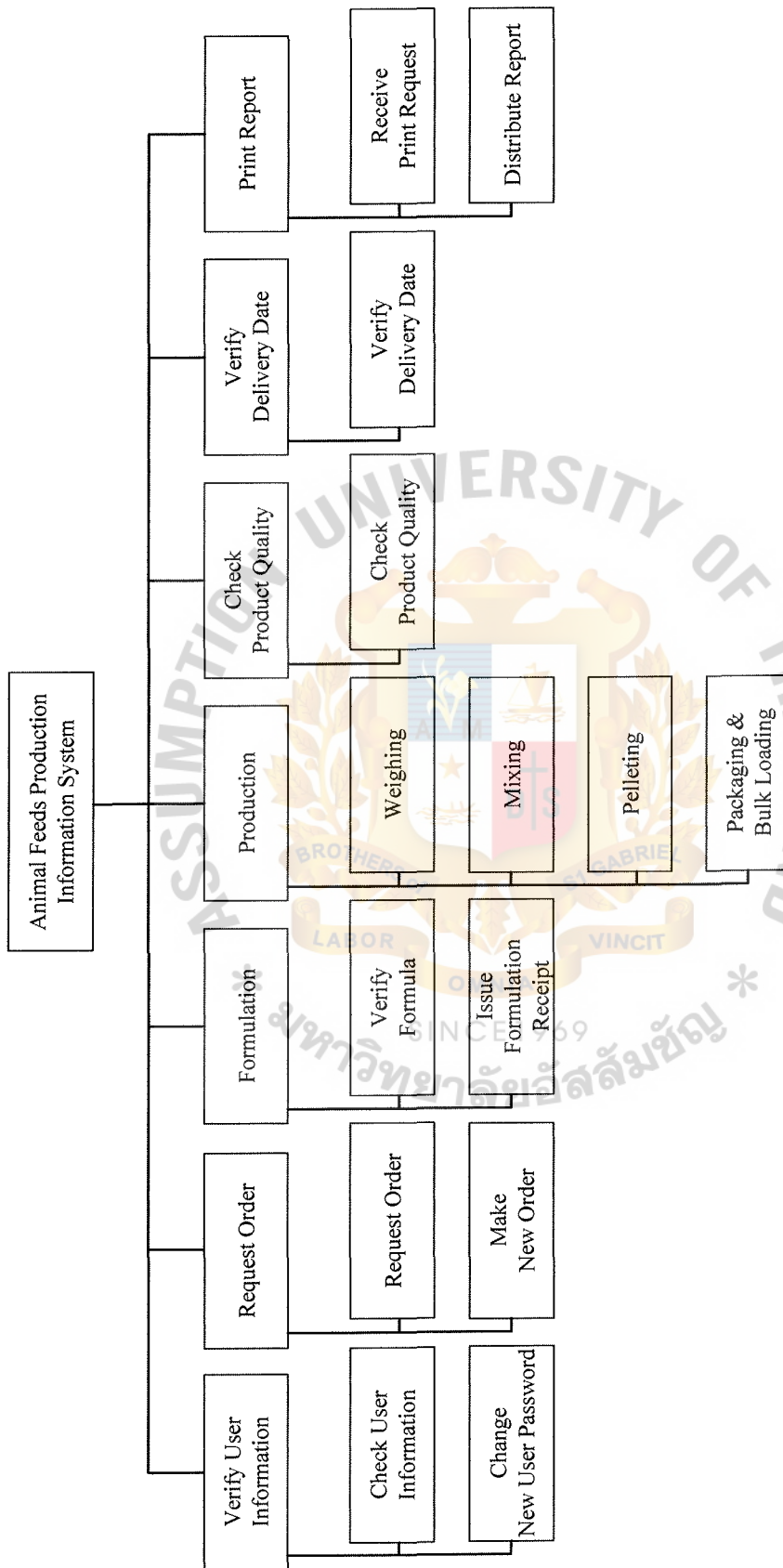


Figure B.1. Functional Decomposition Diagram.

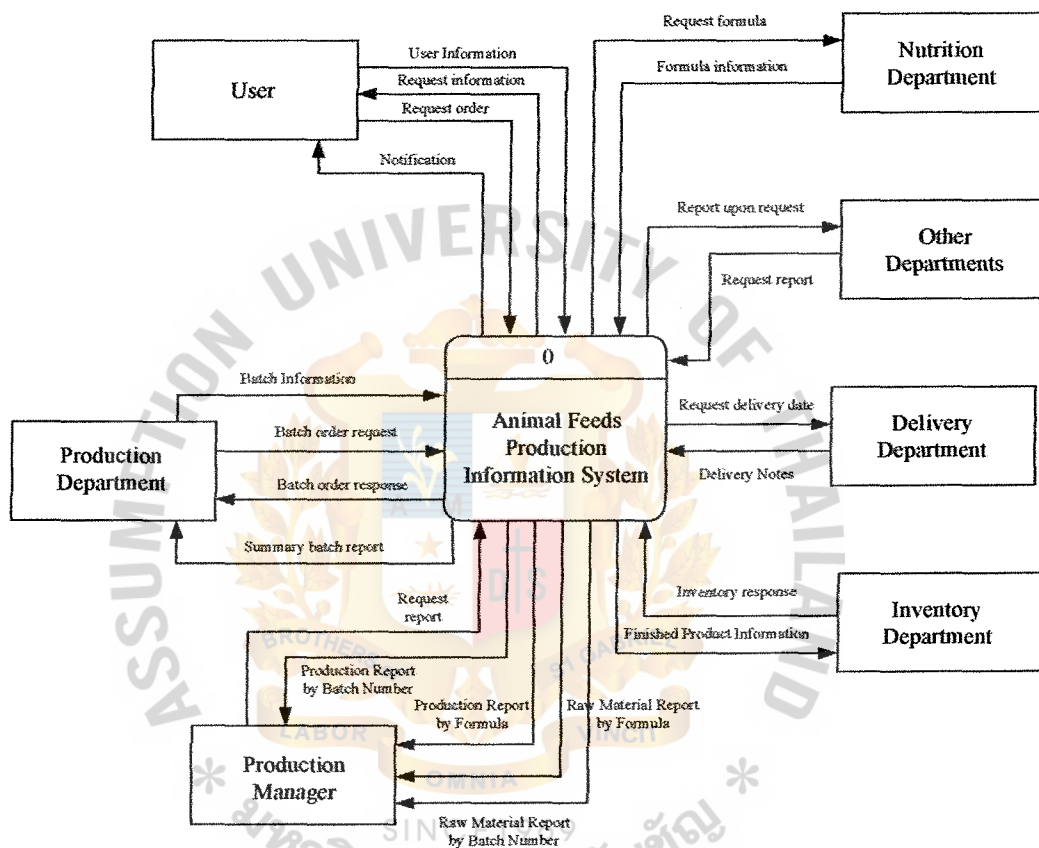


Figure B.2. Context Diagram of the Proposed System.



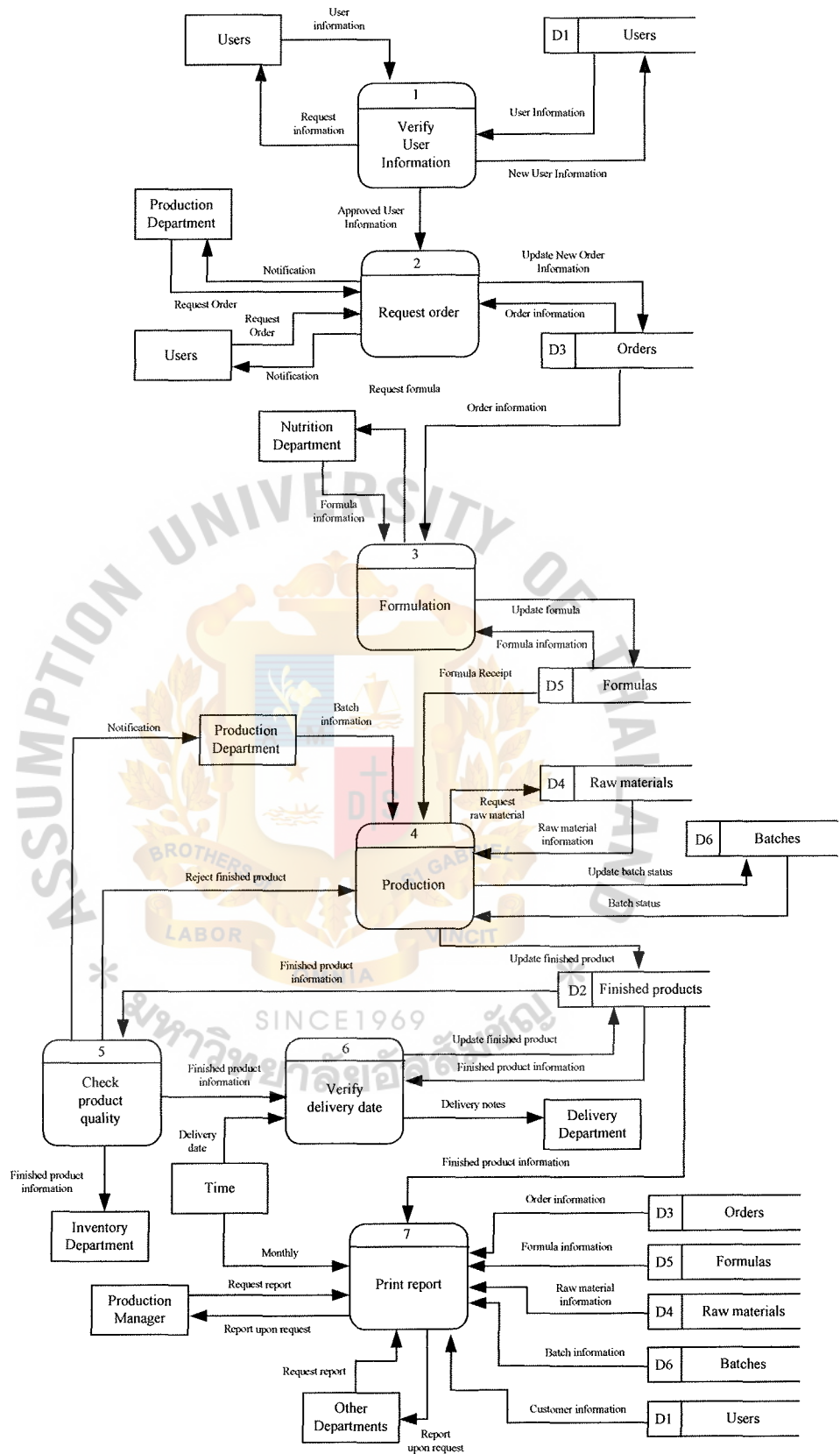


Figure B.3. Data Flow Diagram of the Proposed System.

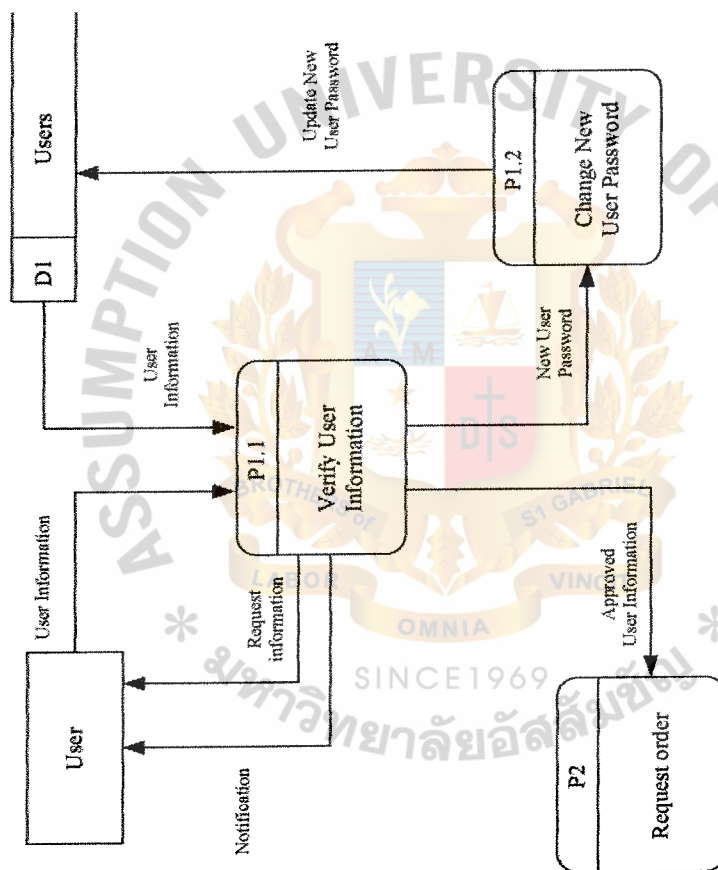


Figure B.4. Data Flow Diagram – Verify User Information

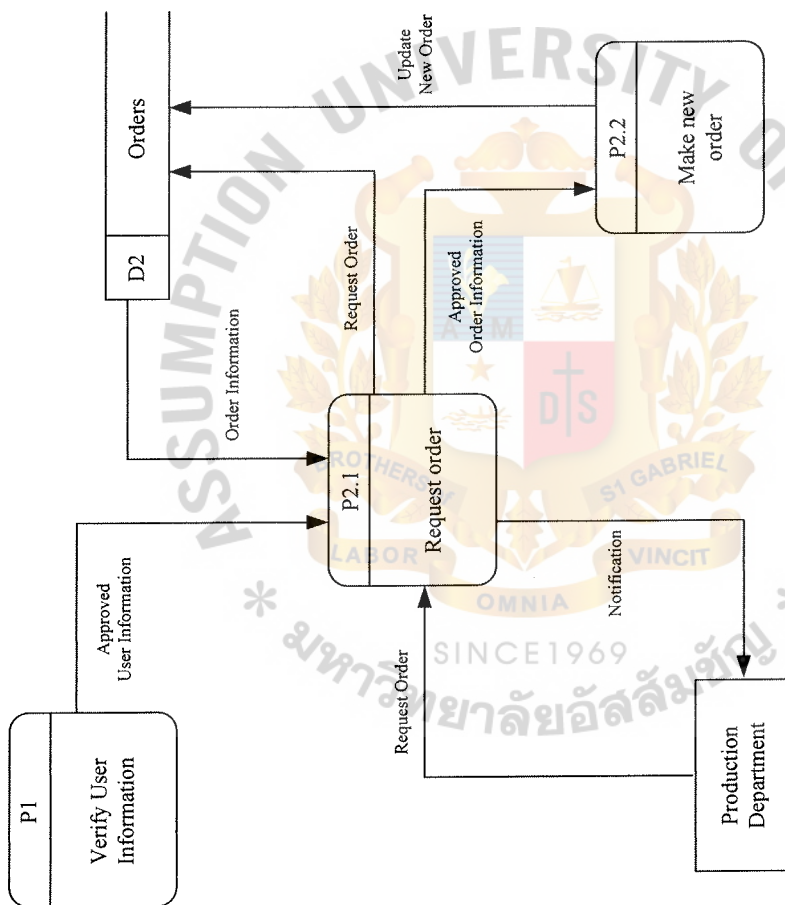


Figure B.5. Data Flow Diagram – Request Order.

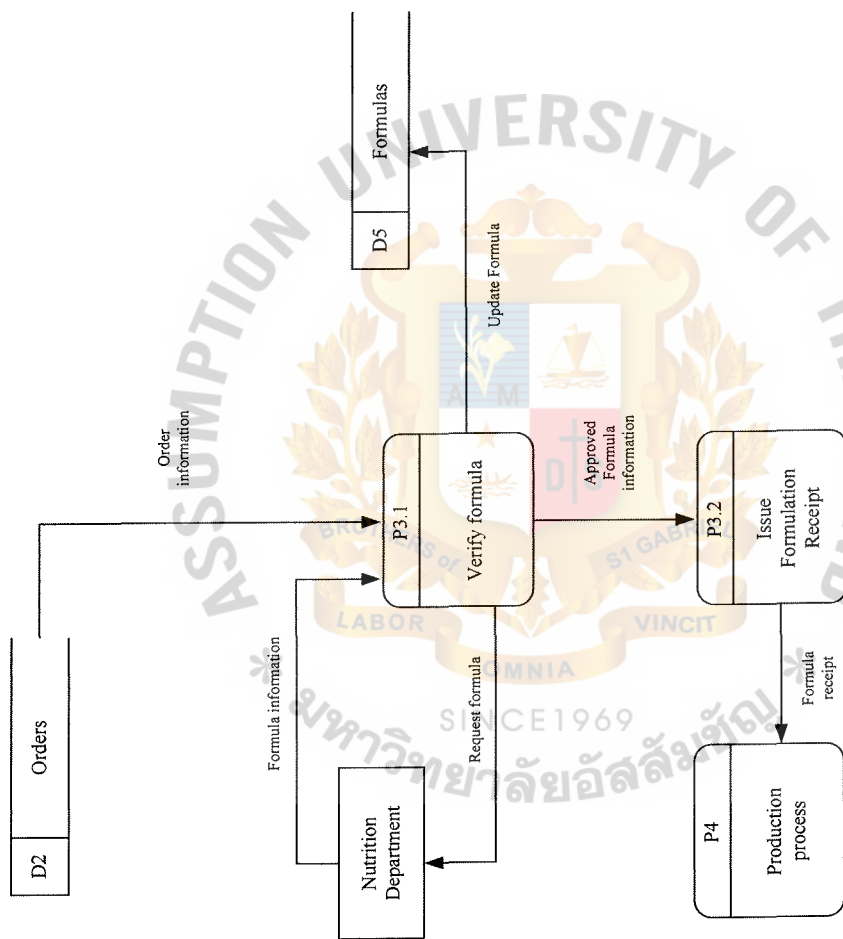


Figure B.6. Data Flow Diagram – Formulation.

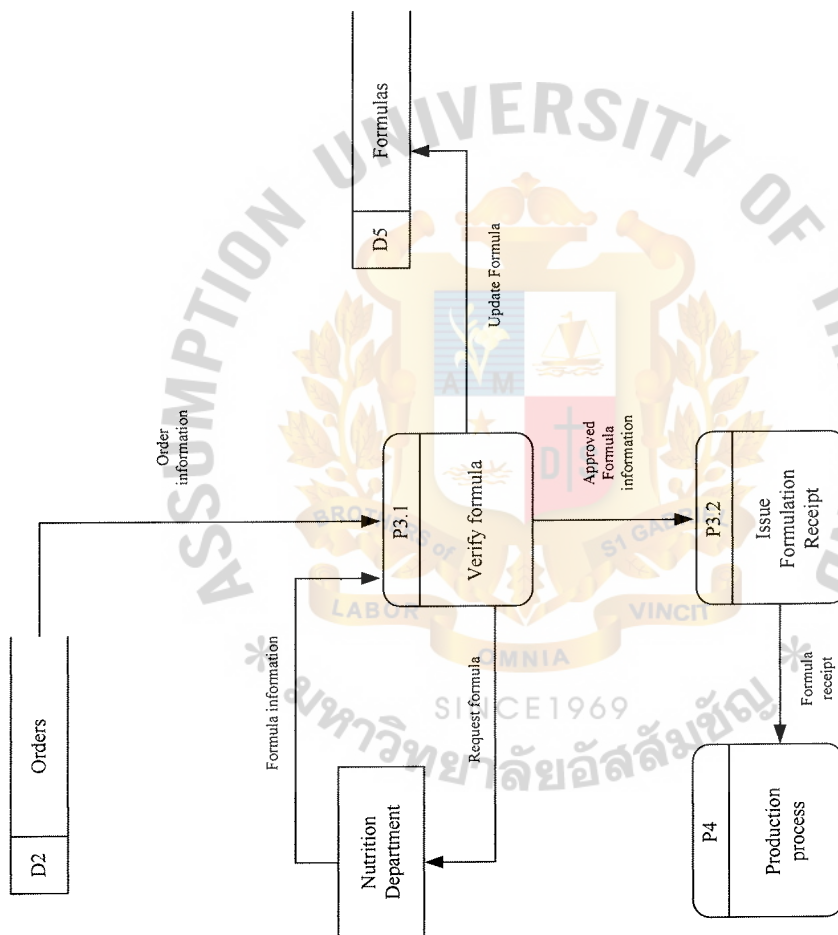


Figure B.6. Data Flow Diagram – Formulation.

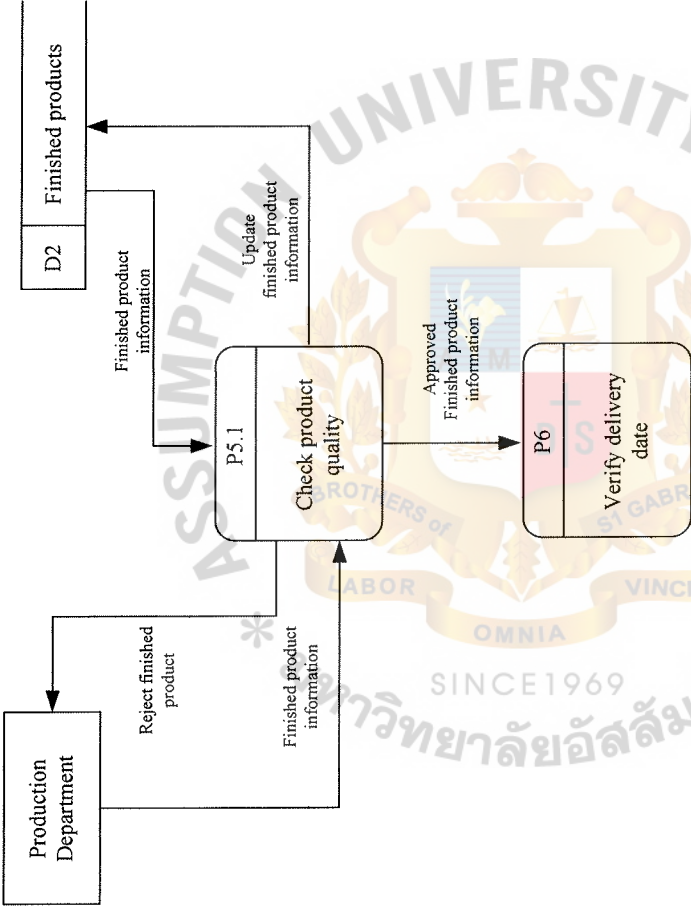


Figure B.8. Data Flow Diagram – Verify Product Quality.

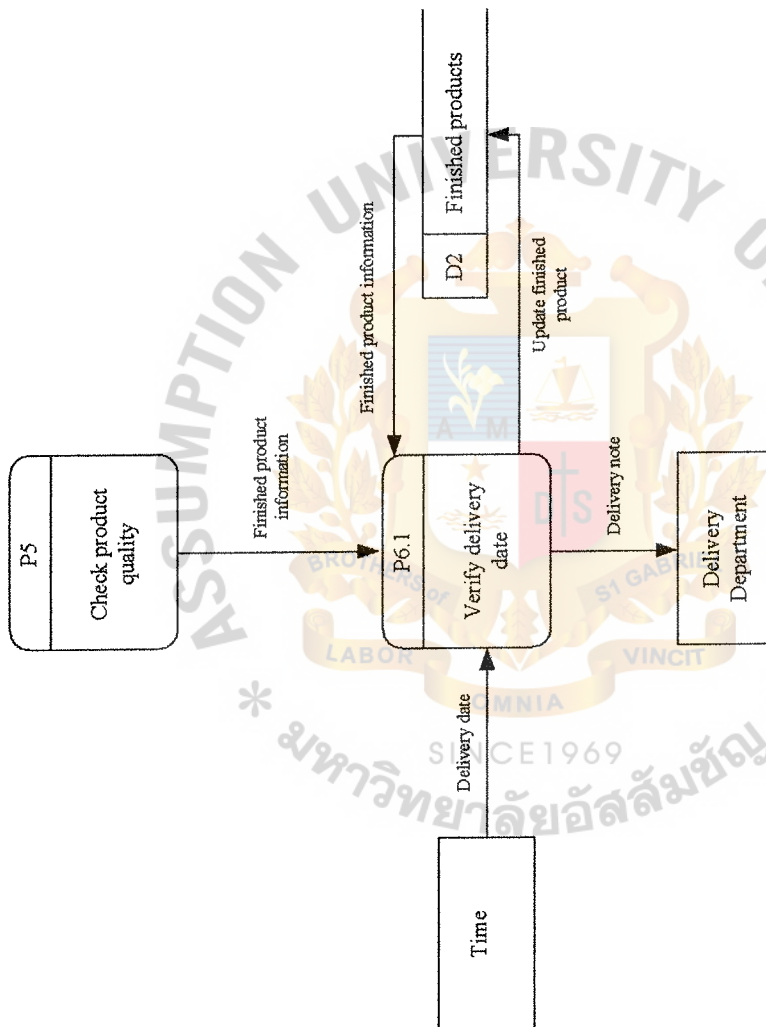


Figure B.9. Data Flow Diagram – Verify Delivery Date.

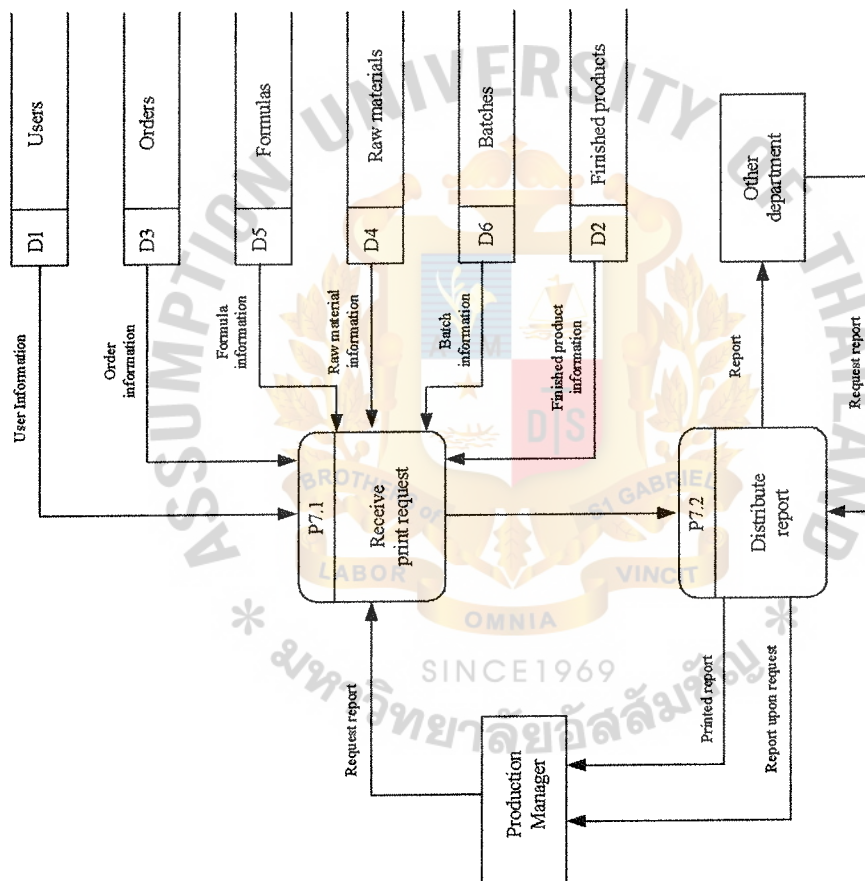
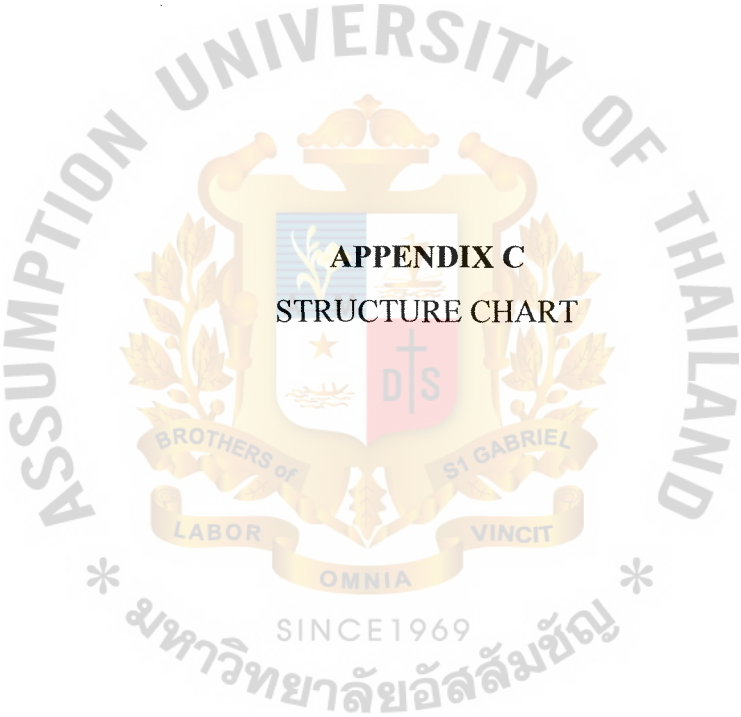


Figure B.10. Data Flow Diagram – Print Report.



APPENDIX C
STRUCTURE CHART

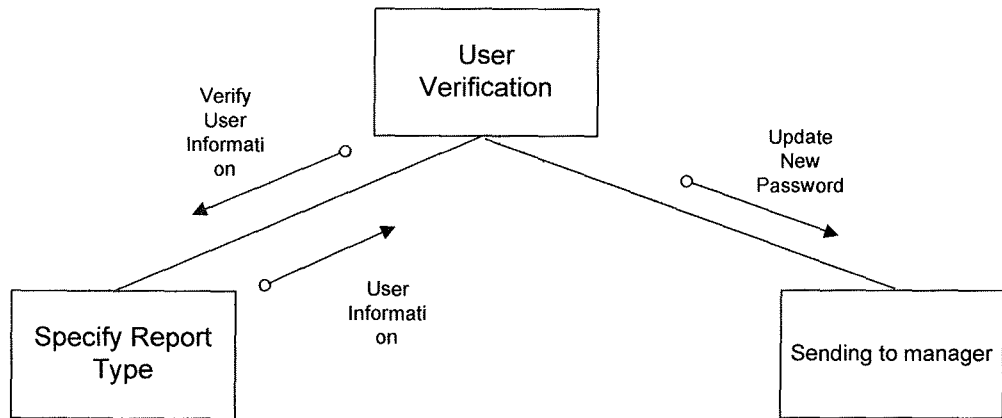


Figure C.1. Structure Chart of User Verification.

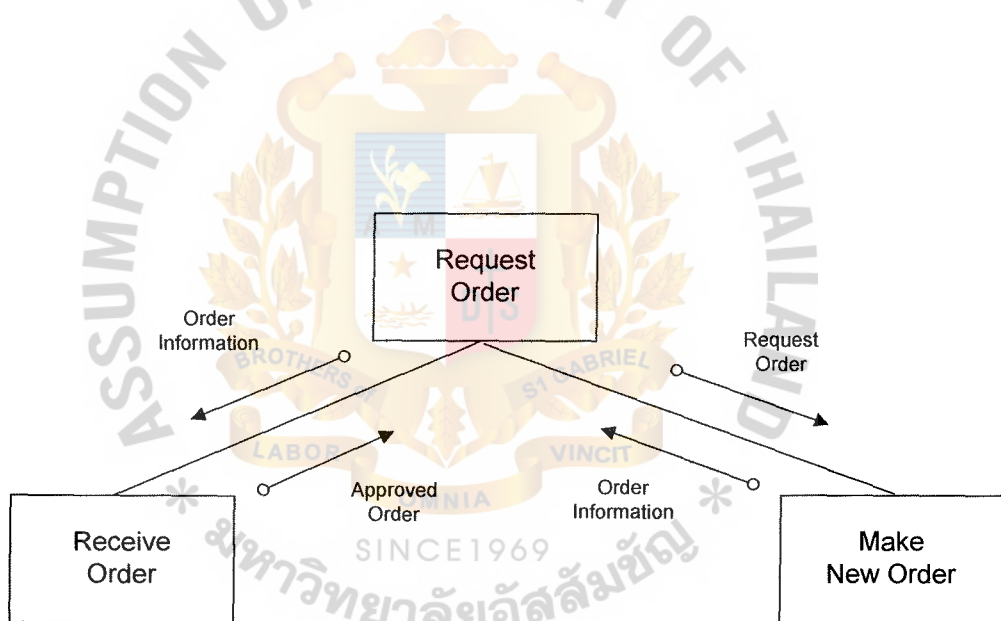


Figure C.2. Structure Chart of Request Order.

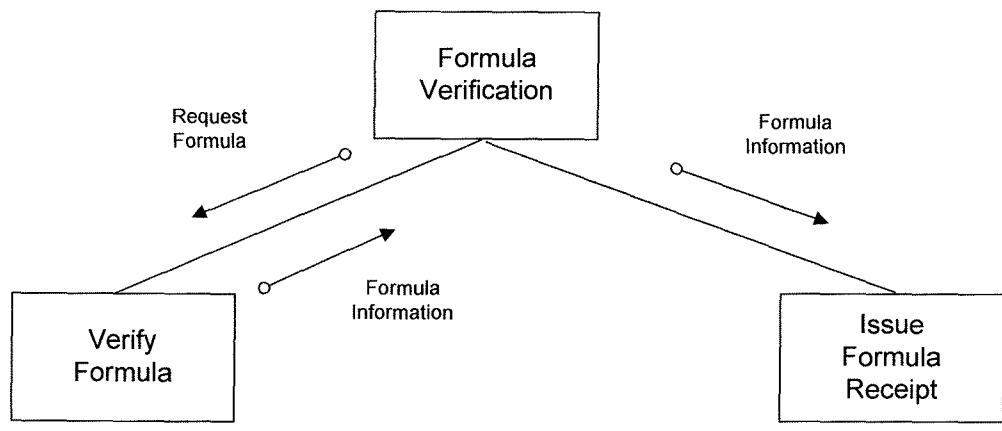


Figure C.3. Structure Chart of Formula Verification.

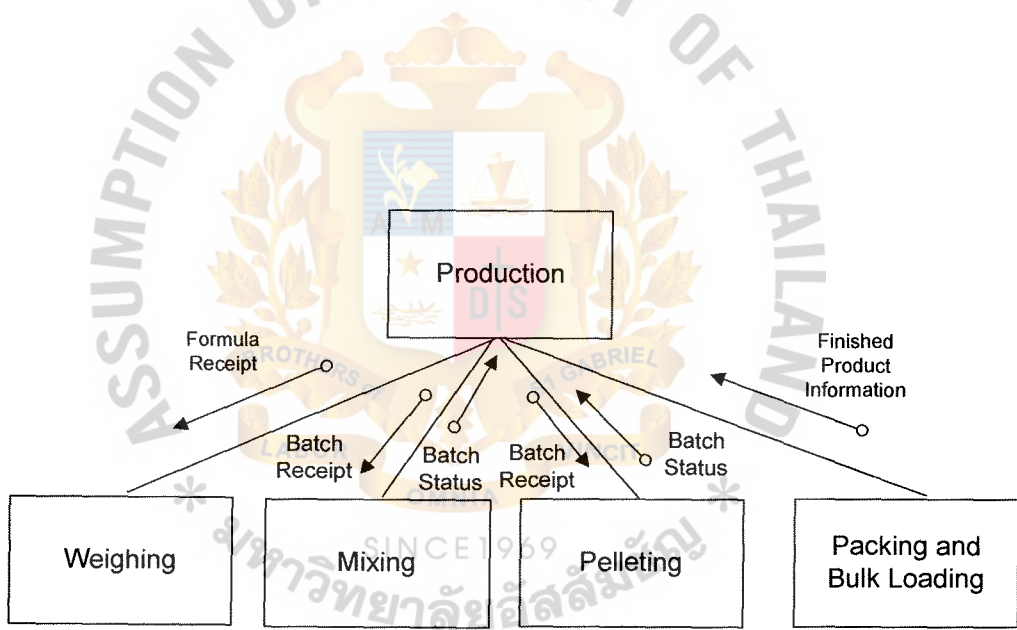


Figure C.4. Structure Chart of Production.

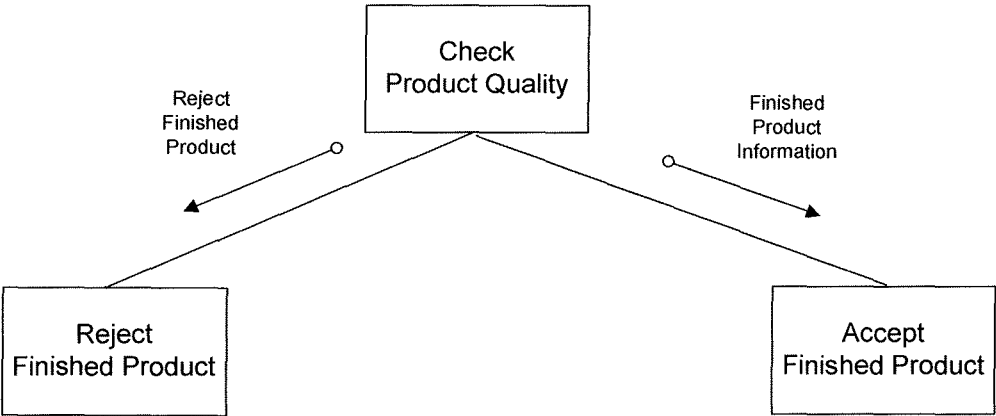


Figure C.5. Structure Chart of Check Product Quality.

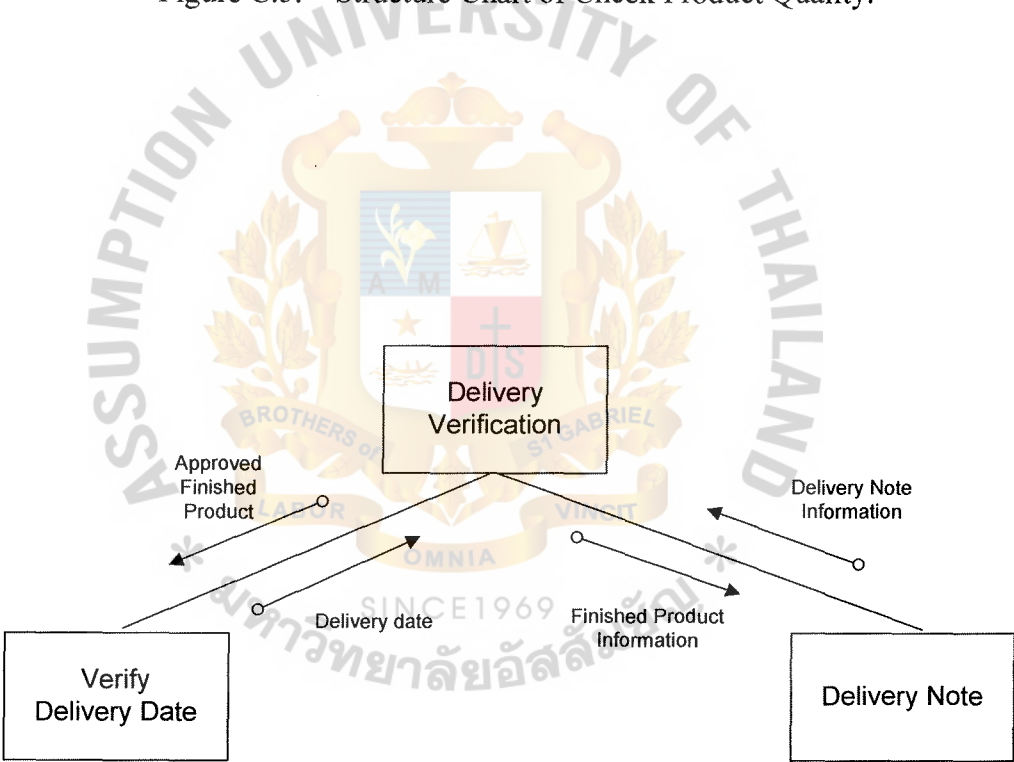


Figure C.6. Structure Chart of Delivery Verification.

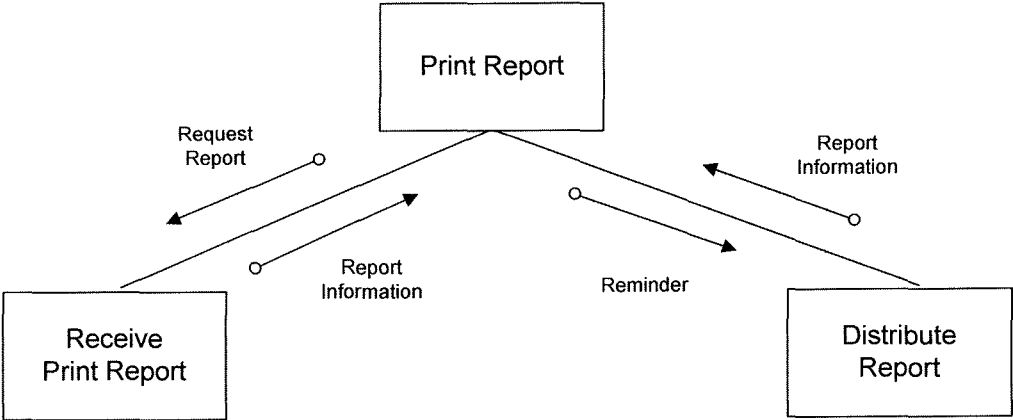


Figure C.7. Structure Chart of Print Report.





APPENDIX D
FEASIBILITY ANALYSIS

Table D.1. The Cost of the Candidate2, Baht.

Cost items	Years				
	1	2	3	4	5
Hardware Cost :					
Computer Server Cost					
1 Unit @ 78,000	15,600	15,600	15,600	15,600	15,600
Client Machine Cost					
6 Units @ 27,000	32,400	32,400	32,400	32,400	32,400
Printer: Laser printer					
1 Unit @ 11,000	2,200	2,200	2,200	2,200	2,200
Printer: Dot matrix					
2 Units @ 8,600	3,440	3,440	3,440	3,440	3,440
UPS 1000VA					
1 Unit @ 7,200	1,440	1,440	1,440	1,440	1,440
UPS 700VA					
6 Units @ 2,800	4,080	4,080	4,080	4,080	4,080
Total Hardware Cost	59,160	59,160	59,160	59,160	59,160
Software Cost:					
Windows 2000 Server					
(5 Clients) 1 Unit @ 34,000	6,800	6,800	6,800	6,800	6,800
Windows XP Professional					
6 Units @ 7,200	8,640	8,640	8,640	8,640	8,640
Windows Office XP					
7 Units @ 15,000	21,000	21,000	21,000	21,000	21,000
Production IS Enterprise					
1 Unit @ 420,000	84,000	84,000	84,000	84,000	84,000
Oracle License					
	60,000	60,000	60,000	60,000	60,000
Network Cost					
	4,300	4,300	4,300	4,300	4,300
Total Software Cost	184,740	184,740	184,740	184,740	184,740
Implementation Cost:					
Training Cost	100,000				
Software Development Cost	470,000				
Total Implementation Cost	570,000				
People-Ware Cost:					
System analysis					
1 person @ 3 months @ 25,000	75,000				
Programmer					
1 person @ 2 months @ 43,000	86,000				
Database Specialist					
1 person @ 3 months @ 24,000	72,000				
Network Specialist					
1 person @ 2 months @ 24,000	48,000				
Total People-Ware Cost	281,000				
Total Development Cost	1,094,900	243,900	243,900	243,900	243,900
Operation Cost					
Maintenance Cost:					
Server Maintenance cost					
1 set @ 55,000		55,000	60,500	66,550	73,205
Workstation Maintenance cost					
3 sets @ 9,000		21,000	23,100	25,410	27,951

Table D.1. The Cost of the Candidate2, Baht (Continued).

Cost items		Years				
		1	2	3	4	5
Software Maintenance cost			6,000	6,600	7,260	7,986
6,000						
Total Maintenance Cost			82,000	90,200	99,220	109,142
Salary Cost:						
Production Manager	1	22,000	24,200	26,620	29,282	32,210
person @ 22,000						
Operator	3	45,000	49,500	54,450	59,895	65,885
persons @ 15,000						
Store Staff	1	8,000	8,800	9,680	10,648	11,713
person @ 8,000						
Total Monthly Salary Cost		75,000	82,500	90,750	99,825	109,808
Total Annual Salary Cost		900,000	990,000	1,089,000	1,197,900	1,317,690
Miscellaneous Cost Per Annual						
Stationary	Per Annual	10,000	12,100	13,310	14,641	16,105
Office Supplier	Per Annual	6,500	7,150	7,865	8,652	9,517
Utility	Per Annual	11,000	13,200	14,520	15,972	17,569
Miscellaneous	Per Annual	10,000	11,000	12,100	13,310	14,641
Total Miscellaneous Cost		37,500	43,450	47,795	52,575	57,832
Total Operating Cost		937,500	1,115,450	1,226,995	1,349,695	1,484,664
Total Computerized Cost		2,032,400	1,359,350	1,470,895	1,593,595	1,728,564

Table D.2. The Cost of the Candidate3, Baht.

Cost items	Years				
	1	2	3	4	5
Hardware Cost :					
Computer Server Cost					
1 Unit @ 78,000	15,600	15,600	15,600	15,600	15,600
Client Machine Cost					
6 Units @ 27,000	32,400	32,400	32,400	32,400	32,400
Printer: Laser printer					
1 Unit @ 11,000	2,200	2,200	2,200	2,200	2,200
Printer: Dot matrix					
2 Units @ 8,600	3,440	3,440	3,440	3,440	3,440
UPS 1000VA					
1 Unit @ 7,200	1,440	1,440	1,440	1,440	1,440
UPS 700VA					
6 Units @ 2,800	4,080	4,080	4,080	4,080	4,080
Total Hardware Cost	59,160	59,160	59,160	59,160	59,160
Software Cost:					
Windows 2000 Server					
(5 Clients) 1 Unit @ 34,000	6,800	6,800	6,800	6,800	6,800
Windows XP Professional					
6 Units @ 7,200	8,640	8,640	8,640	8,640	8,640
Windows Office XP					
7 Units @ 15,000	21,000	21,000	21,000	21,000	21,000
Visual Basic Studio 6					
14,800	14,800	14,800	14,800	14,800	14,800
Network Cost					
7,000	7,000	7,000	7,000	7,000	7,000
Total Software Cost	58,240	58,240	58,240	58,240	58,240
Implementation Cost:					
Training Cost	100,000				
Software Development Cost	500,000				
Total Implementation Cost	600,000				
People-Ware Cost:					
System analysis					
1 person @ 3 months @ 30,000	90,000				
Programmer					
1 person @ 2 months @ 43,000	86,000				
Database Specialist					
1 person @ 3 months @ 26,000	78,000				
Network Specialist					
1 person @ 2 months @ 26,000	52,000				
Total People-Ware Cost	306,000				
Total Development Cost	1,023,400	117,400	117,400	117,400	117,400
<u>Operation Cost</u>					
Maintenance Cost:					
Server Maintenance cost					
1 set @ 55,000		55,000	60,500	66,550	73,205
Workstation Maintenance cost					
3 sets @9,000		21,000	23,100	25,410	27,951

Table D.2. The Cost of the Candidate3, Baht (Continued).

Cost items	Years				
	1	2	3	4	5
Software Maintenance cost 6,000		6,000	6,600	7,260	7,986
Total Maintenance Cost		82,000	90,200	99,220	109,142
Salary Cost:					
Production Manager 1 person @ 30,000	30,000	33,000	36,300	39,930	43,923
Operator 3 persons @ 17,000	51,000	56,100	61,710	67,881	74,669
Store Staff 1 person @ 10,000	10,000	11,000	12,100	13,310	14,641
Total Monthly Salary Cost	91,000	100,100	110,110	121,121	133,233
Total Annual Salary Cost	1,092,000	1,201,200	1,321,320	1,453,452	1,598,797
Miscellaneous Cost Per Annual					
Stationary Per Annual	10,000	12,100	13,310	14,641	16,105
Office Supplier Per Annual	6,500	7,150	7,865	8,652	9,517
Utility Per Annual	11,000	13,200	14,520	15,972	17,569
Miscellaneous Per Annual	10,000	11,000	12,100	13,310	14,641
Total Miscellaneous Cost	37,500	43,450	47,795	52,575	57,832
Total Operating Cost	1,129,500	1,326,650	1,459,315	1,605,247	1,765,771
Total Computerized Cost	2,152,900	1,444,050	1,576,715	1,722,647	1,883,171

Table D.3. The Benefits of the Proposed System, Baht.

Saving:	
Staffs and Operators	420,000 Baht
Office Suppliers & Miscellaneous	21,669 Baht
Opportunity Cost & Intangible Benefit	1,303,800 Baht
Total Saving	1,745,469 Baht

Table D.4. The Payback Period for the Candidate1, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-1,099,000					
Operation & Maintenance Cost		-937,500	-1,086,950	-1,195,645	-1,315,210	-1,446,731
Discount Factor for 12%	1	0.893	0.797	0.712	0.636	0.567
Time Adjusted Costs (adjusted to present value)		-837,188	-866,299	-851,299	-836,474	-820,296
Cumulative Time-Adjusted Costs over Life Time		-1,099,000	-2,802,487	-3,653,786	-4,490,259	-5,310,556
Benefits derived from operation of new system	0	1,745,469	1,920,016	2,112,017	2,323,219	2,555,541
Discount Factor for 12%	1	0.893	0.797	0.712	0.636	0.567
Time Adjusted Benefits (adjusted to present value)		1,558,704	1,530,253	1,503,756	1,477,567	1,448,992
Cumulative Time-Adjusted Benefits over Life Time		1,558,704	3,088,956	4,592,713	6,070,280	7,519,272
	0	1	2	3	4	5
Cumulative Lift Time-Adjusted Costs+Benefits	-1,099,000	-377,484	286,470	938,927	1,580,021	2,208,716

Table D.5. The Payback Period for the Candidate2, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-2,070,500					
Operation & Maintenance Cost		-937,500	-1,115,450	-1,226,995	-1,349,695	-1,484,664
Discount Factor for 12%	1	0.893	0.797	0.712	0.636	0.567
Time Adjusted Costs (adjusted to present value)	-2,070,500	-837,188	-889,014	-873,620	-858,406	-841,804
Cumulative Time-Adjusted Costs over Life Time	-2,070,500	-2,907,688	-3,796,701	-4,670,322	-5,528,728	-6,370,532
Benefits derived from operation of new system	0	1,745,469	1,920,016	2,112,017	2,323,219	2,555,541
Discount Factor for 12%	1	0.893	0.797	0.712	0.636	0.567
Time Adjusted Benefits (adjusted to present value)	0	1,558,704	1,530,253	1,503,756	1,477,567	1,448,992
Cumulative Time-Adjusted Benefits over Life Time	0	1,558,704	3,088,956	4,592,713	6,070,280	7,519,272
	0	1	2	3	4	5
Cumulative Lift Time-Adjusted Costs+Benefits	-2,070,500	-1,348,984	-707,745	-77,609	541,553	1,148,740

Table D.6. The Payback Period for the Candidate3, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	-1,149,832					
Operation & Maintenance Cost		-1,129,500	-1,326,650	-1,459,311	-1,605,247	-1,765,777
Discount Factor for 12%	1	0.893	0.797	0.712	0.636	0.567
Time Adjusted Costs (adjusted to present value)	-1,149,832	-1,008,644	-1,057,340	-1,039,032	-1,020,937	-1,001,192
Cumulative Time-Adjusted Costs over Life Time	-1,149,832	-2,158,476	-3,215,816	-4,254,848	-5,275,785	-6,276,977
Benefits derived from operation of new system	0	1,745,469	1,920,016	2,112,017	2,323,219	2,555,541
Discount Factor for 12%	1	0.893	0.797	0.712	0.636	0.567
Time Adjusted Benefits (adjusted to present value)	0	1,558,704	1,530,253	1,503,756	1,477,567	1,448,992
Cumulative Time-Adjusted Benefits over Life Time	0	1,558,704	3,088,956	4,592,713	6,070,280	7,519,272
	0	1	2	3	4	5
Cumulative Lift Time-Adjusted Costs+Benefits	-1,149,832	-599,772	-126,859	337,865	794,495	1,242,295

Payback Analysis for Candidate 1

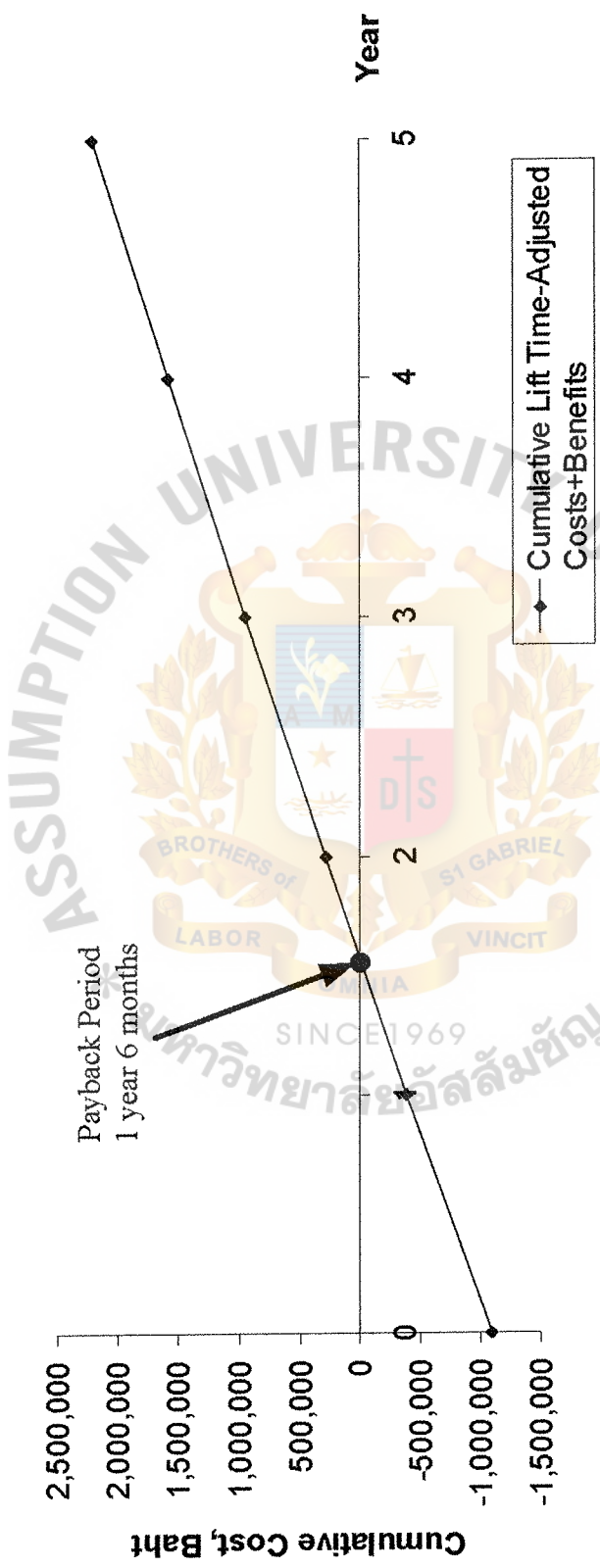


Figure D.1. Payback Period for Candidate 1.

Payback Analysis for Candidate 2

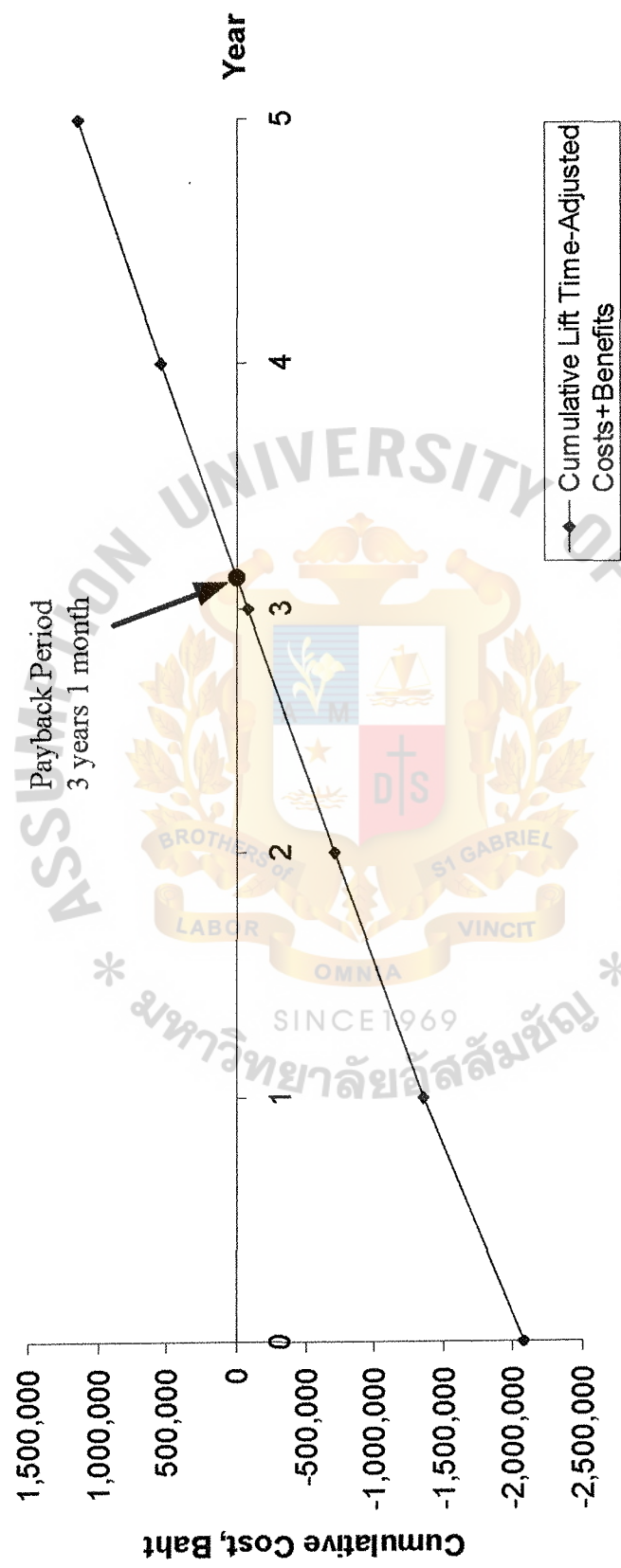


Figure D.2. Payback Period for Candidate 2.

Payback Analysis for Candidate 3

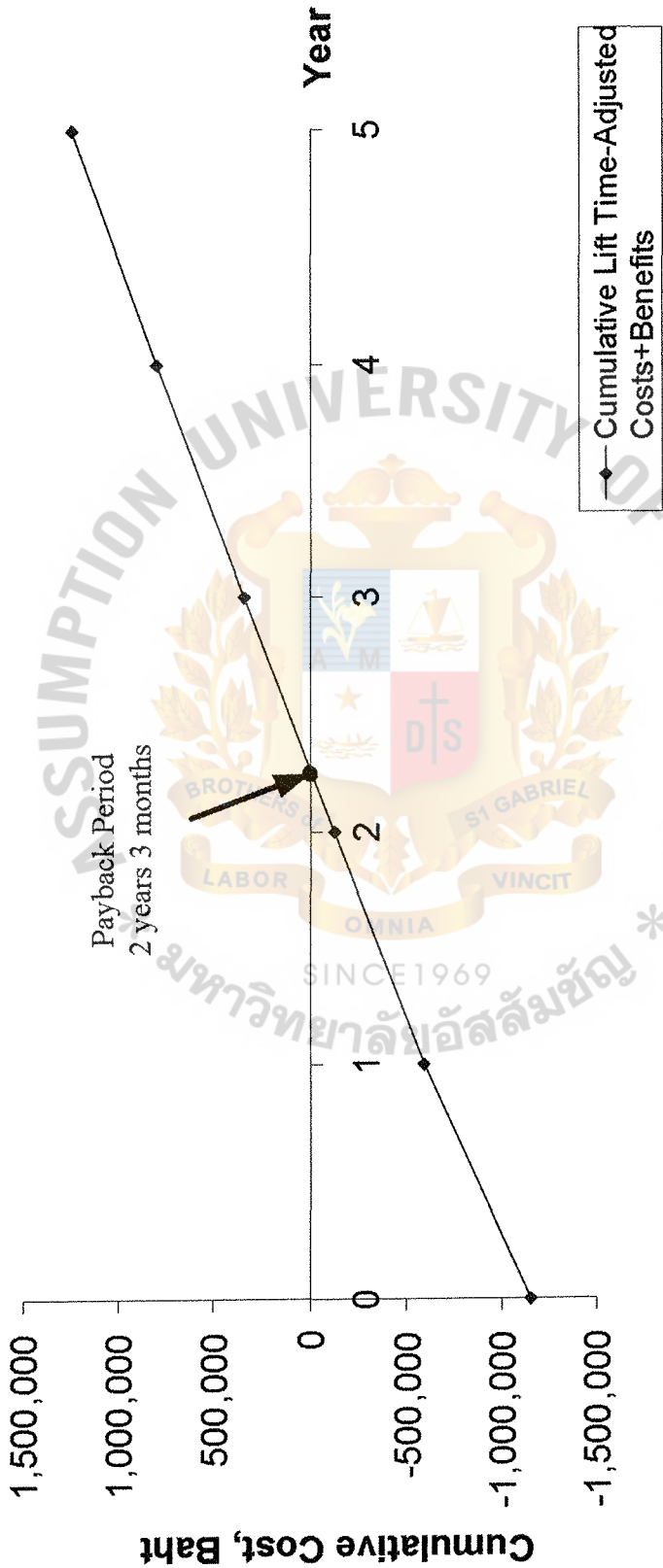


Figure D.3. Payback Period for Candidate 3.

Table D.7. Net Present Value for the Candidate 1, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Development cost:	-1,099,000						
Operation & maintenance cost:		-937,500	-1,086,950	-1,195,645	-1,315,210	-1,446,731	
Discount factors for 12%:	1	0.893	0.797	0.712	0.636	0.567	
Present value of annual costs:	-1,099,000	-837,188	-866,299	-851,299	-836,474	-820,296	
Total present value of lifetime costs:							-5,310,556
Benefits derived from operation of new system:	0	1,745,469	1,920,016	2,112,017	2,323,219	2,555,541	
Discount factors for 12%:	1	0.893	0.797	0.712	0.636	0.567	
Present value of annual benefits:	0	1,558,704	1,530,253	1,503,756	1,477,567	1,448,992	
Total present value of lifetime benefits:							7,519,272
NET PRESENT VALUE OF THIS ALTERNATIVE:							2,208,716

Table D.8. Net Present Value for the Candidate2, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Development cost:	-2,070,500	-937,500	-1,115,450				
Operation & maintenance cost:			-1,115,450	-1,226,995	-1,349,695	-1,484,664	
Discount factors for 12%:	1	0.893	0.797	0.712	0.636	0.567	
Present value of annual costs:	-2,070,500	-837,188	-889,014	-873,620	-858,406	-841,804	
Total present value of lifetime costs:							-6,370,532
Benefits derived from operation of new system:	0	1,745,469	1,920,016	2,112,017	2,323,219	2,555,541	
Discount factors for 12%:	1	0.893	0.797	0.712	0.636	0.567	
Present value of annual benefits:	0	1,558,704	1,530,253	1,503,756	1,477,567	1,448,992	
Total present value of lifetime benefits:							7,519,272
NET PRESENT VALUE OF THIS ALTERNATIVE:							1,148,740

Table D.9. Net Present Value for the Candidate3, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Development cost:	-1,149,832						
Operation & maintenance cost:		-1,129,500	-1,326,650	-1,459,315	-1,605,247	-1,765,771	
Discount factors for 12%:	1	0.893	0.797	0.712	0.636	0.567	
Present value of annual costs:	-1,149,832	-1,008,644	-1,057,340	-1,039,032	-1,020,937	-1,001,192	
Total present value of lifetime costs:							-6,276,977
Benefits derived from operation of new system:	0	1,745,469	1,920,016	2,112,017	2,323,219	2,555,541	
Discount factors for 12%:	1	0.893	0.797	0.712	0.636	0.567	
Present value of annual benefits:	0	1,558,704	1,530,253	1,503,756	1,477,567	1,448,992	
Total present value of lifetime benefits:							7,519,272
NET PRESENT VALUE OF THIS ALTERNATIVE:							1,242,295



APPENDIX E
INTERFACE DESIGN

TFM: Animal Feeds Production Information System: Security Authorization

Login

Welcome to

**Thal Feed Mills
Production**

User ID Information

User ID: kitti

Password: *****

OK

Cancel

Warning: This computer program is protected by copyright law and international treaties. Unauthorized reproduction or distribution of this program, or any portion of it, may result in civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.

Thal Feed Mills Co.,Ltd. V1.0

Figure E.1. Interface Design for User ID Login.

TFM: Animal Feeds Production Information System: Security Authorization

Login Order

24/10/2003 08:40:37

User Information

User Name: Kitti Apikeeratikul

SHIFT: Day

USER ID: PDT00001

Order

User since: January 2003

Last Login: 23/10/2003

Order No: PF00450

Order Description: Poultry Feeds (4.5 mm)

Qty: 4 Batch

Order Start:

Order Finish:

Order No	Order Description	Start	Finish
PF00300	Poultry Feeds (3.0 mm)	24/10/2003 06:00:07	24/10/2003 06:14:28
PF00400	Poultry Feeds (4.0 mm)	24/10/2003 08:16:13	24/10/2003 08:29:36
PF00450	Poultry Feeds (4.5 mm)	24/10/2003 08:31:06	

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Figure E.2. Interface Design for Order Information.

TFM: Animal Feeds Production Information System: Security Authorization

Login Order Formula 24/10/2003 08:40:37

User Information

User Name: Kitti Apikeeratikul SHIFT: Day USER ID: PDT00001 Formula

User since: January 2003 Last Login: 23/10/2003

Formula No: 104 S/1

Formula Description: Shrimp Feed 104/ 1 week

Total Weight: 970.000 Kg.

Create as: Proceed

Seq	FM No	Total Weight	Create
1	104 S/1	970.000	22/10/2003 15:05:08

RM No.	Raw Material Description	Weight
00001	Wheat Flour	500.000
00002	Fish Meas	200.000
00003	Yeast 40%	20.000
00004	Blood Meal	100.000
00005	Fish Oil	50.000
00006	Shrimp Meal	100.000

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Thai Feed Mills Co., Ltd. V1.0

Figure E.3. Interface Design for Formula Information.

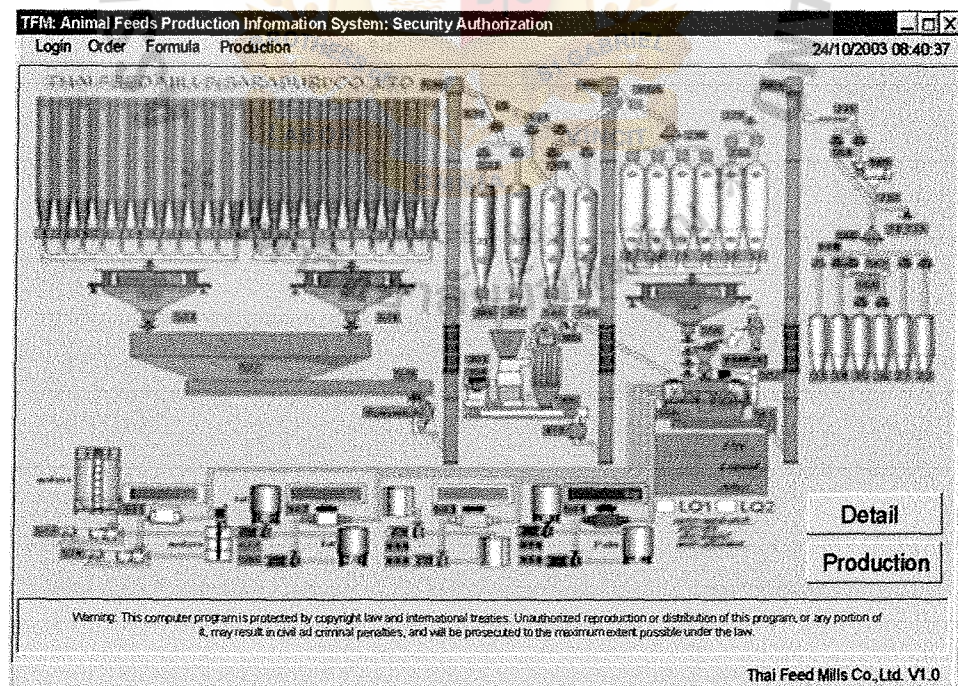


Figure E.4. Interface Design for Production Flow Chart.



Figure E.5. Interface Design for Production Details.

TFM: Animal Feeds Production Information System: Security Authorization

Login Order Formula Production Report Exit

24/10/2003 08:40:37

Report from: 24/10/2003 to: 24/10/2003

Shift: ☒ All ☐ Day ☐ Night

Select Type of the Report

☒ Production Report categorized by Batch Number

☐ Production Report categorized by Formula

☐ Raw Material Report categorized by Batch Number

☐ Raw Material Report categorized by Formula

	SH	Batch No	Qty	Formula
1	D	0045	4	104 S/I
2	D	0046	7	105 S/I
3	D	0047	4	302 F/I
4	D	0048	4	304 F/I
5	N	0049	10	444 P/2
6	N	0050	4	104 S/I
7	N	0051	4	106 S/I

	RM No	RM Name	Preset	Actual
1	00001	Wheat Flour	500.000	501.700
2	00002	Fish Meal	200.000	199.998
3	00003	Yeast 40%	20.000	21.000
4	00004	Blood Meal	100.000	100.000
5	00005	Fish Oil	50.000	49.998
6	00006	Shrimp Meal	100.000	100.000

Process Preview Close Report

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Thai Feed Mills Co., Ltd. V1.0

Figure E.6. Interface Design for Print Report Screen.



APPENDIX F
REPORT DESIGN

THAI FEED MILLS (SaraBuri) CO.,Ltd.

Production Report categorized by Batch Number

From Date: 24/10/2003 to: 24/10/2003 Printed since: 30/10/2003 15:34:45

	Order No	Batch	Formula No	Preset	Actual	Difference	Finish
1	PF00300	1	104 S/1	970.000	972.686	-2.686	24/10/2003 08:30:24
2	PF00300	2	104 S/1	970.000	972.940	-2.940	24/10/2003 08:40:30
3	PF00300	3	104 S/1	970.000	970.200	-0.200	24/10/2003 08:50:44
4	PF00300	4	104 S/1	970.000	970.000	0.000	24/10/2003 09:00:03

	3,880.000	3,885.826	-5.826
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Operator Name: Kitti Apikeeratikul User ID: PDT00001 SHIFT: Day

Figure F.1. Production Report Categorized by Batch Number.

THAI FEED MILLS (SaraBuri) CO.,Ltd.

Production Report categorized by Formula

From Date: 24/10/2003 to: 24/10/2003 Printed since: 30/10/2003 15:34:45

	Formula No	Batch	Preset	Actual	Difference	Finish
1	104 S/1	4	970.000	972.686	2.686	24/10/2003 08:30:24
2	105 S/1	7	1,000.000	999.000	-1.000	24/10/2003 08:40:30
3	302 F/1	4	870.000	872.000	0.200	24/10/2003 08:50:44
4	304 F/1	4	1,100.000	1,120.000	20.000	24/10/2003 09:00:03
5	444 P/2	10	1,100.000	1,099.000	-1.000	24/10/2003 09:10:03
6	104 S/1	4	970.000	970.000	0.000	24/10/2003 09:20:03
7	106 S/1	4	970.000	970.000	0.000	24/10/2003 09:30:03

6,980.000	7,002.680	22.686
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Operator Name: Kitti Apikeeratikul User ID: PDT00001 SHIFT: Day

Figure F.2. Production Report Categorized by Formula.

THAI FEED MILLS (SaraBuri) CO.,Ltd.

Raw Material Report

From Date: 24/10/2003 to: 24/10/2003 Printed since: 30/10/2003 15:34:45

RM No	Raw Material Description	Preset	Actual	Difference
1 00001	Wheat Flour	11,970.000	11,972.686	2.686
2 00002	Fish Meat	970.000	972.940	2.940
3 00003	Yeast 40%	970.000	970.200	0.200
4 00004	Blood Meal	970.000	970.000	0.000
5 00005	Fish Oil	4,720.000	4,721.500	1.500
6 00006	Shrimp Meal	970.000	970.000	0.000
7 00011	Corn	91,130.000	91,133.000	3.000
8 00025	Full Fat Soybean	11,600.000	11,611.000	11.000
9 00036	Feather Meal	8,235.000	8,241.000	6.000
10 00064	Salt	1,365.000	1,365.987	0.987
11 00069	Di Calcium	3,430.000	3,430.000	0.000
		136,330.000	136,358.313	28.313

Operator Name: Kitti Apikeeratikul User ID: PDT00001 SHIFT: Day

Figure F.3. Raw Materials Report.

THAI FEED MILLS (SaraBuri) CO.,Ltd.

Raw Material Report categorized by Formula

From Date: 24/10/2003 to: 24/10/2003 Printed since: 30/10/2003 15:34:45

Formula No	RM No	RM Description	Preset	Actual	Difference	
1	104 S/1	00001	Wheat Flour	970.000	972.686	2.686
2		00002	Fish Meat	1,000.000	999.000	-1.000
3		00003	Yeast 40%	870.000	872.000	0.200
4		00004	Blood Meal	1,100.000	1,120.000	20.000
5		00005	Fish Oil	1,100.000	1,099.000	-1.000
6		00006	Shrimp Meal	970.000	970.000	0.000
			6,010.000	6,032.686	22.686	

Operator Name: Kitti Apikeeratikul User ID: PDT00001 SHIFT: Day

Figure F.4. Raw Material Report Categorized by Formula.



APPENDIX G
DATABASE DESIGN

Table G.1. Structure of User Table.

Name	Type	Null	Foreign key to table	Check	Key Type
UserID	Integer	Not	-	-	Primary Key
User_Name	Char	Null	-	-	Attribute
User_Surname	Char	Not	-	-	Attribute
U_Address	Char	Not	-	-	Attribute
U_Email	Char	Null	-	-	Attribute
U_City	Date	Not	-	-	Attribute
U_Province	Char	Not	-	-	Attribute
U_Shift	Char	Null	-	-	Attribute
U_Date	Date	Null	-	-	Attribute

Table G.2. Structure of User Order Table.

Name	Type	Null	Foreign key to table	Check	Key Type
Order_No	Integer	Not	Order	-	Foreign Key
User_ID	Integer	Not	User	-	Foreign Key
Order_IssDate	Date	Null	-	-	Attribute
Order_Qty	Integer	Null	-	-	Attribute
Order_Batch	Char	Null	-	-	Attribute

Table G.3. Structure of Order Table.

Name	Type	Null	Foreign key to table	Check	Key Type
Order_No	Integer	Not	-	-	Primary Key
Order_Date	Date	Null	-	-	Attribute
O_StrTime	Date	Null	-	-	Attribute
O_FinTime	Date	Null	-	-	Attribute

Table G.4. Structure of Formula Table.

Name	Type	Null	Foreign key to table	Check	Key Type
Formula_Code	Integer	Not	-	-	Primary Key
F_Name	Char	Null	-	-	Attribute
F_Weight	Integer	Null	-	-	Attribute
F_IssDate	Date	Null	-	-	Attribute

Table G.5. Structure of Raw Material Table.

Name	Type	Null	Foreign key to table	Check	Key Type
RM_Code	Integer	Not	-	-	Primary Key
RM_Name	Char	Null	-	-	Attribute
RM_Type	Char	Null	-	-	Attribute
RM_Qty	Integer	Null	-	-	Attribute
RM_Grade	Char	Null	-	-	Attribute
RM_Price	Integer	Null	-	-	Attribute
RM_Lot	Integer	Null	-	-	Attribute
RM_Date	Date	Null	-	-	Attribute

Table G.6. Structure of Batch Table.

Name	Type	Null	Foreign key to table	Check	Key Type
Formula_Code	Integer	Not	Formula	-	Foreign Key
Batch_Number	Integer	Not	-	-	Primary Key
B_Description	Char	Null	-	-	Attribute
B_StrTime	Date	Null	-	-	Attribute
B_FinTime	Date	Null	-	-	Attribute

Table G.7. Structure of Finished Product Table.

Name	Type	Null	Foreign key to table	Check	Key Type
Product Code	Integer	Not	-	-	Primary Key
Product Name	Char	Not	-	-	Attribute
P_Qty	Integer	Null	-	-	Attribute
P_FinTime	Date	Null	-	-	Attribute
P_ExpDate	Date	Null	-	-	Attribute



APPENDIX H
PROCESS SPECIFICATION

PROCESS SPECIFICATION

Process Specification shows the process of Animal Feeds Production Information

System that consists of:

- (1) Verifying User Information Process
- (2) Changing New User Password Process
- (3) Requesting Order Process
- (4) Making New Order Process
- (5) Verifying Formula Process
- (6) Issuing Formulation Receipt Process
- (7) Weighing Process
- (8) Mixing Process
- (9) Pelleting Process
- (10) Packaging and Bulk Loading Process
- (11) Checking Product Quality Process
- (12) Verifying Delivery Date Process
- (13) Receiving Print Report Process
- (14) Distributing Report Process

Table H.1. Process Specification of Verifying User Information.

Items	Description
Process Name :	Verify User Information
Data In :	User Information
Data Out :	User Information Approved User Information
Process :	(1) Request user information from customer (2) Receive user information (3) Check user information (4) Send Notification back to User (5) Send Approved User Information to process2

Table H.2. Process Specification of Changing New User Password Customer.

Items	Description
Process Name :	Change New User Password
Data In :	User Information
Data Out :	New User Information
Process :	(1) Receive User Information (2) Send new User information to the User records

Table H.3. Process Specification of Requesting Order.

Items	Description
Process Name :	Request Order
Data In :	Approved User Information Request Order Order Information
Data Out :	Request Order Notification Approved Order Information

Table H.3. Process Specification of Requesting Order (Continued).

Items	Description
Process :	(1) Receive Approved User information (2) Request Order (3) Receive Request Order (4) Send Quotation to Customer (5) Send notification of the request to Production Department (6) Send Approved Order Information to next process

Table H.4. Process Specification of Making New Order.

Items	Description
Process Name :	Make New Order
Data In :	Approved Order Information
Data Out :	Update New Order
Process :	(1) Receive Approved Order Information (2) Update New Order records

Table H.5. Process Specification of Verify Formula.

Items	Description
Process Name :	Verify Formula
Data In :	Order Information Formula Information
Data Out :	Request Formula Request Material Update Formula
Process :	(1) Receive Order Information from Order records (2) Request Formula Information from Nutrition Department (3) Receive Formula Information from Nutrition Department (4) Update Formula (5) Send Formula Information to next process

Table H.6. Process Specification of Issuing Formula Receipt.

Items	Description
Process Name :	Formula Receipt
Data In :	Formula Information
Data Out :	Formula Receipt
Process :	(1) Receive Formula Information from Verify Formula process (2) Send Formula Receipt to next process

Table H.7. Process Specification of Weighing of Production.

Items	Description
Process Name :	Weighing Ingredient
Data In :	Formula Receipt Raw Material Information Batch Information Batch Status
Data Out :	Request Formula Information Request Raw Material Information Update Batch Status Batch Receipt
Process :	(1) Receive Formula Receipt (2) Receive Formula Information from Formula records (3) Request Raw Material from Raw Material records (4) Receive Raw Material information from Raw Material records (5) Receive Batch Information from Production Department (6) Update Batch Status from Batch records (7) Receive Batch Status from Batch records (8) Send Batch Receipt to next process

Table H.8. Process Specification of Mixing of Production.

Items	Description
Process Name :	Mixing Raw Materials

Table H.8. Process Specification of Mixing of Production (Continued).

Items	Description
Data In :	Batch Receipt Batch Status
Data Out :	Update Status Batch Receipt
Process	(1) Receive Receipt from Weighing Ingredients process (2) Receive Batch Status from Batch records (3) Update Batch Status to Batch records (4) Send Batch Receipt to next process

Table H.9. Process Specification of Pelleting of Production.

Items	Description
Process Name :	Pelleting Mills
Data In :	Batch Receipt Batch Status
Data Out :	Update Batch Status Batch Receipt
Process	(1) Receive Batch Receipt from previous process (2) Receive Batch Status from Batch records (3) Update Batch Status to Batch records (4) Send Batch Receipt to next process

Table H.10. Process Specification of Packaging and Bulk Loading.

Items	Description
Process Name :	Packaging and Bulk Loading
Data In :	Batch Receipt Batch Status Finished Products Information
Data Out :	Finished Products Information Update Finished Product Update Batch Status

Table H.10. Process Specification of Packaging and Bulk Loading (Continued).

Items	Description
Process	(1) Receive Batch Receipt from previous process (2) Receive Batch Status from Batch records (3) Update Batch Status to Batch records (4) Update Finished Product to Finished Product records (5) Receive Finished Product Information (6) Send Finished Product Information to Inventory Department

Table H.11. Process Specification of Checking Product Quality.

Items	Description
Process Name :	Check Product Quality
Data In :	Finished Product Information
Data Out :	Checked Finished Product Information Update Finished Product Information
Process	(1) Receive Finished Product information from Finished Product records (2) Update Finished Product to Finished Product records (3) Send Reject Finished Product to Production Department (4) Receive Finished Product from Production Department (5) Send Approved Finished Product to next process

Table H.12. Process Specification of Verifying Delivery Date.

Items	Description
Process Name :	Verify Delivery Date
Data In :	Checked Finished Product Information Delivery Date
Data Out :	Update Finished Product Information Delivery Note

Table H.12. Process Specification of Verifying Delivery Date (Continued).

Items	Description
Process	(1) Receive Checked Finished Product Information from previous process (2) Receive Delivery Date from Time (3) Update Finished Product Information to Finished Product records (4) Receive Finished Product Information from Finished Product records (5) Send Delivery Note to Delivery Department

Table H.13. Process Specification of Receiving Print Request.

Items	Description
Process Name :	Receive Print Request
Data In :	User Information Finished Product Information Order Information Raw Material Information Formula Information Batch Information Request Report
Data Out :	Print Report
Process	(1) Receive User Information from User records (2) Receive Finished Product Information from Finished Product records (3) Receive Order Information from Order records (4) Receive Raw Material Information from Raw Material records (5) Read Formula Information from Formula records (6) Read Batch Information from Batch records (7) Receive Request Report from Production Manager (8) Send Print Report to next process

Table H.14. Process Specification of Distributing Report.

Items	Description
Process Name :	Distribute Report
Data In :	Print Report Request Report
Data Out :	Print Report Report Upon Request
Process	(1) Receive Print Report from previous process (2) Send Print Report to Production Manager (3) Send Report Upon Request to Production Manager (4) Receive Request Report from Other Department (5) Send Print Report to Other Department





APPENDIX I
DATA DICTIONARY

Table I.1. Data Dictionary of Data Flow Diagram.

Name	Type	Description
Add New Customer	Process	Add new customer information in customer records
Approved Purchasing Order	Data Flow	Information of the order being proved by the process
Batch Order Request	Data Flow	Request for the information of the batch being produced
Batch Order Response	Data Flow	Information of the batch number
Batch Schedule	Data Flow	Sequence of the batch being produced in the production process
Batches	Data Store	Store information about Batch number
Check Customer Information	Process	Verify customer information in customer records
Check Inventory	Data Flow	Check for the availability of inventory
Check Product Quality	Process	Verify information of finished product checking for its quality
Check Raw Material	Data Flow	Check for the availability of raw materials
Customer	External Entity	Customers who are willing to order the product
Customer Information	Data Flow	Information of customers who are the member
Customers	Data Store	Store information about customers
Delivery Date Response	Data Flow	Information of delivery date that finished product is scheduled
Delivery Department	External Entity	A department concerns the management of deliverable product
Delivery Note	Data Flow	Information of finished product with delivery date assigned
Distribute Report	Process	Distribute report information according to the request
Finished Products	Data Store	Store information about finished products
Formula Information	Data Flow	Information of formula used for the production process
Formula Receipt	Process	Step of generating information of the formula
Formulas	Data Store	Store information about formulas

Table I.1. Data Dictionary of Data Flow Diagram (Continued).

Name	Type	Description
Inventory Department	External Entity	A department where manages finished products and raw materials
Inventory Response	Data Flow	Information of the available inventory
Make New Order	Process	Input new order information which had been requested by customers
Mixing	Process	Verify batch receipt and batch status for mixing
Monthly Report	Data Flow	Report information that has to be submit to manager every month
Notification	Data Flow	Notification to inform customer
Nutrition Department	External Entity	A department concerns with formula generation
Order Information	Data Flow	Information of order made by customer
Orders	Data Store	Store information about orders
Other Departments	External Entity	Other department who may need to see the process information
Packaging and Bulk Loading	Process	Verify batch receipt and batch status for packaging and bulk loading
Pelleting	Process	Verify batch receipt and batch status for pelleting
Production Department	External Entity	A department concerns the production of the products
Production Manager	External Entity	Person who requests for all production information that need for decision making
Purchasing Department	External Entity	A department concerns with purchase or acquire raw material
Purchasing Order	Data Flow	Information of the required products made by customers
Quotation	Data Flow	Information of the price of products quoted to customers
Raw Material Response	Data Flow	Information of the available raw materials
Raw Materials	Data Store	Store information about raw materials
Receive Print Request	Process	Receive information from every data record and prepare report

Table I.1. Data Dictionary of Data Flow Diagram (Continued).

Name	Type	Description
Report Upon Request	Data Flow	Information that is prepared according to the request
Request Delivery Date	Data Flow	Request delivery date of the finished product
Request Formula	Data Flow	Request formula that required for the produce the product
Request Information	Data Flow	Request information used for the production process
Request Order	Data Flow	Request order made by customer
Request Report	Data Flow	Request report used for oversee the production process
Summary Batch Report	Data Flow	Information of total batch produced
Time	External Entity	Remained to system when the time comes
Update Customer Information	Data Flow	Update the information of customers
Update Finished Product	Data Flow	Update the information of finished products
Update Formula	Data Flow	Update the information of formulas
Update Raw Material	Data Flow	Update the information of raw materials
Verify Delivery Date	Process	Verify information of delivery date to checked finished product
Verify Formula	Process	Verify formula information for the production
Weighing	Process	Verify formula and raw material for weighing

Table I.2. Data Dictionary of Database.

Field Name	Meaning
B_Description	The description of each batch
B_FinTime	Finish time of making batch
B_StrTime	Start time of making batch
Batch Number	The number of Batch producing
F_IssDate	The date when the formula is issued
F_Name	Formula's name
F_Weight	Total weight for each formula
Formula_Code	Formula number assigned for each formula
O_FinTime	Finish time of making an order
O_StrTime	Start time of making an order
Order_Batch	One order contains a lot of batches
Order_Date	The date when the order is issued
Order_IssDate	The date when the order is issued
Order_No	The number of order
Order_No	The number of Order
Order_Qty	Quantity of the order
P_ExpDate	The expired date assigned to finished product
P_FinTime	Finish time of making an finished product
P_Qty	Quantity of the finished product
Product_Name	The name of the finished product
RM_Code	Raw material number assigned for each raw material
RM_Date	The date when the raw material is purchased
RM_Grade	Quality of raw material

Table I.2. Data Dictionary of Database (Continued).

Field Name	Meaning
RM_Lot	Lot of raw material
RM_Name	The name of raw material
RM_Price	Price of raw material
RM_Qty	Quantity of raw material
RM_Type	The type of raw material
U_Address	User's address
U_City	User's city of living
U_Date	User's date of being a member of this company
U_Email	User Email address
U_Province	User's province of living
U_Shift	User's shift, mostly seperated as Day and Night
User_ID	User Identify number assigned to each user
User_Name	User's name
User_Surname *	User's surname *

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