Quality Control Information System for Wick and Heuglan Co., Ltd.

by

Mr. Jirapat Wanasuksathit

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
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Project Title	Quality Control Information System for Wick and Heuglan Co., Ltd.
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Academic Year	March 17, 2002

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

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ABSTRACT

Wick and Heuglan Co., Ltd. is the largest manufacturer and installation of HDPE Pipe in Asia. It is a prosperous and high potential in its business. They have many products such as HDPE Pipe, HDPE fitting, LDPE Pipe, and MDPE Pipe in order to sell to the customers. Before products are sold to the customers, they were inspected by quality control laboratory in its factory at Bangpakong Industrial Park II. It has many microcomputers and networking at the head quarter at Bangkok and its factory at Bangpakong Industrial Park II. All systems in departments and document forms are complete themselves by using application software. The company has only one problem about quality of pipes. Each year, some products were not approved because they had a lot of errors such as low tensile strength, low pressure, errors in diameter, and so forth. Although this company has many engineers and supervisors to control, their errors occur from low-knowledge workers. From these losses of pipes that were rejected by quality control laboratory, this company loses incomes about 30,000,000 Baht per year. Although the participant of this company had a meeting about this problem and corrected it by changing the new workers to produce pipes, this problem still occurs; therefore the Quality Control Information System is to develop the effective production for quality control system.

The current existing Quality Control System is based on the manual system. The process is operated by low-knowledge worker. It requires many staffs to maintain the system, and has to face the general problems of manual system, which are error-prone and having a high maintenance cost.

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I. INTRODUCTION

1.1 Background of the Project

Wick and Heuglan Co., Ltd. is the largest manufacturer and installation of HDPE Pipe in Asia. It is a prosperous and high potential in its business. They have many products such as HDPE Pipe, HDPE fitting, LDPE Pipe, and MDPE Pipe in order to sell to the customers. Before products are sold to the customers, they were inspected by quality control laboratory in its factory at Bangpakong Industrial Park II. It has many microcomputers and networking at the head quarter at Bangkok and its factory at Bangpakong Industrial Park II. All systems in departments and document forms are complete themselves by using application software. The company has only one problem about quality of pipes. Each year, some products were not approved because they had a lot of errors such as low tensile strength, low pressure, errors in diameter, and so forth. Although this company has many engineers and supervisors to control, their errors occur from low-knowledge workers. From these losses of pipes that were rejected by quality control laboratory, this company loses incomes about 30,000,000 Baht per year. Although the participant of this company had a meeting about this problem and corrected it by changing the new workers to produce pipes, but this problem still occurs.

Mr. Pornchai Santinantakul, Managing Director of Wick and Heuglan Co., Ltd. wanted to improve the quality of the products and then he approved their project analysts' team to solve these problems. From investigation in this factory, their project analysts' team found many workers not intended to do their works. They were operated day-by-day that in fact this company had the policies for the workers who had responsibility and worked very well could be promoted up to supervisor position.

And this company has many microcomputers and their accessories that they can improve the quality of products.

Project analysts surveyed, studied, and planned this project that is shown in this project proposal. They thought the problems of the old system occurred from lack of intention of the workers. They had a meeting and concluded the results for solve the problems by using some microcomputers to control pipe production replacing the workers. Supervisors will be reduced from 8 persons to 4 persons. The workers who still work in this project were reduced from 36 persons to 12 persons. Supervisors will train using of computers to produce the products before they operate with the new system.

1.2 Objectives of the Project

The objective of the project is to design and implement computerized quality control information system for Wick and Heuglan Co., Ltd. The system is aimed for developing a computerized system to reduce losses and errors while producting, and ensure accuracy in quality of products. Comparing with the existing system, the proposed system enhances the higher capability of the company.

The objectives of the proposed system are as following:

(1) To analyze the existing system of Wick and Heuglan Co., Ltd.

(2) To study problems occurred in the existing system.

(3) To design the Quality Control Information System which is the new computerized system.

(4) Establishing new computerized system regarding the organizational requirements.

(5) To increase the response time of all processes.

(6) To increase the quality of pipes and fittings.

(7) To increase profits of the organization.

(8) To enhance the effectiveness of the company's database system.

(9) To diminish manufacturing document works.

(10) To reduce any fault occurred during manufacturing processes.

(11) To reduce errors from wrong input data.

(12) To reduce cost of Supervisors and Workers.

(13) To reduce cost of materials.

(14) To reduce transaction or manufacturing cost.

(15) To reduce losses in income.

1.3 Scope of the Project

The Quality Control Information System is a developing computerized system for improving the quality of pipe and fitting products according to customers' satisfaction. The Quality Control Information System will focus on collecting customers' specification, matching standard specification, controlling process, and making quality control report, which in the existing system are manual systems. The Quality Control Information System will install 12 new computers, programmable logic controllers, and software with the 12 machines, testing the new system, and training users. All of them can complete within 4 months.

The developing project will cover these scopes:

(1) To analyze and design the Quality Control Information System that is the computerized system.

(2) To develop new devices to control machines that relates to the computerized system.

(3) To develop a new software to control process while producting.

(4) To construct the database, inputs, and user interface for operators.

(5) To replace paper-based documents with electronic documents.

(6) To implement the Quality Control Information System to the organization.

1.4 Deliverables

The deliverables of this project shall be employed with:

(a) Input Screens layouts for user-interface

(b) Project Works, which contains the following contents

(1) Project Overview

(2) Context Diagram

(3) Data Flow Diagram

(4) Entity-Relationship Diagram (ER-Diagram)

(5) System Flowchart

(6) Cost/Benefit Analysis Report

(7) Input-Output

(8) Inspection and Test plan, including their results

(9) Conclusion and Recommendation

(10) Data Dictionary

1.5 Project Plan

The project plan of the Quality Control Information System would be started from the first week of June 2002, and will be completed in the fourth week of September 2002. Figure 1.1 is the project plan of the Pipe Production Information System.

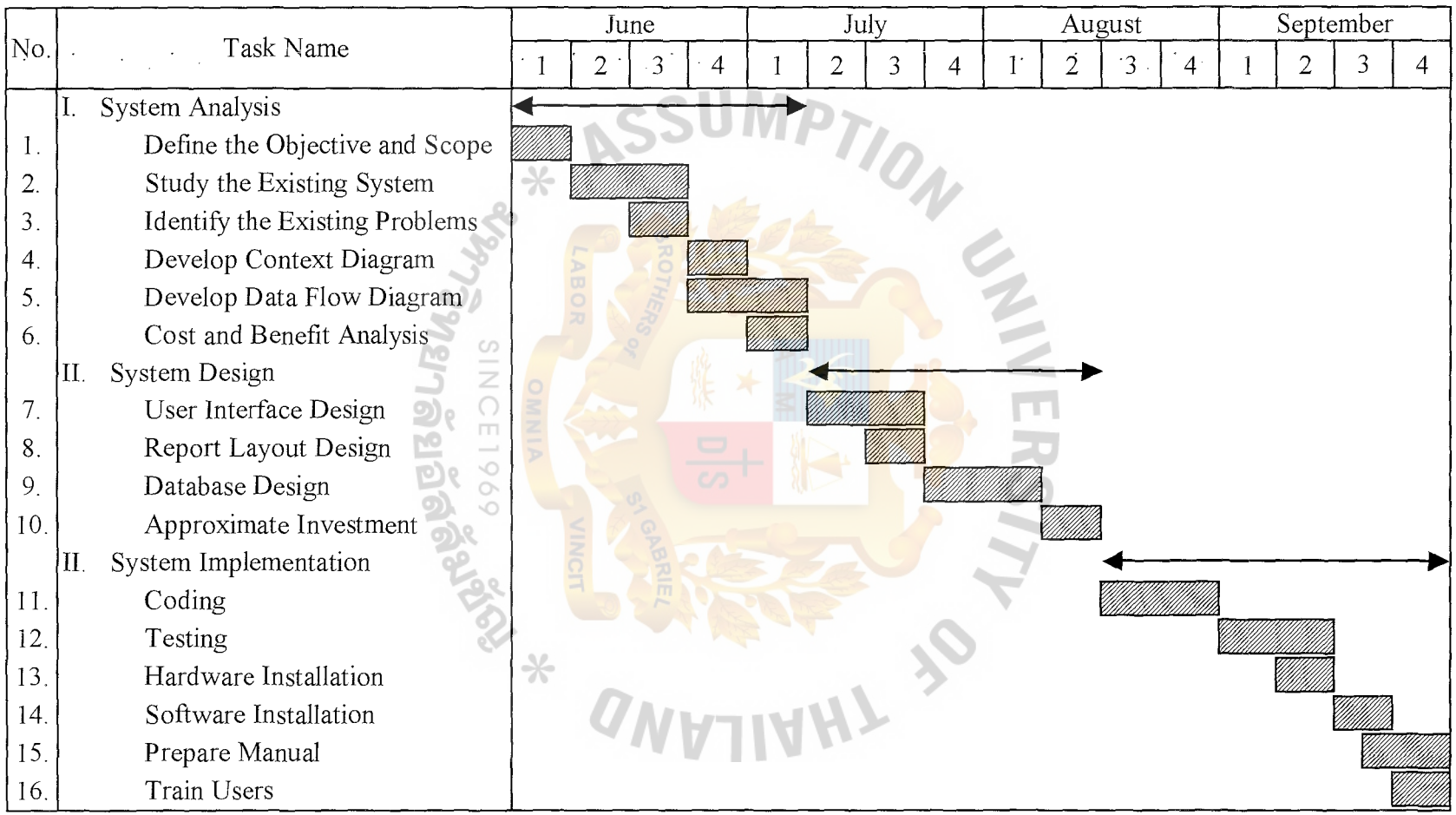

Figure 1.1. Project Plan of Quality Control Information System

II. THE EXISTING SYSTEM

The existing system is the current system that the company would like to analyze in order to design the new system. System analysis will be done thoroughly starting from the background of the organization, the existing business function, the current problems and the existing system.

2.1 Background of the Organization

Wick and Heuglan Co., Ltd., Thailand, is a subsidiary of Vaasa Pipe Ltd., Vaasa Finland, which started manufacturing plastic pipes in 1995. The main product is High Density Polyethylene pipe (HDPE). Presently, Vaasa Pipe Ltd. operates pipe factories in more than 10 countries around the world.

Vaasa Pipe Ltd. is a multi-national organization, and one of the biggest suppliers of HDPE pipe in the world. The company undertakes design, construction, and installation of PE piping system to customers' specifications throughout the world for more than 40 years.

In 1980, Vaasa Pipe was invited by Metropolitan Water Works Authority (MWA) to submit a proposal to renew Bangkok's cast-iron water pipe system in Rama IV, Rajdamri, and Silom Roads. This was a turnkey project that included design, construction, installation, and material supply.

Vaasa Pipe Ltd. won the tender by offering a special method which feeds new pipes into the old ones, thus eliminating leakage, and the advantages of relining system are:

(1) It minimizes traffic inconvenience and damages to streets and surrounding buildings.

(2) It minimizes interruption of water distribution.

(3) It provides a leak-proof, non-corrosive, non-toxic system with low friction loss and a life expectancy of at least fifty years.

Presently, the installed pipes are still in good condition.

During the execution of the MWA project, the idea of setting up a manufacturing unit in Thailand was mooted. The factory in Navanakorn Industrial Estate, promoted by Board of Investment (BOI) had been in production for manufacturing HDPE, LDPE, PP, MDPE pipes and fittings since 1983. In 1986, Thailand Industrial Standard Institute (TISI) certified the company's HDPE pipe.

Due to steady growth, the company expanded its base by shifting the factory to Bangpoo Industrial Estate in 1988, which was six times larger than the old factory. In April 1995, the company granted ISO 9003 and ISO 9002 in April 1996, at the beginning of that year, the company shifted the factory to Bangpakong Industrial Park II to increase its capacity to 16,000 tons per year. Nowadays, the company has employees of approximately 150 people. It produces products by using injection machines and control by supervisors and workers.

Moreover, Wick and Heuglan Co., Ltd. Thailand, is the regional center of Vaasa Pipe in Asia, and operates PE pipe factories in India, Malaysia, and China. As a leading and experienced polyethylene pipe manufacturer, the company is constantly invited to participate in the international tenders. Figure 2.1 is an organization chart of Wick and Heuglan Co., Ltd.

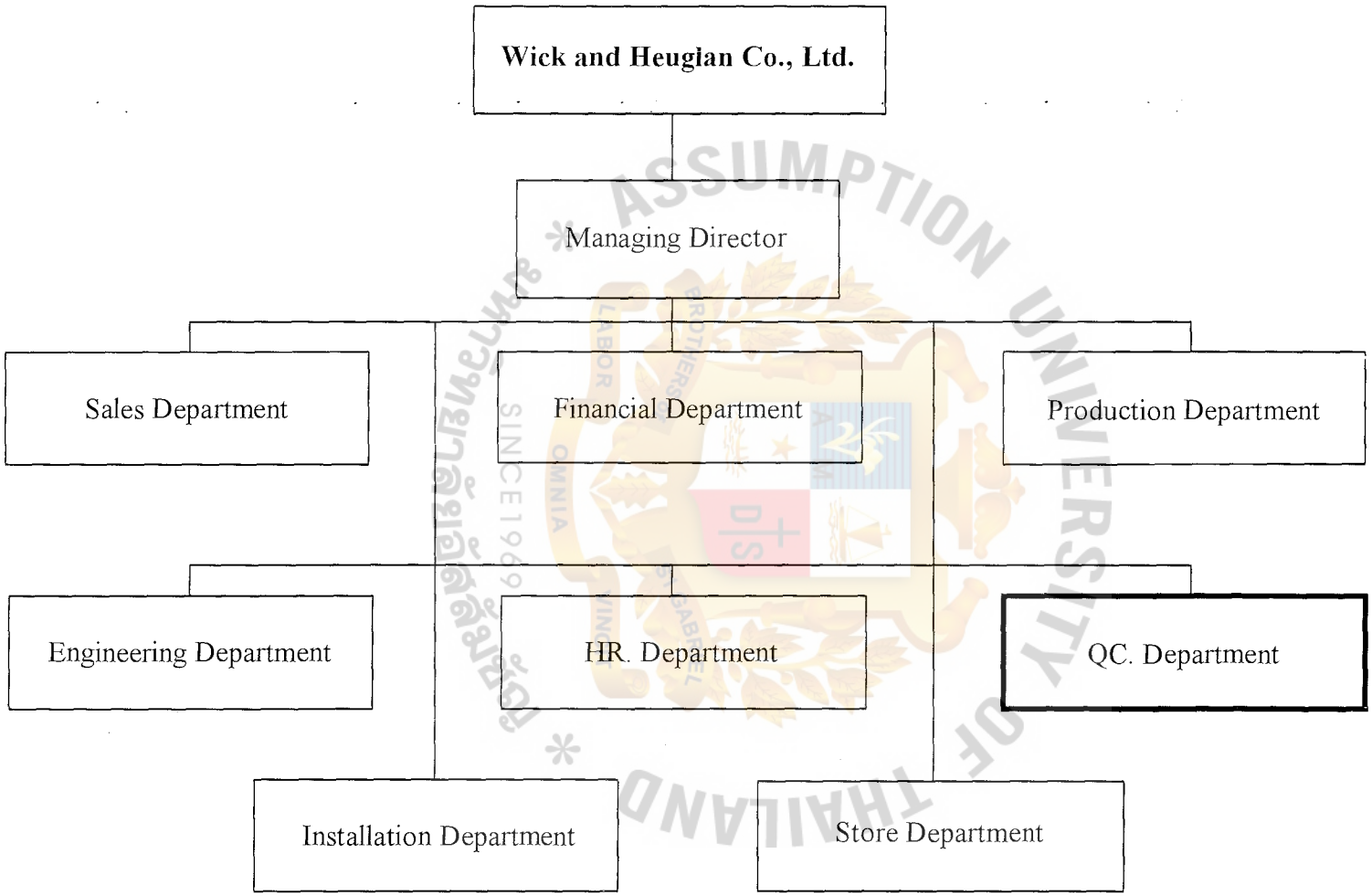

Figure 2.1. Organization Chart of Wick and Heuglan Co., Ltd.

2.2 The Existing Business Functions

The function of each department of the Wick and Heuglan Co., Ltd. can be described and illustrated as following:

(1) Sales and Marketing Department

This department is responsible for taking care of customers, sales technical support for customers, sales company's products to customers. In fact, there are three main activities that this department has to do:

(a) Sales: This activity concerns contacting and servicing the existing customers, and searching for new customers.

(b) Technical support: This activity concerns suggesting of products such as piping design, determine pipe standard, pipe specification according to customers' requirements, and presentation products for customers.

(c) Planning: This activity concerns long-term and short-term sales and marketing plan and strategy.

(2) Financial and Accounting Department

This department is responsible for handling accounting activities that cover revenue cycle, payment cycle, and general ledger handling, undertaking in company fund, budget, revenues, cost, compensation including foreign currency changes, and all currency activities. In addition, it concerns making quotations for customers.

(3) Engineering and Maintenance Department

This department is responsible for calculating piping design, piping drawing, technical support for sales engineer, maintenance of all machines, solving problems within factory.

(4) Production Department

This department is responsible for gathering all information of sales orders to determine schedule plan of pipe and fitting production, control process while production, train new supervisors and workers about their responsibilities, bring some of pipes and fittings that rejected from quality control laboratory to recycle to be raw materials to produce low standard of pipes and fittings, and making production report to head office.

(5) Quality Control Department

This department is responsible for checking quality of pipe and fitting before sending to customers. If some pipes and fittings are not approved, it must be rejected, and sent to production department for recycling.

(6) Store Department

This department is responsible for handling, storing, and maintaining all products that prepare to send to customers, storing all of raw materials, and checking inventory in the warehouse.

(7) Installation Department

This department is responsible for determining schedule plan of each project, control foreman and workers to install pipes and fittings in the trench according to customers' location project, and maintenance of welding machines.

(8) Human Resources Department

This department is responsible for human resources management, administration, human resources salary, including salary contributes.

2.3 Current Problems

From investigation, Wick and Heuglan Co., Ltd. is a prosperous and high potential in its business. It has many microcomputers and networking at the head office and its factory. All systems in departments and documents forms are complete themselves by using application software. But the current manual system of production department at Wick and Heuglan Co., Ltd. is human control. All production processes are controlled by supervisors and workers which could cause wrong input errors. Thus the company has one problem only about qualities of pipes and fittings products. The qualities of many pipes and fittings are low. There are many errors in pipes and fittings such as wrong sizes, type of raw material not according to the specification of customers' requirement, wrong input of process, and so forth. There are some causes of the problem as following:

(1) This problem occurs from the workers' neglect and attitude and circumspect to do their works.

(2) The workers may input wrong data into the machine controller.

(3) The workers lack understanding to control the machine.

(4) The workers are low-knowledge workers.

(5) The machine may deteriorate.

2.4 Existing System

The existing system of Wick and Heuglan Co., Ltd. involves six processes as following:

Process 1: Receive Sales Orders from the Sales and Marketing Department

This process will occur in the first time, when sales engineers in sales and marketing department contact with customers and their customers order to buy pipes and fittings products from the company. Sales engineers will make sales orders that

include raw material, diameter, pressure bar, standard, and quantities of products and send them to production department by LAN networking.

Process 2: Prepare Schedule Plan for the Production Line

When production manager receives sales orders, he and his staffs will check raw material, specification of customers' requirement, quantities, standard of pipes and fittings, and machines in order to determine schedule plan for production. Afterthat, they will prepare schedule plan for the production line.

Process 3: Determine Supervisors and Workers to Control Process

After schedule plan is completed, they will determine supervisors and workers to control process of pipes and fitting production. Because the company is the largest manufacturer and installation of HDPE pipe in Asia, there are many sales orders. They separate supervisors and workers into day shift and night shift to operate their works.

Process 4: Send Products to Quality Control Department

When pipes and fittings produced were complete, they are delivered to quality control laboratory to inspect about thickness, tensile strength, pressure, and so forth. If quality controller approved, the products will be kept in the warehouse. If quality controller rejected, the products will be sent back to production department to recycle to be raw materials to produce low standard of pipes and fittings.

Process 5: Receive Quality Control Report

After checking all products, quality controller will send quality control report to production department to consider and kept into database. If there are a lot of losses of pipes that were rejected, they will advise with engineering and maintenance department to rectify their problems.

Process 6: Send Production Report to the Sales and Marketing Department

Production manager will send production report to the sales and marketing department to keep in their database. Sales engineers will check details in production report about diameter, pressure, standard, and so forth according to customers' specification. After that, they will contact with their customers to receive products. If their customers want the company to install pipes and fittings in their projects' location, sales engineers will make sales orders for pipes and fittings installation to the installation department.

III. THE PROPOSED SYSTEM

The proposed system is designed to replace the existing manual system. The proposed computerized system will control all information of all sections, especially the processes in the production department.

3.1 System Specification

Wick and Heuglan Co., Ltd. now requires an effective computerized system, which can facilitate the processes of pipes and fittings production, and solving the problem occurring from the existing manual system.

In order to achieve the target, the new proposed system of the Quality Control Information System should have the components as Programmable Logic Controller that uses extending from simple process to manufacturing system controls and monitoring, and used for high-speed digital processing, high-speed digital communication, high-level computer language support, and, of course, for basic process control and Production Control System Software Development developed by programmers to control pipes and fittings production, available for every responsible supervisors, and workers. Furthermore, the proposed system also covers additional functions that enhance the higher capability and a lot of profits of the company.

The system specifications are as following:

(1) To reduce all errors that occurs from human being.

(2) To increase the response time of all processes.

(3) To increase the quality of pipes and fittings.

(4) To enhance the efficiency and effectiveness of each work process.

(5) To speed up processes in each department.

(6) To reduce cost of Supervisors and Workers.

(7) To reduce cost of materials.

(8) To reduce income losses.

(9) To perform the right procedures in the right order.

(10) To provide user-friendly interfaces that are in electronic documents.

3.2 System Design

3.2.1 Application Architecture

(1) Microprocessor-based system Architecture

The proposed system of the Wick and Heuglan Co., Ltd. uses Programmable Logic Controller (PLC) to control the operation of electromechanical devices. PLCs is special-propose in the sense that it has been engineered for use in manufacturing environments, and it is programmed using a special-propose language compatible with the requirements of sequential control of electromechanical systems. Any computer having input and output interfaces can be used to control external devices.

Finally, microcomputers typically offer a number of programming capabilities, including the use of several languages for writing code. When semiconductor logic functions became available and programmable factory controllers could be built, it was apparent that it would be necessary to standardize on a language. Without standardizing it would be difficult for technicians to troubleshoot programs that had been developed by other technicians. The language that technicians had traditionally used to design and document factory control circuits was ladder diagramming of relay logic. In order to introduce the programmable logic controller into the factory with minimum retraining, the language of 'ladder logic' was

adopted as the standard. Often, code written in such high-level languages can coexist with the ladder-diagram program. Besides sequential logic, PLCs would be allowed to perform arithmetic and logical operations on bytes of data, communicate with other devices using RS232 or other protocol, and perform analog control functions.

(2) Network Architecture

The proposed system of the Wick and Heuglan Co., Ltd. uses Client/Server Computing (Two-tier Client/Server) connected by the company's local area network (LAN). A LAN is a set of client computers connected to one or more server computers

For the topology network architecture, the proposed system uses Ring Topology. It is the network topology in which all computers are linked by a closed loop in a manner that passes data in one direction from one computer to another. This topology has no host so it does not rely on a central host computer and will not necessarily break down if one of the component computers malfunctions. Ring topology generally transmits packets in one direction; therefore, many computers can transmit at the same time to increase network throughput.

Moreover, the database server, instead of file server, is installed to store the data so that all database commands will be executed on this database server, making it possible to reduce traffic over the network. In the database server, the database commands are also executed on this server. The clients merely send this database commnands to the server, the server returns only the result of the database command processing, not

entire database or tables. Network configuration of the proposed system is shown in Figure 3.1.

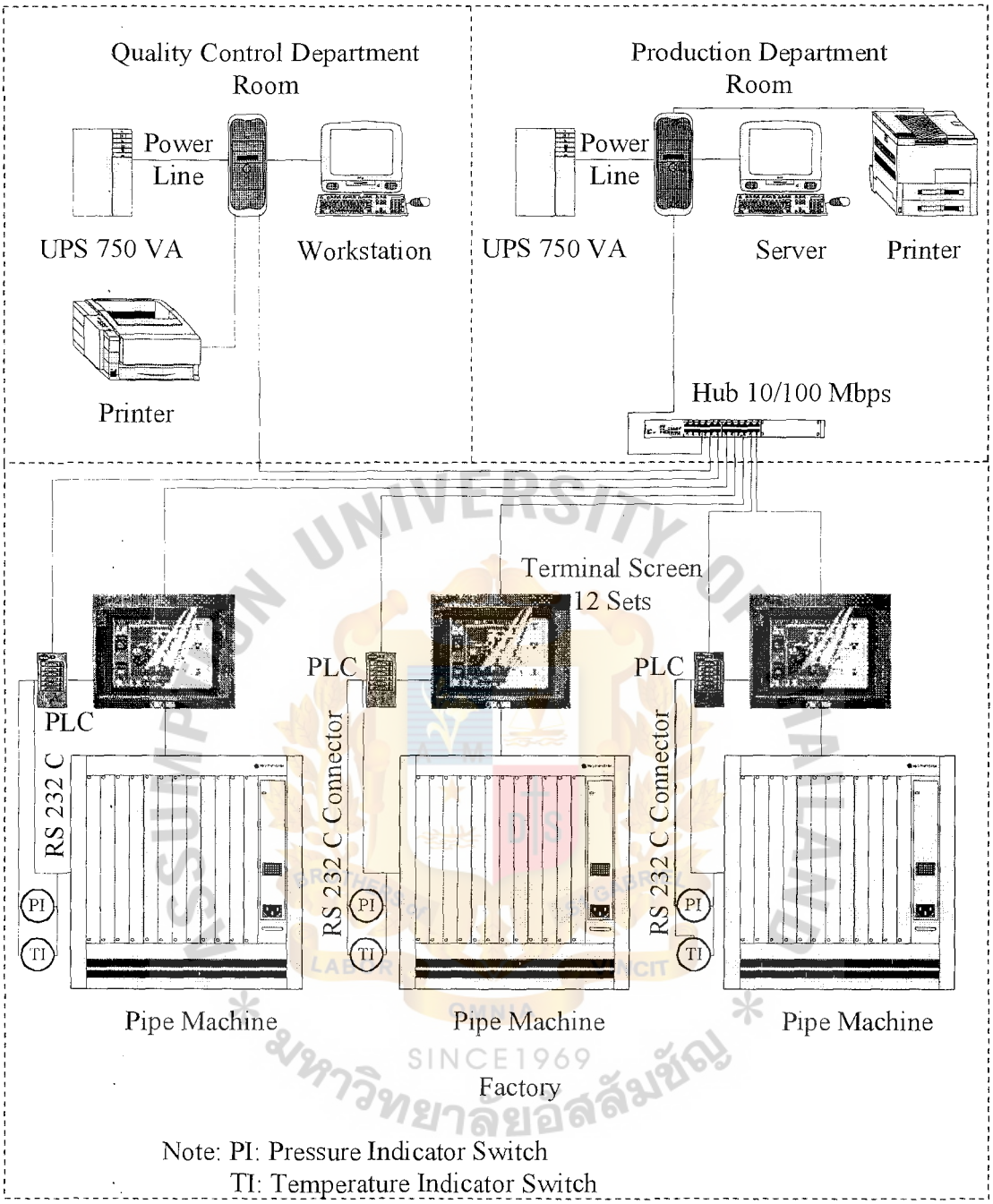

Figure 3.1. Network Configuration of Proposed System.

(3) Data Architecture

The proposed system uses the Distributed Relational Database System (Distributed RDBMS). It is a type of DBMS that is designed in relational data model. It is a type of logical database that treats data as if they were stored in two-dimensional tables. It can relate data stored in one table to data in another as long as the two tables share a common data element.

In database, we use data replication in order to store all data into all clients. When we want to update, delete, and insert, we do these activities in only one client. Then data are automatically changed.

(4) Interface Architecture

The proposed system uses on-line processing interface. On-line systems provide for a conversational dialogue between the user and computer. Business transactions and inquiries are often best processed when they occur. Errors are identified and corrected more quickly. Wick and Heuglan Co., Ltd. brings GUI technology into the production department to enhance the user interface in its Client/Server application, data are keyed by using keyboard.

(5) Process Architecture

The proposed system chooses Microsoft Access 97 that is a software development environment for Two-Tiered Client/Server for Two-Tiered Client/Server network architecture. Moreover, for developing Production Control System Software Development, the proposed system chooses High-level language programming developed by programmers to communicate between computers and machines, and add other device

which is PLC for control pipes and fittings production, available for every responsible supervisors, and workers.

3.2.2 Data Flow Diagram of Proposed System

The Pipe Production Information System is the proposed system that is designed in order to solve the current problem and to meet the user requirements. The context diagram, data flow diagram (DFD) and structure chart are used as the essential tools in system design portion. It includes 9 processes as following:

Process 1: Send Sales Order Process

This process will occur the first time when the customers order products to sales department, the proposed system will make sales order and prepare to send to production department.

Process 1.1 Check Customer Requirement

The proposed system will check customer's requirements that consists of type of products, standard, quantities, etc.

Process 1.2 Check Raw Material

Before the proposed system will make sales order, it must check type of raw material and quantities in the inventory system.

Process 1.3 Check Production Plan

Before the proposed system will make sales order, it must check production plan at production department database.

Process 1.4 Make Sales Order

In this process, the proposed system will make sales order, and prepare to send to production department.

Process 2: Prepared Production Information

In the proposed system, the production department will prepare all of production information from sales order to determine production line schedule, machine number and program in the computers.

Process 2.1 Receive Sales Order

In the proposed system, the production department will receive sales order from sales department.

Process 2.2 Check Product Requirement

When the production department received sales order information, it will check production requirement such as type of pipe, diameter, thickness, pressure, standard, etc.

Process 2.3 Check Machine

When product requirement approved, the proposed system will check available machine that can produce the product.

Process 2.4 Make Production Schedule

When there is available machine to produce the product, the proposed system will make production schedule and send final production information includes production requirement, prompted machine, and production schedule to production information database.

Process 3 Receive Process Input

The proposed system will receive production information from production information database which consists of process input for key to the computer by IT Officer.

Process 4 Control Program

This process concerns about use of computer to control production line.

Process 4.1 Analyze Process Input

IT Officer will receive process input and analyze them before key into the computer. Because there are many products in this computer, there are many input screens.

Process 4.2 Input Data

This process, IT Officer will key analyzed process input into the program.

Process 4.3 Watch Process

When the program runs, IT Officer will watch progress of the production line. If the production line occurs some problems, IT Officer will interrupt and investigate the program. When the process completed, the proposed system will send final program information to the program information database.

Process 5 Receive Process Input

The proposed system will receive production information from production information database which consists of process input for supervisor to control production line.

Process 6 Control Process

When supervisor received process information, he will control process on the production line. When the process completed, he will send process report to the process report database.

Process 7 Create Production Report

After the process completed, the proposed system will create production report.

Process 7.1 Receive Process Report

The proposed system will receive process report from the process report database to investigate.

Process 7.2 Check Final Process Report

This process will check all errors on the process.

Process 7.3 Make Production Report

When it checked final process report completed, the proposed system will make production report.

Process 7.4 Send Production Report

The proposed system will send production report to the production Report database and to quality control department.

Process 8 Create QC Report

This process will create QC report.

Process 8.1 Receive Product

All products that produced completely, they must check quality at quality control laboratory before sending to the customers. The quality control department will receive products to investigate.

Process 8.2 Inspect Product

This process will inspect the quality of the products.

Process 8.3 Approve/Reject Product

Quality controller will check quality of products such as pressure, tensile strength, thickness, etc. If the products inspected pass, quality controller will approve the product quality. If the products inspected do not pass, quality controller will reject the product quality.

Process 8.4 Make Inspection Report

Then quality controller will make inspection report.

Process 8.5 Send Inspection Report

This process will send inspection report to production department and inspection report database.

Process 9 Create Final Report

This process will create final report and send to sales department.

Process 9.1 Receive Approved QC Report

This process will receive approved QC report.

Process 9.2 Make Final Report

The proposed system will check approved QC report, and then make final report which includes product requirement, machine number, supervisor and worker ID., QC report number, etc.

Process 9.3 Send Final Report

This process will send final report to final report database. The approved product will be sent to keep in the warehouse that prepares to deliver to the customers.

Process design for the proposed system shown in context data flow diagram and data flow diagram level 1 of each process in Appendix A. Furthermore, process specification for the proposed system is shown in Appendix B.

3.2.3 Database Design

Database should be designed to meet Normalization; that is a technique for organizing data attributes in the form that is stable, flexible, and adaptive. Normalization is a three-step technique that places data model into first normal form, second normal form and third normal form. They are described as follows:

(1) First Normal Form: This phase is to make sure that there is no repeating group in database design.

(2) Second Normal Form: To be in the second normal form, it must be in the first normal form with an addition that it is fully functional dependence. All non-key attributes (those that are not primary key) must be fully dependent in the primary key and not just part of it.

(3) Third Normal Form: To be in third normal form, it must be in the second normal form with an addition that there is no transitive FD. Transitive FD is when an attribute is dependent on a non-key attribute.

After normalizing our logical data model, our logical data model has already mapped in the third normal form. Database design for the proposed system is shown in Appendix C.

3.2.4 Structure Design

This is the top-down hierarchy of modules. The result can be evaluated accordingly to ensure the best modular design for the program.

Structure chart is used to depict a modular design of a program. It shows how the program has been partitioned into smaller, more manageable module, organization of those modules and the communication interfaces between modules. The structure chart is shown in Figure 3.2.

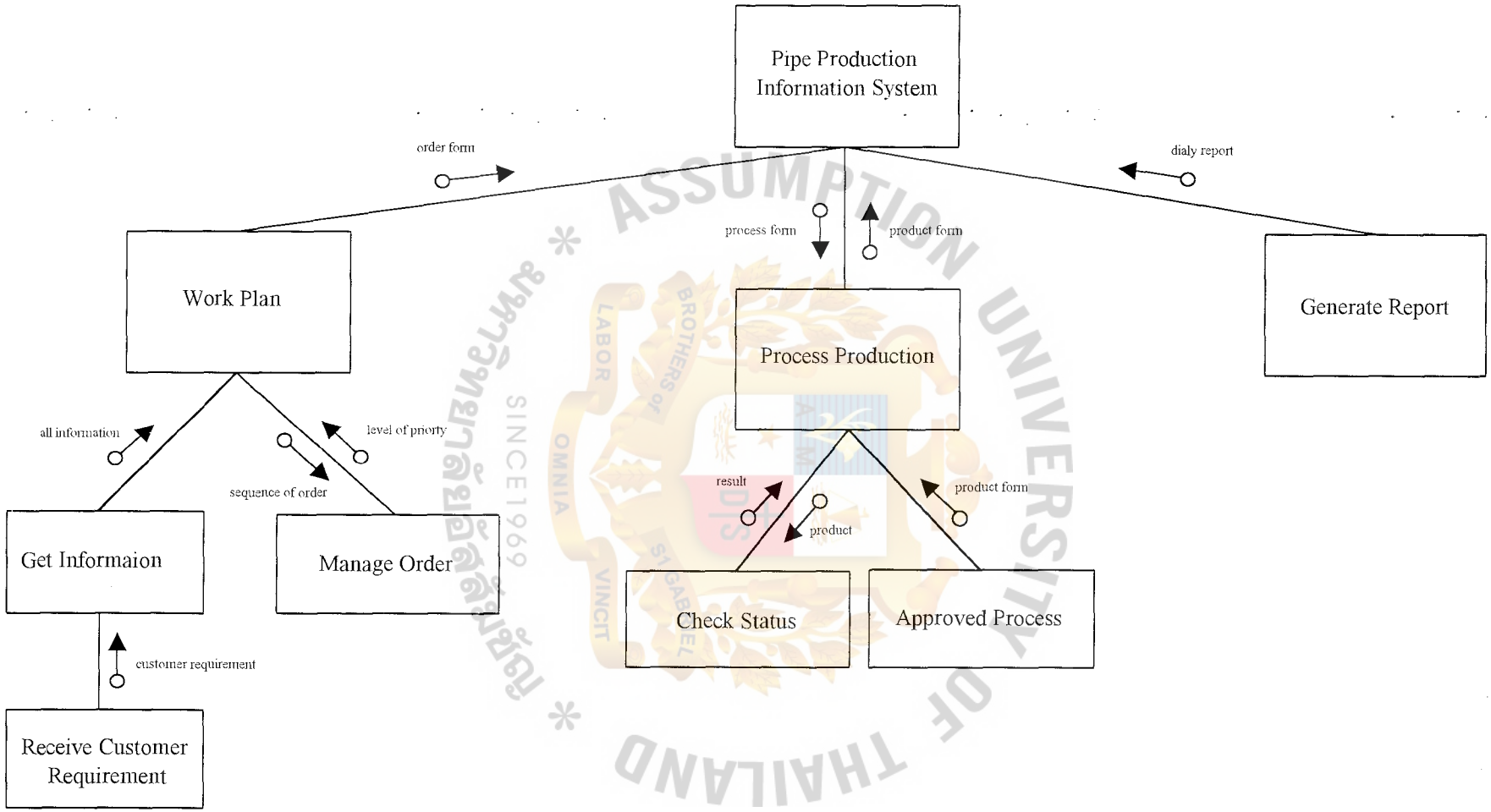

Figure 3.2. Structure Chart of Proposed System.

3.2.5 Input and Output Design

The interfaces of input designs are shown in Appendices D and E.

3.3 Hardware and Software Requirement

The hardware and software specifications for the proposed Quality Control Information System require generally specifications for hardware that use only to input pipe data such as diameter, raw material, pressure, thickness, etc. For software specification, it must write program to process data that users input to the computers and control processes while production, the language of 'ladder logic' was adopted as the standard. Control program can be written by using software programming such as Java, C++, Visual programming, and so forth to construct. It uses database software to store records of products.

3.3.1 Hardware Requirement

(1) Server 1 set

(a) CPU Intel Pentium III 1.8 GHz

(b) SDRAM 512 MB Bus 133 MHz

(c) Cache memory 512 MB

(d) Hard Disk 40 GB Seagate

(e) Medium Tower Case

(f) Disk Drive 1.44 MB

(g) CD ROM 40x

(h) Monitor 17" Super VGA Color-digital

(i) Keyboard 104 keys or Windows 95 PS/2 Thai Version

(j) Mouse PS/2 Style-2 Buttons

(k) UPS 750 VA

(2) Terminals 12 sets

(a) CPU Celeron 750 MHz

(b) SDRAM 64 MB

(c) Hard Disk 4 GB Seagate

(d) Mini Tower Case

(e) Disk Drive 1.44 MB

(f) CD ROM 32x

(g) Monitor 15" SVGA

(h) Keyboard 104 keys or Windows 95 PS/2 Thai Version

(i) Mouse PS/2 Style-2 Buttons

(j) UPS 500 VA

(3) Printer

(a) Dot-matrix Printer (Epson 2 sets)

(b) Laser Printer (HP LaserJet 1 set)

(4) Network Peripheral

(a) Hub 16 ports 2 sets

(b) Ethernet LAN card 10/100 Mbps.

3.3.2 Software Requirements

(1) Software specification for server

(a) Operating System: Microsoft Windows 2000 (Server)

(b) Database Server: Microsoft Access 97

(2) Software specification for Client

(a) Operating System: Microsoft Windows 98 ME

(b) Application Software: Visual Basic 6.0

(c) Programmable Logic Controller Software: Ladder Logic

3.4 Security and Control

System security is the key point that every system has to implement and pay attention. The security and control of the proposed system can be categorized into 3 topics as following:

(1) User Security

The proposed system prioritizes all data in the whole system as the user authorization. Each user is allowed to access in different level of permission. Only the valid users are allowed to access information. User can access the menu of the program by giving specific user login name and password. User login name has to have both characters and numbers, and it has to be more than 4 digits. Password that matches user login name has to be at least 8 digits. When user enters the password, it will not be seen on the screen, but only the character of "*" will be shown on the screen. Moreover, for system security reason, user login name and password may be changed every 6 months.

(2) Hardware Security

The hardware security should be concerned. All computers that are used as server have to have UPS equipment, and they also are settled in the safe place to make sure all computer hardware is safe from electric closing circuit or a stroke of lightning. All computer hardware is in the production department, which will be locked after working hours.

(3) Data Backup

The whole data files and electronic documents of the proposed system will be made a backup usually in a period of time in order to prevent the system error, file error or any accident. The backup media

must be kept in the safe place. When the system has some problems, or some files loss, the data can be restored from the backup files in the right time.

3.5 Cost and Benefit Analysis

3.5.1 Cost Analysis

(1) Costs of Manual System

The manual system cost analysis is separated into three cost types that are fixed cost, salary cost, and maintenance & miscellaneous as shown in Table 3.1.

Table 3.1. The Manual System Cost Analysis, Baht.

Cost items		Years				
		1	2	3	4	5
Fixed Cost						
Computer	2 units @ 25,500	51,000.00	51,000.00	51,000.00	51,000.00	51,000.00
Total Fixed Cost		51,000.00	51,000.00	51,000.00	51,000.00	51,000.00
Salary Cost:						
Supervisor	8 persons @ 13,000	104,000.00	112,000.00	120,000.00	128,000.00	136,000.00
Worker	24 persons @ 8,000	192,000.00	204,000.00	216,000.00	228,000.00	240,000.00
Total month Salary Cost		296,000.00	316,000.00	336,000.00	356,000.00	376,000.00
Total Annual Salary Cost		3,552,000.00	3,792,000.00	4,032,000.00	4,272,000.00	4,512,000.00
Maintenance & Miscellaneous Cost:						
Maintenance	Per Annual	200,000.00	240,000.00	288,000.00	345,600.00	414,720.00
Utility Cost	Per Annual	10,000.00	15,000.00	20,000.00	25,000.00	30,000.00
Miscellaneous	Per Annual	10,000.00	15,000.00	20,000.00	25,000.00	30,000.00
Total Annual Maintenance & Miscellaneous Cost		220,000.00	270,000.00	328,000.00	395,600.00	474,720.00
Total Manual System Cost		3,823,000.00	4,113,000.00	4,411,000.00	4,718,600.00	5,037,720.00

Table 3.2. Five Years Accumulated Manual System Cost, Baht.

Year	Total Manual Cost	Accumulated Cost
1	3,823,000.00	3,823,000.00
2	4,113,000.00	7,936,000.00
3	4,411,000.00	12,347,000.00
4	4,718,600.00	17,065,600.00
5	5,037,720.00	22,103,320.00
Total	22,103,320.00	-

(2) Costs of Computerized System

The computerized system cost analysis is separated into two cost types that are fixed cost and operating cost as shown in Table 3.3.

Table 3.3. The Proposed System Cost Analysis, Baht.

Cost items	Years				
	1	2	3	4	5
Fixed Cost					
Hardware & Software Cost:					
Computer Server & Terminal Cost	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00
Software Cost	50,000.00	30,000.00	30,000.00	30,000.00	30,000.00
Network Cost	20,000.00	20,000.00	20,000.00	20,000.00	20,000.00
PLC Cost	300,000.00	300,000.00	300,000.00	300,000.00	300,000.00
Total Hardware & Software Cost	870,000.00	850,000.00	850,000.00	850,000.00	850,000.00
Implementation Cost:					
Training Cost	100,000.00	–	–	–	–
Set up Cost	200,000.00	–	–	–	–
System Analyst Team	400,000.00	–	–	–	–
Programmer Team	300,000.00	–	–	–	–
Total Implementation Cost	1,000,000.00	–	–	–	–
Total Fixed Cost	1,870,000.00	850,000.00	850,000.00	850,000.00	850,000.00
Operating Cost					
People-Ware Cost:					
Supervisor 4 persons @ 15,000	60,000.00	64,000.00	68,000.00	72,000.00	76,000.00
Worker 12 persons @ 8,000	96,000.00	102,000.00	108,000.00	114,000.00	120,000.00
IT Officer 1 person @ 20,000	20,000.00	22,000.00	24,000.00	26,000.00	28,000.00
Total Monthly Salary Cost	176,000.00	188,000.00	200,000.00	212,000.00	224,000.00
Total Annual Salary Cost	2,112,000.00	2,256,000.00	2,400,000.00	2,544,000.00	2,688,000.00
Legal & Miscellaneous Cost:					
Legal	10,000.00	–	–	–	–
Miscellaneous	20,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Utility Cost	10,000.00	15,000.00	20,000.00	25,000.00	30,000.00
Total Legal & Miscellaneous Cost	40,000.00	25,000.00	30,000.00	35,000.00	40,000.00
Maintenance Cost:					
Maintenance Per Annual	200,000.00	220,000.00	242,000.00	266,200.00	292,820.00
Total Maintenance Cost	200,000.00	220,000.00	242,000.00	266,200.00	292,820.00
Total Operating Cost	2,352,000.00	2,501,000.00	2,672,000.00	2,845,200.00	3,020,820.00
Total Computerized System Cost	4,222,000.00	3,351,000.00	3,522,000.00	3,695,200.00	3,870,820.00

Table 3.4. Five Years Accumulated Computerized Cost, Baht.

Year	Total Computerized Cost	Accumulated Cost
1	4,222,000.00	4,222,000.00
2	3,351,000.00	7,573,000.00
3	3,522,000.00	11,095,000.00
4	3,695,200.00	14,790,200.00
5	3,870,820.00	18,661,020.00
Total	18,661,020.00	-

3.5.5 Breakeven Analysis

Breakeven analysis is a technique, which is used to find the period that accumulative cost of current system, is equal to accumulate cost of the new system. The point that they are equal is called breakeven point. The comparison of the system costs between the computerized cost and the manual cost is shown in Table 3.5. The breakeven point between the current system and the proposed system is shown in Figure 3.3.

Table 3.5. The Comparison of the System Cost, Baht

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	3,823,000.00	4,222,000.00
2	7,936,000.00	7,573,000.00
3	12,347,000.00	11,095,000.00
4	17,065,600.00	14,790,200.00
5	22,103,320.00	18,661,020.00

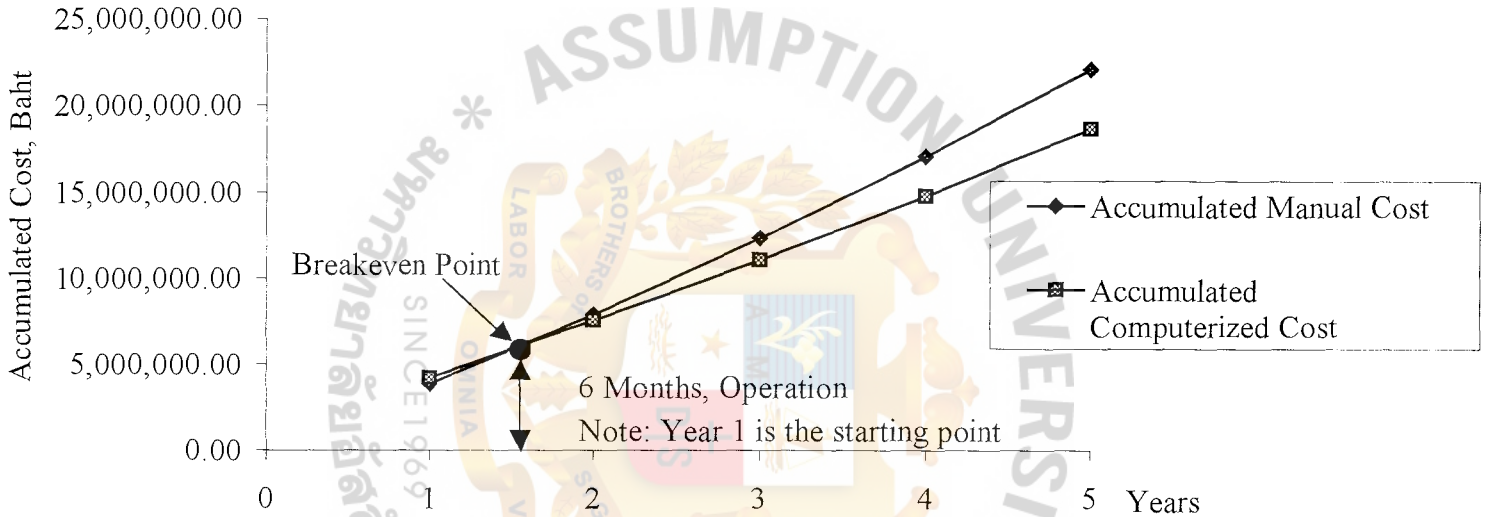

Figure 3.4. Breakeven Point between Current System and Proposed System.

3.5.2 Benefit Analysis

Benefit analysis can be divided into two categories, tangible benefits and intangible benefits as shown as follows:

(1) Tangible Benefits: This type of benefit can be measured in value. The proposed system has annual benefits from the following:

(a) Reduction of supervisor salary

Salary 13,000 baht * 4 persons	624,000 baht

(b) Reduction of worker salary

Salary 8,000 baht * 12 persons	1,152,000 baht

(c) Reduction of maintenance cost	60,000 baht
Total Tangible Benefits	1,836,000 baht

(2) Intangible Benefits: This type of benefit is difficult or impossible to quantify in value. The proposed system provides the intangible benefits, which are summarized as follows:

(a) Reducing human error from working.

(b) Better strategy. The company has useful, up-to-date, easy to use and accurate information to support decision-making and strategy for master project planning.

(c) Increase speed of daily operation.

(d) High quality of products.

(e) Ability to be superior to the competition.

3.5.3 Payback Analysis

The payback analysis technique is a method for determining if and when an investment will pay for itself. Because systems development costs are incurred long before benefits begin to accrue, it will take some time period for the benefits to

overtake the costs. After implementation, they will incur additional operating expenses that must be recovered. Payback analysis determines how much time will lapse before accrued benefits overtake accrued and continuing costs. This period of time is called the payback period. The payback period can be calculated as following:

$$P = \frac{I}{(1-T)\,R}$$

where P = Payback period

I = Initial investment and implementation costs

T = Corporate tax rate in percentage (12%)

R = Average annual return on investment

So

$$P = \frac{4,212,000.00}{(1-0.12)\,1,836,000}$$

$$= 2.61 \text{ years}$$

The payback period of the proposed system is 2.61 years. Payback analysis of the proposed system is shown in Table 3.6 and Figure 3.4.

Table 3.5. Payback Analysis for the Proposed System, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	-1,870,000.00	-	-	-	-	-
Operation and maintenance cost:	-	-2,342,000.00	-2,486,000.00	-2,652,000.00	-2,820,200.00	-2,990,820.00
Discount factors for 12%:	1.00	0.89	0.80	0.71	0.64	0.57
Time-adjusted costs (adjusted to present value):	-1,870,000.00	-2,091,406.00	-1,981,342.00	-1,888,224.00	-1,793,647.20	-1,695,794.94
Cumulative time-adjusted cost over lifetime:	-1,870,000.00	-3,961,406.00	-5,942,748.00	-7,830,972.00	-9,624,619.20	-11,320,414.14
Benefits derived from operation of new system:	0.00	1,836,000.00	5,000,000.00	9,000,000.00	13,000,000.00	17,000,000.00
Discount factors for 12%:	1.00	0.89	0.80	0.71	0.64	0.57
Time-adjusted benefits (adjusted to present value):	0.00	1,634,040.00	4,000,000.00	6,390,000.00	8,320,000.00	9,690,000.00
Cumulative time-adjusted benefits over lifetime:	0.00	1,634,040.00	5,634,040.00	12,024,040.00	20,344,040.00	30,034,040.00
Cumulative lifetime time-adjusted costs+benefits:	-1,870,000.00	-2,327,366.00	-308,708.00	4,193,068.00	10,719,420.80	18,713,625.86

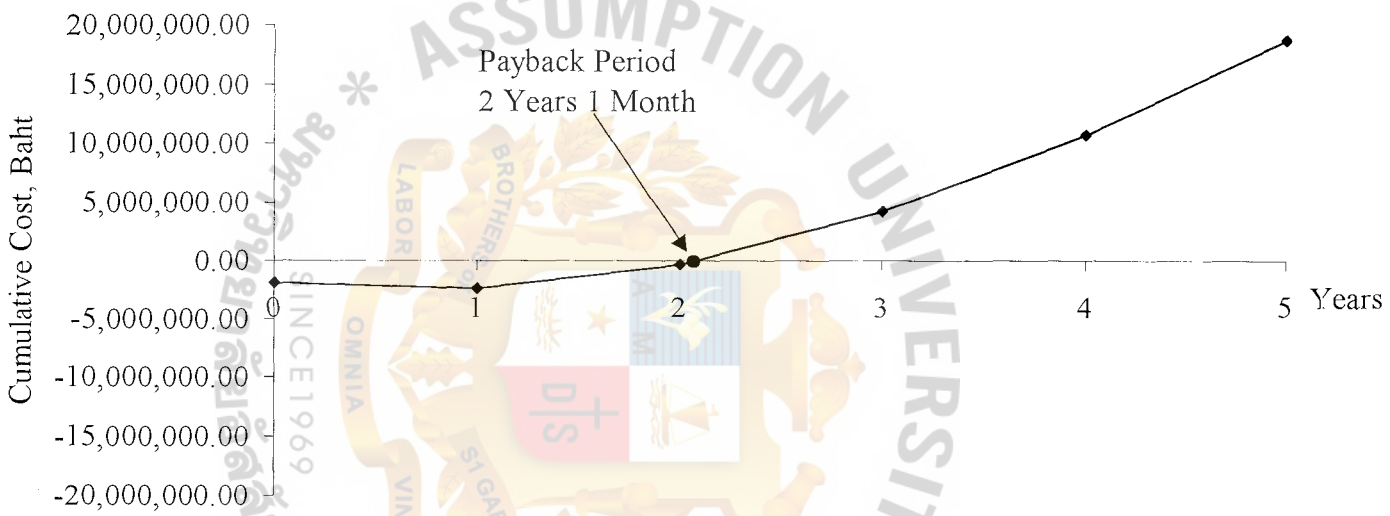

Figure 3.5. Payback Analysis for the Proposed System.

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

Project Implementation is the planned and orderly conversion from a current existing system to the new proposed information system. The final design should be evaluated first to make sure that the new proposed system can meet the desired goals and objectives, and then the other remaining processes will be performed.

The proposed system has the implementation process, which is set up by using parallel run concept. By this concept, the proposed system has to run in parallel with the existing system for a period of time, until the proposed system can operate normally and correctly. Furthermore, the users have to be familiar with the proposed system in this period of time. Therefore, in this period of time the users have to make double jobs on each process both in the existing system and the proposed system. However, the proposed system is designed based on the routine job of the users which will take a short time to understand the proposed system and operate it correctly.

The project implementation of the Quality Control Information System can be divided into 5 main parts; installation, testing, conversion, training, and documentation.

4.2 Installation

The installation of the proposed system has 2 main parts, hardware installation and software installation. First, the hardware installation, the proposed system has to install some new hardware that the existing system does not have. The existing system is the manual system, which is different from the proposed system; the computerized system. The hardware installation has to be concerned in many reasons, such as compatibility between each hardware component reason, suitable location of

the hardware component reason and security of the hardware component reason. Second, the software installation, the proposed system has to install new software, which is designed for to solve the current problem and increase the ability of the system. The program will use Visual Basic 6.0 to write the proposed system and it will be inspected to guarantee the efficiency of the application before installation.

4.3 Testing

4.3.1 Program Testing

After they install all hardware and software completely, they must test program before change to replace the existing system. Because if they have some problems in program, they can redesign and correct them again until when the test program to produce pipes and fittings, has no errors.

4.3.2 Network Testing

(1) Review the network design outline.

(2) Construct and then test new network.

(3) Revise network specification for the future reference.

4.3.3 Database Testing

Testing for database server.

4.3.4 Security and Control Testing

(1) User logging and system authentication.

(2) Access level testing.

4.4 Conversion

Conversion is the step for converting system, from old system to proposed system. It is a significant step. There are many methods for system conversion. For this system, the converting from the existing system to the proposed system will be operated in parallel conversion. The users will continue to operate the existing system

in the accustomed manner, but they also begin to use the new system. This is done to ensure that when the proposed system does not correctly work, there is the old system to support operation. Then we have time to solve proposed system's problems. All major problems will be solved before the old system is discarded.

Parallel conversion minimizes the risk of proposed system's problem causing irreparable harm to the business. Although it increases cost of running two systems over the same period and consumes more time with double workload of employees, it is suitable for converting from manual system to computerized system as this system.

4.5 Training

Training the supervisors and workers is a necessary part in the implementation. The user will make the system correctly when they understand it well. The user must be instructed of how to operate the equipment and how to take care of the system. Department would enable the training topic.

4.6 Documentation

The user handbook describes the method of how to use the program in each step. The programming handbook describes the flow of the system that helps the programmer to develop and maintain the system. The data dictionary describes all system components. All of these things should to be prepared for the proposed system.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In Wick and Heuglan Co., Ltd., the manual existing system cannot effectively work in the quality of the products. The proposed system; computerized system, can replace the existing system with high performance and more productivity especially in production process because it helps to increase quality of the products and reduce costs of the human being. The important advantage is providing just in time to support the management in making decisions and planning for new strategies to expand market share around the world. Moreover, related staff is provided the full training course to operate the computerized system smoothly.

The proposed system helps to reduce cost and to gain competitive advantages. The proposed system has systematic database that returns high efficiency and effectiveness. Payback period for the proposed system is around two years and six months, and the breakeven point is around one year and one month that is the appropriate period to develop a system.

Finally, the proposed system has the advantages for management in planning, making decision and controlling for the organization. The proposed system is more efficient and effective than the existing system, see Table 5.1.

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

Process	Existing System	Proposed System
Production Requirement Process	45 minutes	10 minutes
Production Planning Process	30 minutes	15 minutes
Production Input Process	15 minutes	2 minutes
Total	1 hour 30 minutes	27 minutes

From Table 5.1, the proposed system can save around 1 hour and three minutes in the operating process. Furthermore, the proposed system can generate that is more precise and timely than the existing system for an executive to make decisions.

The proposed system has several expected benefits as following:

(1) Accuracy: Because it uses computers to control production then it can guarantee accuracy than human control.

(2) Fast: Because it uses computers to control production then 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: Because it uses computers to control production then it has high quality of products.

(5) Less problems: Because it uses computers to control production then it has or has not less problems.

5.2 Recommendations

From project perspective, this company should change the manual system that is controlled by the workers to be controlled by computerized system. The computerized system can control pipes and fittings production process more accurate than the workers.

The characteristics of the proposed system

(1) The machine controlled by using production control program that it will be written and developed by programmer.

(2) Each new microcomputer will connect with each machine and control data and process by program.

(3) The computerized system will replace many supervisors and workers and then this company can save a lot of costs of employees.

(4) All input data such as type of raw material, size of pipe, temperature and pressure will key into the computer and it executes and controls their data to produce pipe.

(5) Because computers controlled them, they have no error in pipe production. When they have some errors, IT Officer will investigate and solve problems.

APPENDIX A

ENTITY RELATIONSHIP DIAGRAM

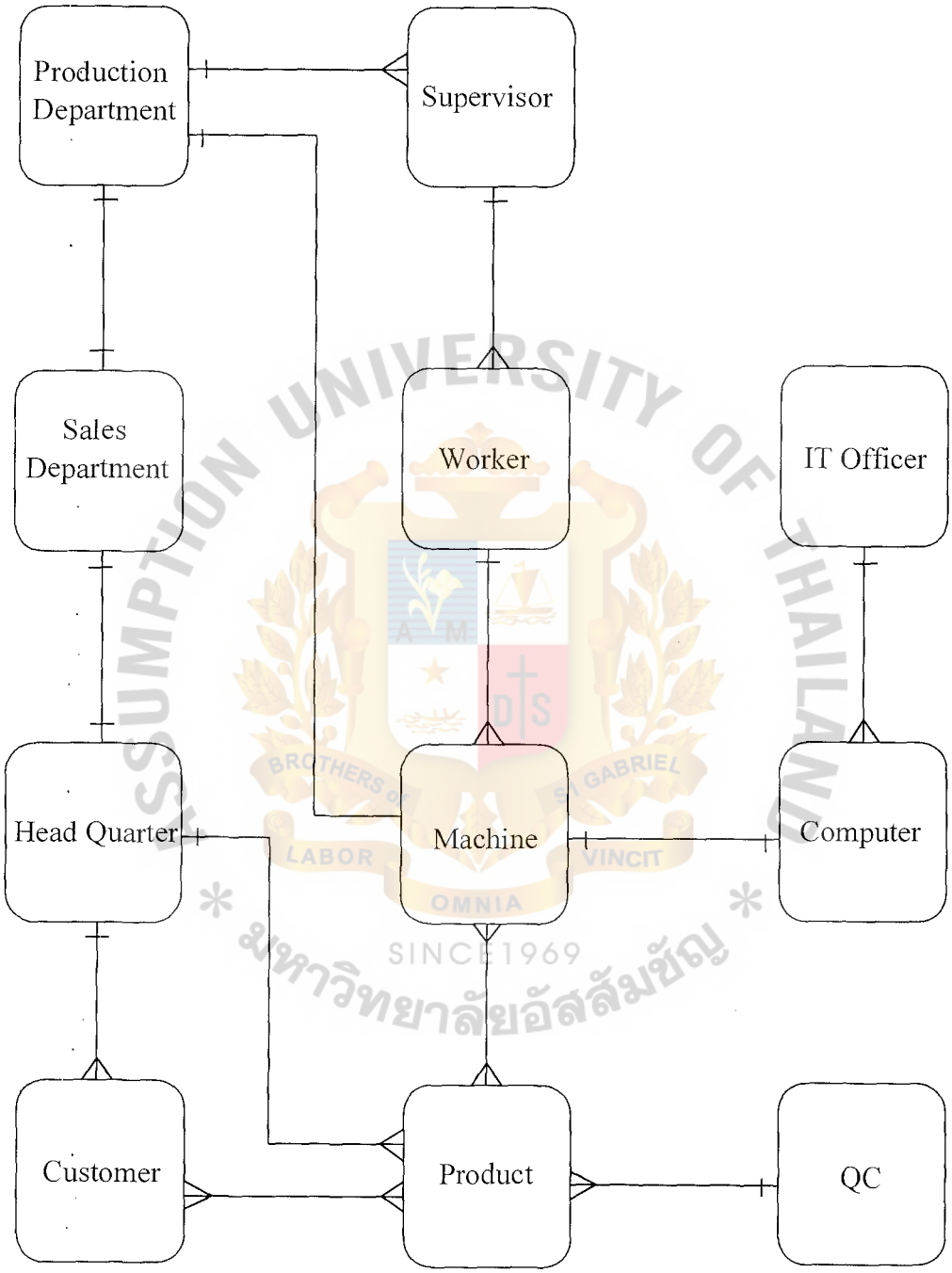

Figure A.1. Entity Relationship of Proposed System.

APPENDIX B

DATA FLOW DIAGRAM

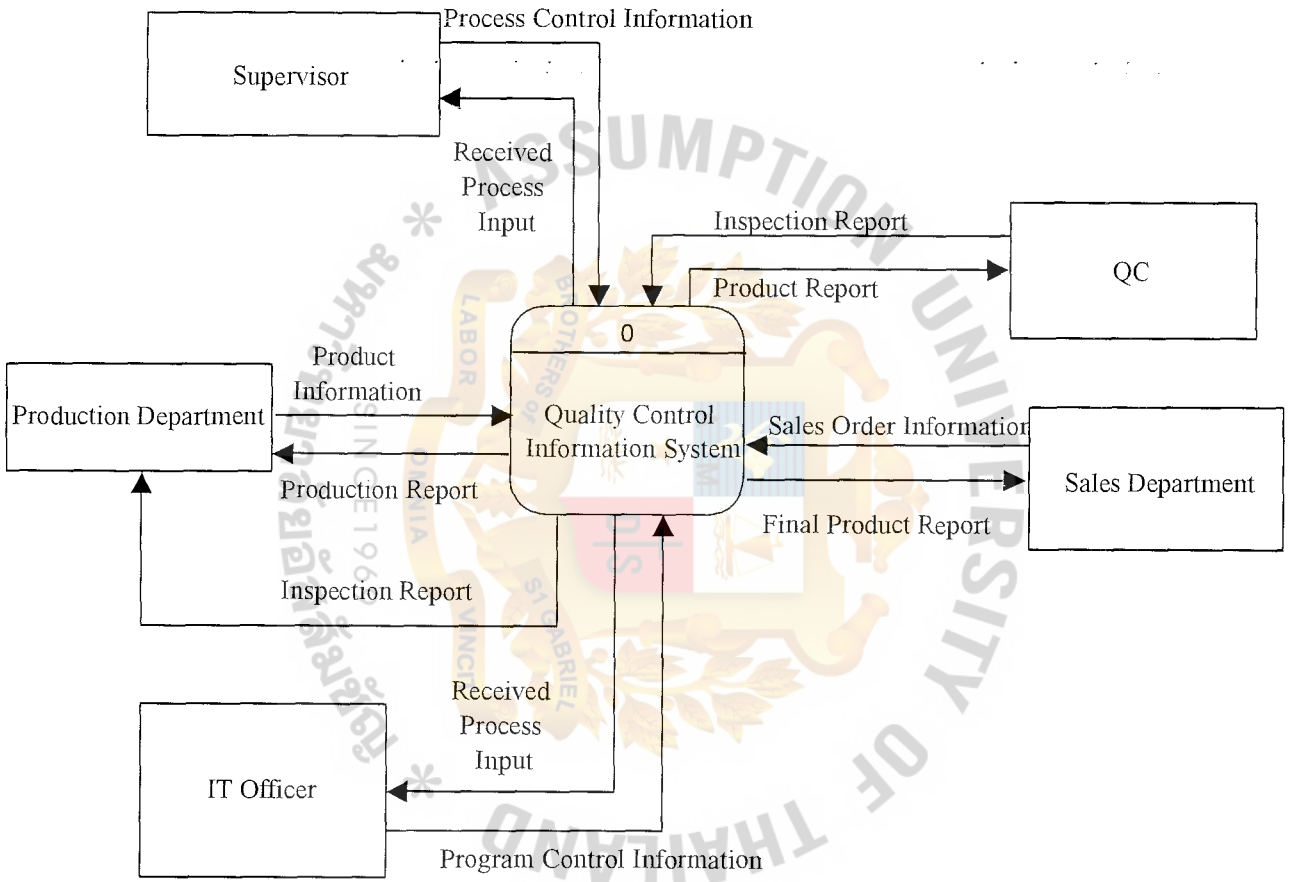

Figure B.1 Context Data Flow Diagram of Proposed System.

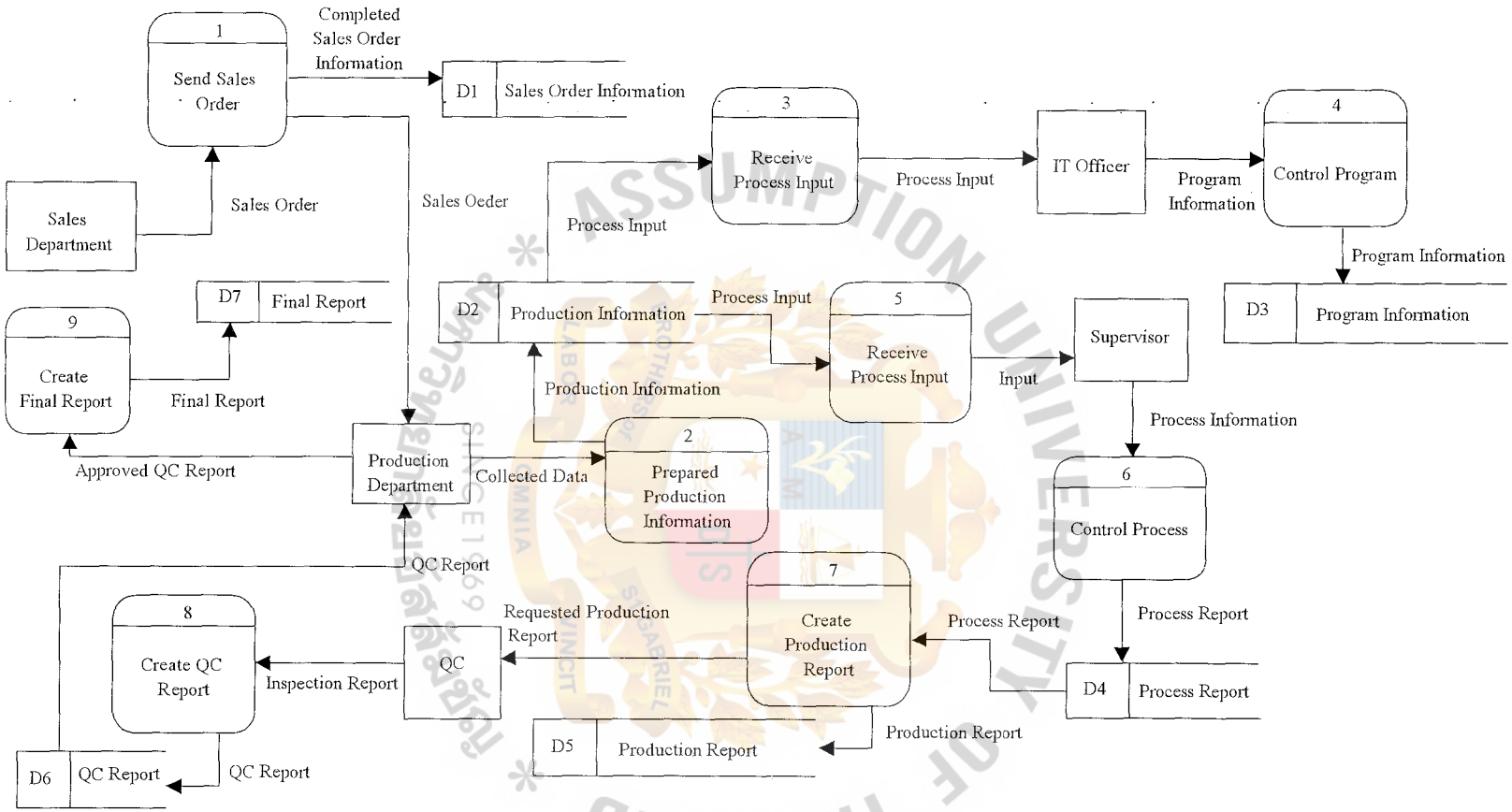

Figure B.2. Data Flow Diagram Level 0 of Proposed System.

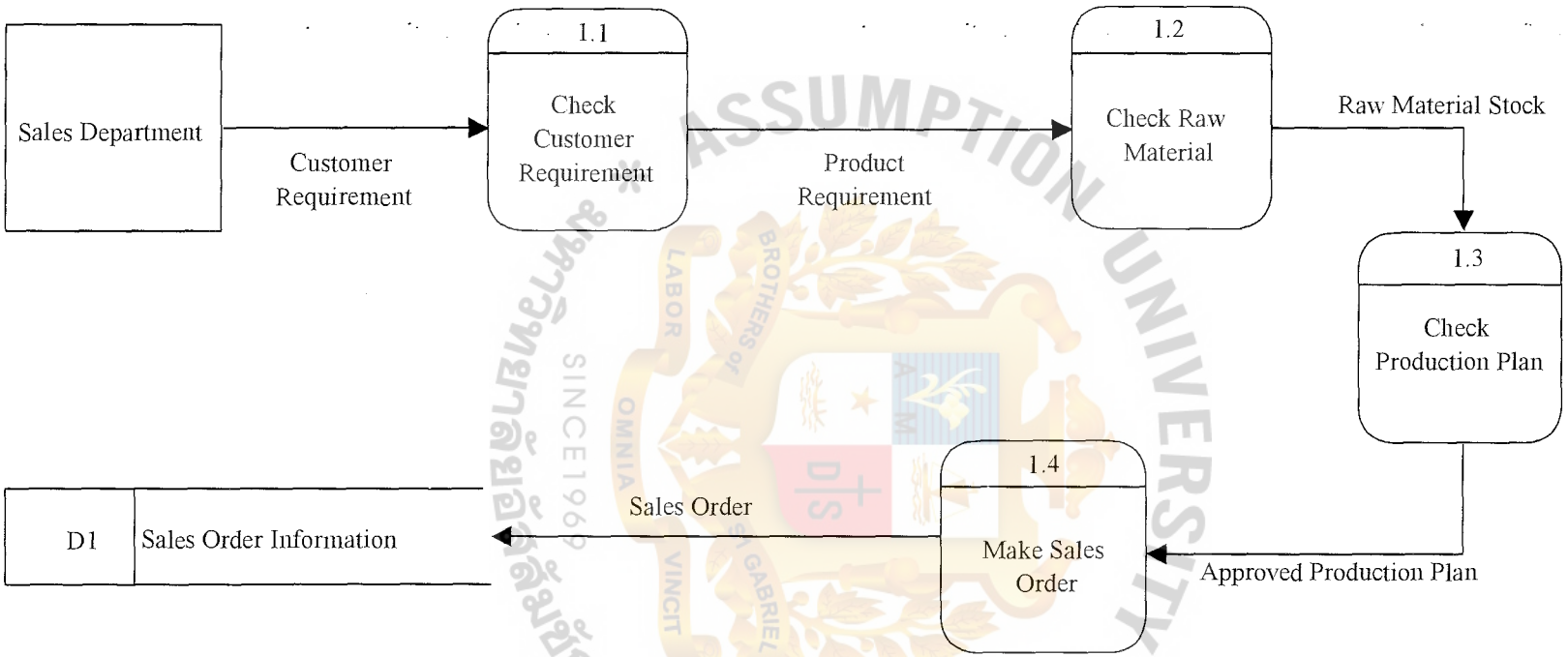

Figure B.3. Data Flow Diagram Level 1 Process 1 Send Sales Order.

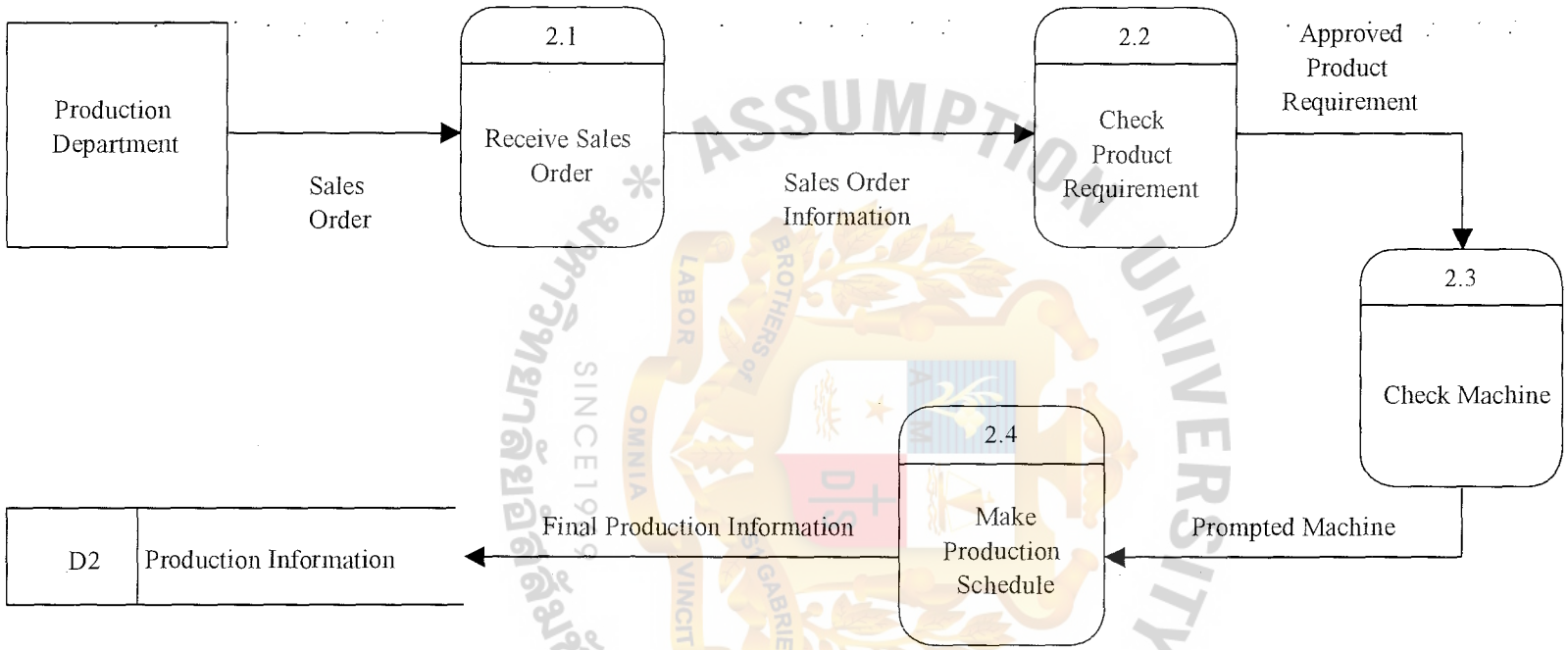

Figure B.4. Data Flow Diagram Level 1 Process 2 Prepare Production Information.

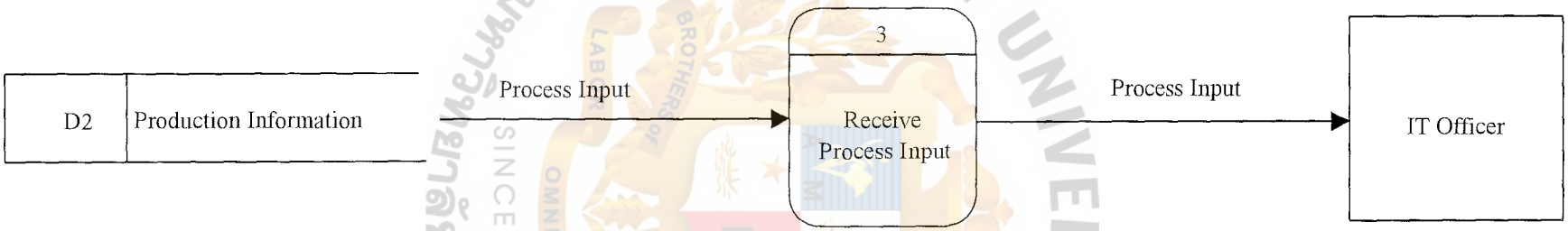

Figure B.5. Data Flow Diagram Level 1 Process 3 Receive Process Input.

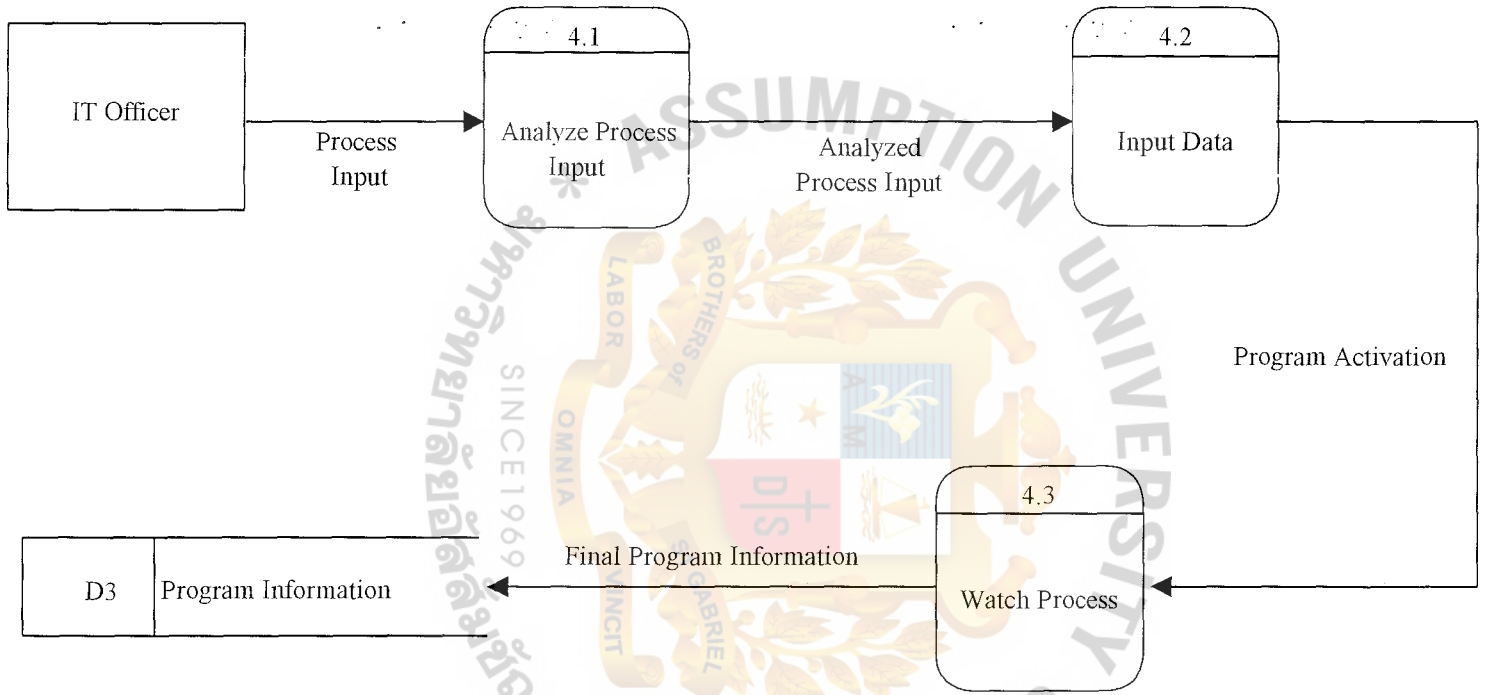

Figure B.6. Data Flow Diagram Level 1 Process 4 Control Program.

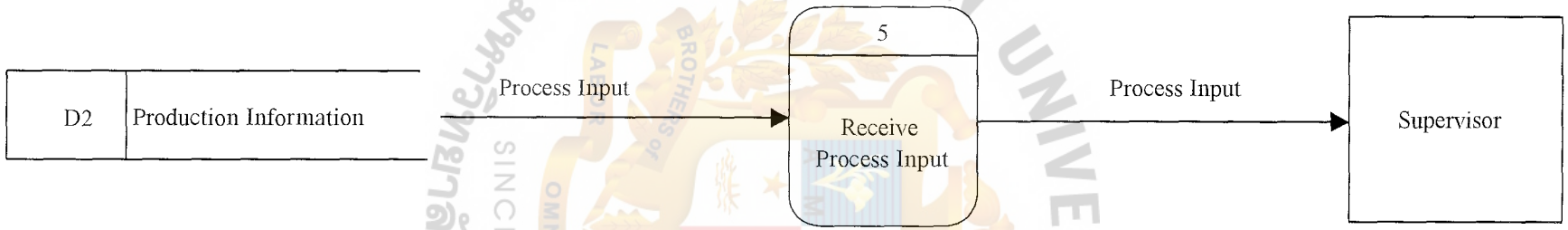

Figure B.7. Data Flow Diagram Level 1 Process 5 Receive Process Input.

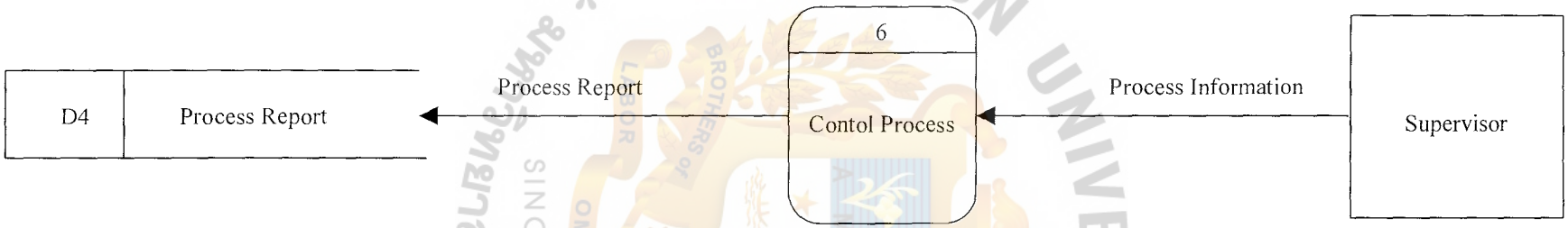

Figure B.8. Data Flow Diagram Level 1 Process 6 Control Process.

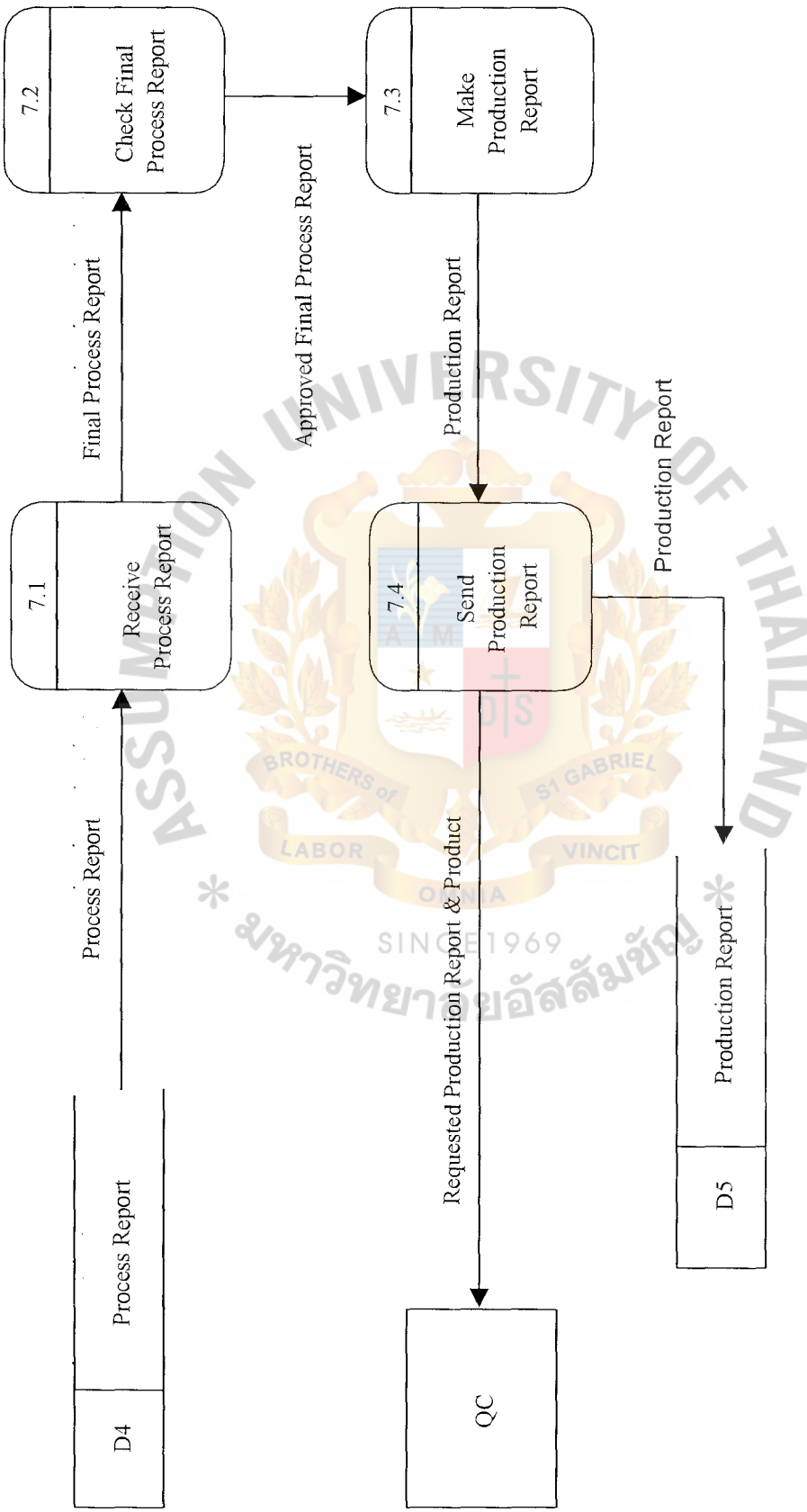

Figure B.9. Data Flow Diagram Level 1 Process 7 Create Production Report.

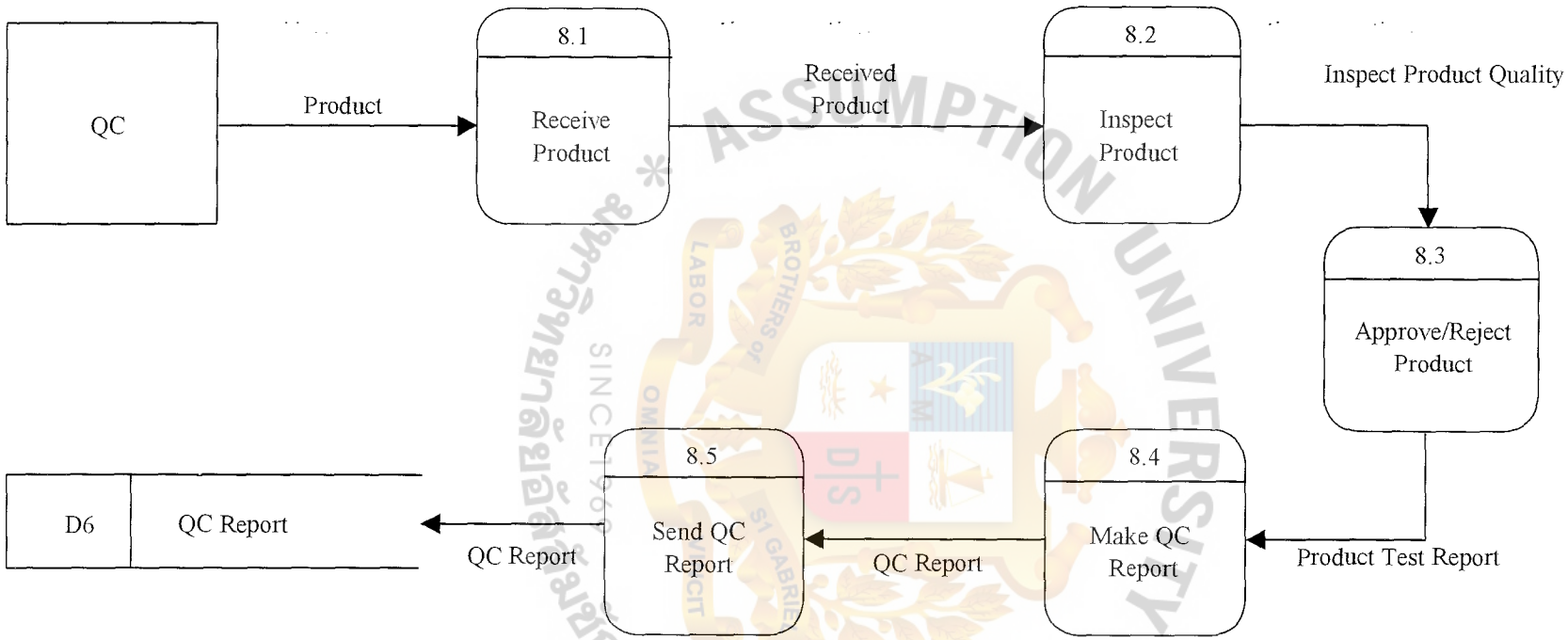

Figure B.10. Data Flow Diagram Level 1 Process 8 Create QC Report.

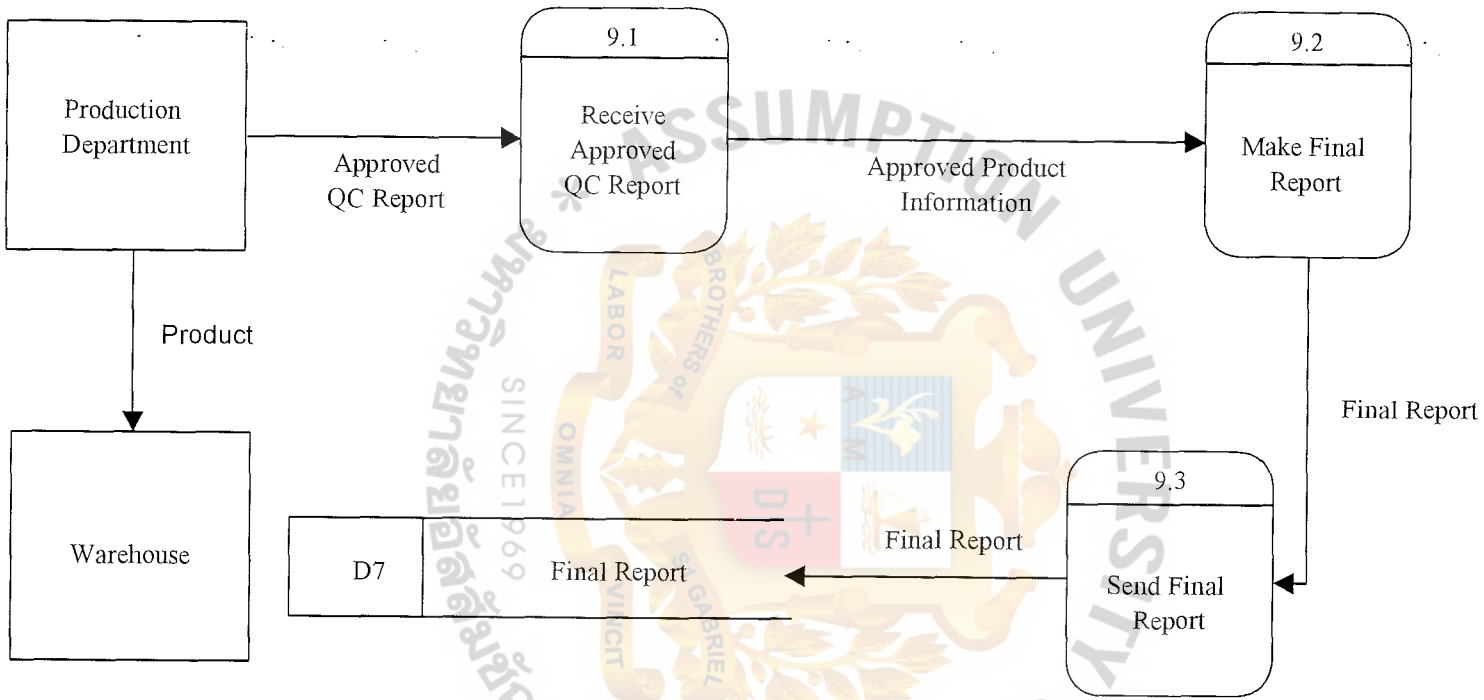

Figure B.11. Data Flow Diagram Level 1 Process 9 Create Final Report.

APPENDIX C

PROCESS SPECIFICATION

Table C.1. Process Specification of Process 1.1.

Items	Description
Process Name:	Check Customer Requirement
Data In:	Customer Requirement
Data Out:	Product Requirement
Process:	(1) Receive customer requirement from sales department. (2) Check customer requirement that are according to the products of the company. (3) Send product requirement to next process.
Attachment:	Sales Department

Table C.2. Process Specification of Process 1.2.

Items	Description
Process Name:	Check Raw Material
Data In:	Product Requirement
Data Out:	Raw Material Stock
Process:	(1) Receive product requirement in order to check raw material remain in the warehouse. (2) Send remain raw material information to next process.
Attachment:	-

Table C.3. Process Specification of Process 1.3.

Items	Description
Process Name:	Check Production Plan
Data In:	Raw Material Stock
Data Out:	Approved Production Plan
Process:	(1) Receive raw material stock information that remains in the warehouse. (2) Check production plan in order to determine produce date. (3) Send approved production plan to next process.
Attachment:	-

Table C.4. Process Specification of Process 1.4.

Items	Description
Process Name:	Make Sales Order
Data In:	Approved Production Plan
Data Out:	Sales Order
Process:	(1) Receive approved production plan in order to make sales order. (2) Send sales order to production department and to the sales order information database.
Attachment:	Data Store D1 (Sales Order Information Database)

Table C.5. Process Specification of Process 2.1.

Items	Description
Process Name:	Receive Sales Order
Data In:	Sales Order
Data Out:	Sales Order Information
Process:	(1) Production department will receive sales order from sales department. (2) Send sales order to next process.
Attachment:	Production Department

Table C.6. Process Specification of Process 2.2.

Items	Description
Process Name:	Check Product Requirement
Data In:	Sales Order Information
Data Out:	Approved Product Requirement
Process:	(1) Receive sales order information and check product requirement. (2) Send approved product requirement to next process.
Attachment:	-

Table C.7. Process Specification of Process 2.3.

Items	Description
Process Name:	Check Machine
Data In:	Approved Production Requirement
Data Out:	Prompted Machine
Process:	(1) Receive approved product requirement. (2) Check free machines for produce products. (3) Send prompted machine information to next process.
Attachment:	-

Table C.8. Process Specification of Process 2.4.

Items	Description
Process Name:	Make Production Schedule
Data In:	Prompted Machine
Data Out:	Final Production Information
Process:	(1) Receive prompted machine information. (2) Make production schedule plan for produce products. (3) Send final production information to the production information database.
Attachment:	Data Store D2 (Production Information Database)

Table C.9. Process Specification of Process 3.

Items	Description
Process Name:	Receive Process Input
Data In:	Process Input
Data Out:	Process Input
Process:	(1) Receive process input from the production information database. (2) Send process input to IT Officer to program.
Attachment:	(1) Data Store D2 (Production Information Database) (2) IT Officer

Table C.10. Process Specification of Process 4.1.

Items	Description
Process Name:	Analyze Process Input
Data In:	Process Input
Data Out:	Analyzed Process Input
Process:	(1) Receive process input from IT Officer. (2) Analyze process input in order to key data into the program. (3) Send analyzed process input to next process.
Attachment:	IT Officer

Table C.11. Process Specification of Process 4.2.

Items	Description
Process Name:	Input Data
Data In:	Analyzed Process Input
Data Out:	Program Activation
Process:	(1) Receive analyzed process input. (2) Input all data into the program. (3) Control program activation along production process.
Attachment:	-

Table C.12. Process Specification of Process 4.3.

Items	Description
Process Name:	Watch Process
Data In:	Program Activation
Data Out:	Final Program Information
Process:	(1) Watch program activation along production process. (2) Send final program information to the program information database.
Attachment:	Data Store D3 (Program Information Database)

Table C.13. Process Specification of Process 5.

Items	Description
Process Name:	Receive Process Input
Data In:	Process Input
Data Out:	Process Input
Process:	(1) Receive process input from the production information database. (2) Send process input to supervisor.
Attachment:	(1) Data Store D2 (Production Information Database) (2) Supervisor

Table C.14. Process Specification of Process 6.

Items	Description
Process Name:	Control Process
Data In:	Process Information
Data Out:	Process Report
Process:	(1) Receive process information from supervisor. (2) Control production process and when process finished, make process report. (3) Send process report to the process report database.
Attachment:	(1) Data Store D4 (Process Repot Database) (2) Supervisor

Table C.15. Process Specification of Process 7.1.

Items	Description
Process Name:	Receive Process Report
Data In:	Process Report
Data Out:	Final Process Report
Process:	(1) Receive process report from the process report database. (2) Check information in the process report and send final process report to next process.
Attachment:	Data Store D4 (Process Report Database)

Table C.16. Process Specification of Process 7.2.

Items	Description
Process Name:	Check Final Process Report
Data In:	Final Process Report
Data Out:	Approved Final Process Report
Process:	(1) Receive final process report. (2) Check final process report. (3) Send approved final process report to next process.
Attachment:	-

Table C.17. Process Specification of Process 7.3.

Items	Description
Process Name:	Make Production Report
Data In:	Approved Final Process Report
Data Out:	Production Report
Process:	(1) Receive approved final process report. (2) Make production report. (3) Send production report to next process.
Attachment:	-

Table C.18. Process Specification of Process 7.4.

Items	Description
Process Name:	Send Production Report
Data In:	Production Report
Data Out:	Requested Production Report & Product
Process:	(1) Receive production report. (2) Send requested production report and products to QC department in order to inspect quality of the products. (3) Send production report to the production report database.
Attachment:	(1) Data Store D4 (Process Report Database) (2) Data Store D5 (Production Report Database)

Table C.19. Process Specification of Process 8.1.

Items	Description
Process Name:	Receive Product
Data In:	Product
Data Out:	Received Product
Process:	(1) Receive products from production department. (2) Send received product to next process.
Attachment:	QC

Table C.20. Process Specification of Process 8.2.

Items	Description
Process Name:	Inspect Product
Data In:	Received Product
Data Out:	Inspect Product Quality
Process:	(1) Receive products in order to inspect products qualities. (2) Inspect products qualities by testing machines. (3) Send inspect products qualities to next process.
Attachment:	-

Table C.21. Process Specification of Process 8.3.

Items	Description
Process Name:	Approve/Reject Product
Data In:	Inspect Product Quality
Data Out:	Product Test Report
Process:	(1) Receive inspect products qualities. (2) Sign approve products or reject products. (3) Send product test report to next process.
Attachment:	-

Table C.22. Process Specification of Process 8.4.

Items	Description
Process Name:	Make Inspection Report
Data In:	Product Test Report
Data Out:	Inspection Report
Process:	(1) Receive product test report in order to make QC report. (2) Send QC report to next process.
Attachment:	-

Table C.23. Process Specification of Process 8.5.

Items	Description
Process Name:	Send Inspection Report
Data In:	QC Report
Data Out:	QC Report
Process:	(1) Receive QC report. (2) Send QC report to the QC report database.
Attachment:	Data Store D6 (QC Report Database)

Table C.24. Process Specification of Process 9.1.

Items	Description
Process Name:	Receive Approved QC Report
Data In:	Approved QC Report
Data Out:	Approved Product Information
Process:	(1) Receive approved QC report from QC department. (2) Send approved product information to next process.
Attachment:	Production Department

Table C.25. Process Specification of Process 9.2.

Items	Description
Process Name:	Make Final Report
Data In:	Approved Product Information
Data Out:	Final Report
Process:	(1) Receive approved product information. (2) Make final report. (3) Send final report to next process.
Attachment:	-

Table C.26. Process Specification of Process 9.3.

Items	Description
Process Name:	Send Final Report
Data In:	Final Report
Data Out:	Final Report
Process:	(1) Receive final process. (2) Send final report to the final report database.
Attachment:	Data Store D7 (Final Report Database)

APPENDIX D

DATABASE DESIGN

Table D.1. Sales Order.

Field Name	Type	Length	Format
Sales Order No.	Auto Number	Integer	999...
Date	Date	Short Date	dd/mm/yy
Product Requirement	Text	255	xxx...
Quantity	Number	Integer	999...
Unit	Number	Integer	999...
Unit Prize	Currency	General Number	999...
Total Prize	Currency	General Number	999...
Amount	Currency	General Number	999...
Note	Memo		xxx...

Table D.2. Production.

Field Name	Type	Length	Format
Production No.	Auto Number	Integer	999…
Date	Date	Short Date	dd/mm/yy
Product Type	Text	20	xxx…
Diameter	Number	Integer	999…
Thickness	Number	Integer	999…
Pressure	Number	Integer	999…
Standard	Text	20	xxx…
Raw Material	Text	20	xxx…
Supervisor ID	Number	Integer	999…
Machine No.	Number	Integer	999…
Produced Date	Date	Short Date	dd/mm/yy
Sent Date	Date	Short Date	dd/mm/yy
Produced Time	Time	Short Time	hr/min
Note	Memo		xxx…

Table D.3. Program.

Field Name	Type	Length	Format
Program No.	Auto Number	Integer	999...
Terminal No.	Number	Integer	999...
Production No.	Number	Integer	999...
Date	Date	Short Date	dd/mm/yy
IT Officer ID	Number	Integer	999...

Table D.4. Process Report.

Field Name	Type	Length	Format
Process Report No.	Auto Number	Integer	999...
Date	Date	Short Date	dd/mm/yy
Supervisor ID	Number	Integer	999...
Machine No.	Number	Integer	999...
Produced Pressure	Number	Integer	999...
Produced Temperature	Number	Integer	999...
Machine No.	Number	Integer	999...
Produced Date	Date	Short Date	dd/mm/yy
Produced Time	Time	Short Time	hr/min
Note	Memo		xxx...

Table D.5. Production Report.

Field Name	Type	Length	Format
Production Report No.	Auto Number	Integer	999...
Date	Date	Short Date	dd/mm/yy
Supervisor ID	Number	Integer	999...
Machine No.	Number	Integer	999...
Produced Pressure	Number	Integer	999...
Produced Temperature	Number	Integer	999...
Machine No.	Number	Integer	999...
Produced Date	Date	Short Date	dd/mm/yy
Produced Time	Time	Short Time	hr/min
Last Modify	Date	Short Date	dd/mm/yy
Status	Accept/Deny	1	A/D
Note	Memo		xxx...

Table D.6. QC Report.

Field Name	Type	Length	Format
QC Report No.	Auto Number	Integer	999...
Production Report No.	Number	Integer	999...
Inspector ID	Number	Integer	999...
Date	Date	Short Date	dd/mm/yy
Product Type	Text	20	xxx...
Tested Tensile Strength	Number	Integer	999...
Tested Pressure	Number	Integer	999...
Tested Temperature	Number	Integer	999...
Tested Ultra-Sound	Number	Integer	999...
Last Modify	Date	Short Date	dd/mm/yy
Status	Accept/Reject	1	A/R
Note	Memo		xxx...

Table D.7. Final Report.

Field Name	Type	Length	Format
Final Report No.	Auto Number	Integer	999...
Date	Date	Short Date	dd/mm/yy
Sales Order No.	Number	Integer	999...
Production Report No.	Number	Integer	999...
Last Modify	Date	Short Date	dd/mm/yy
Status	Accept/Deny	1	A/D
Note	Memo		xxx...

APPENDIX E

INTERFACE DESIGN

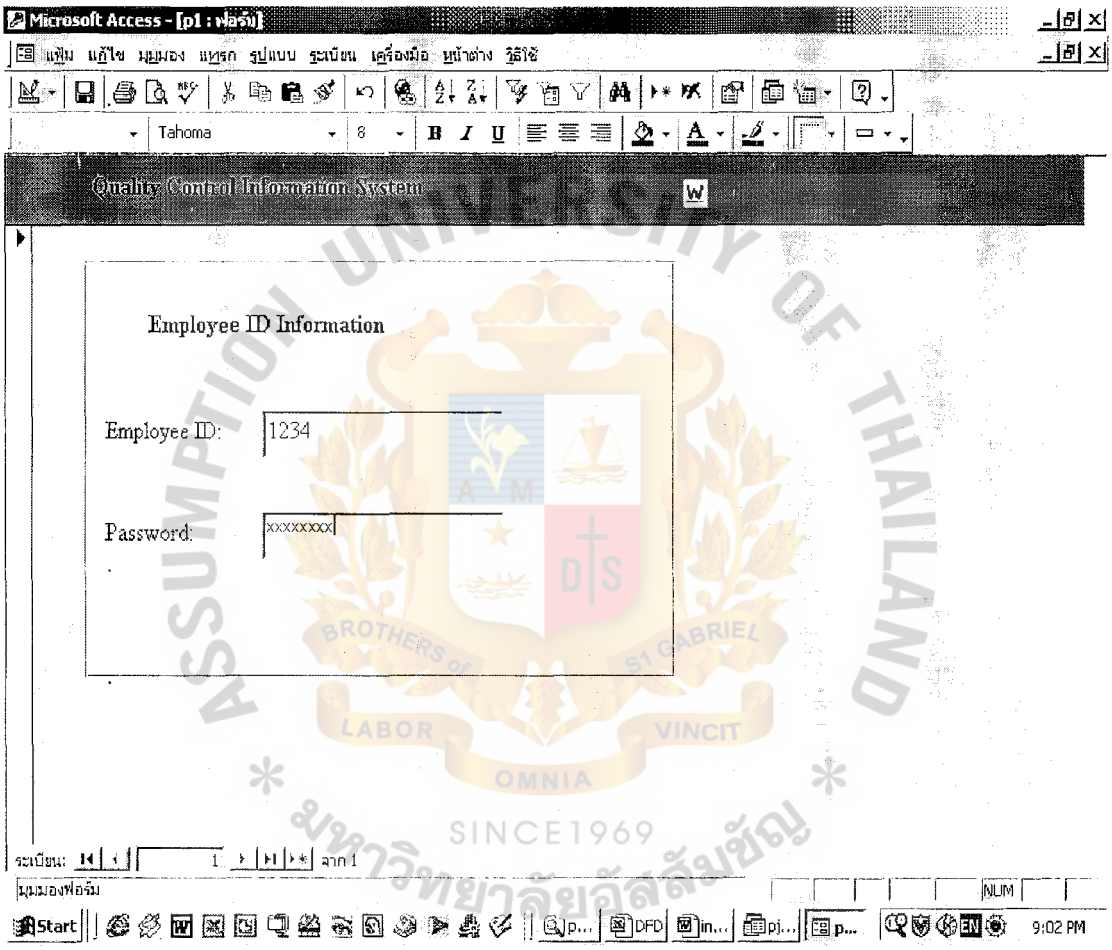

Figure E.1. Employee ID Information.

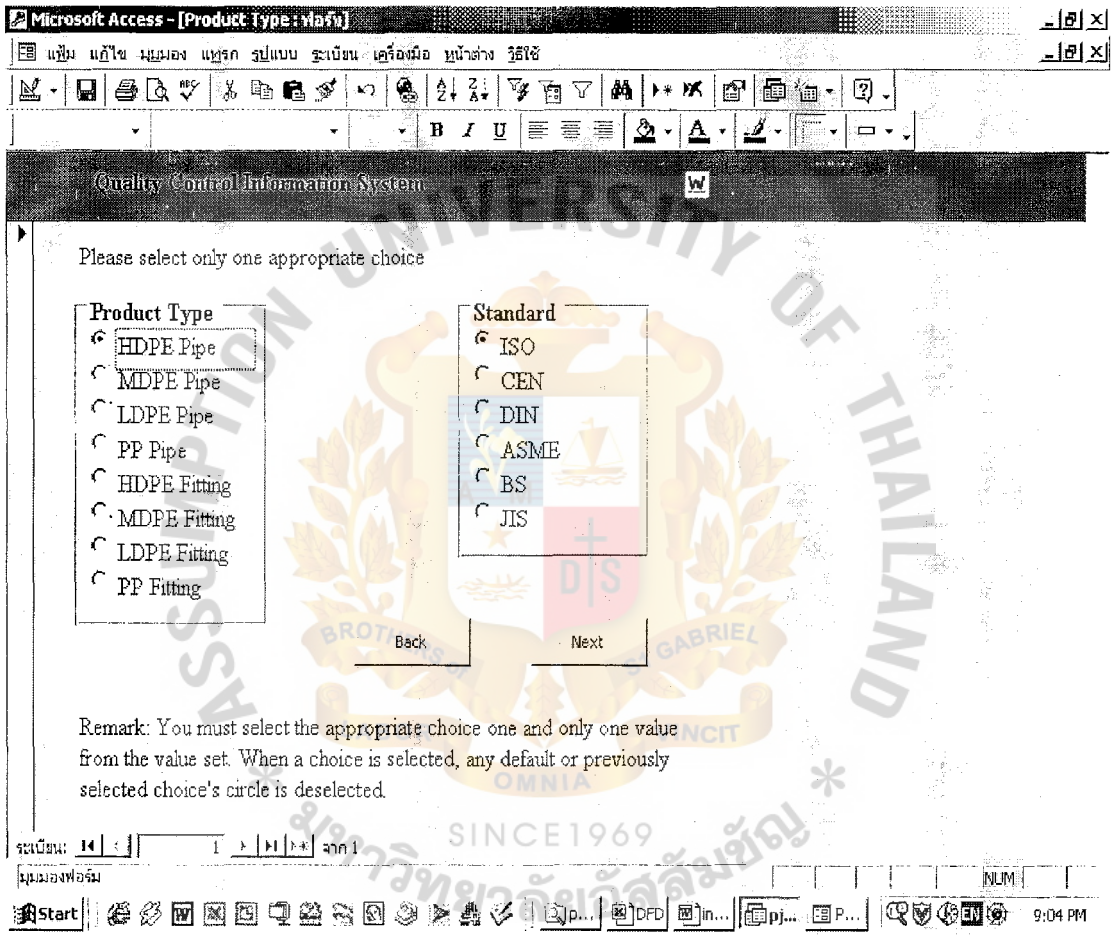

Figure E.2. Product Requirement.

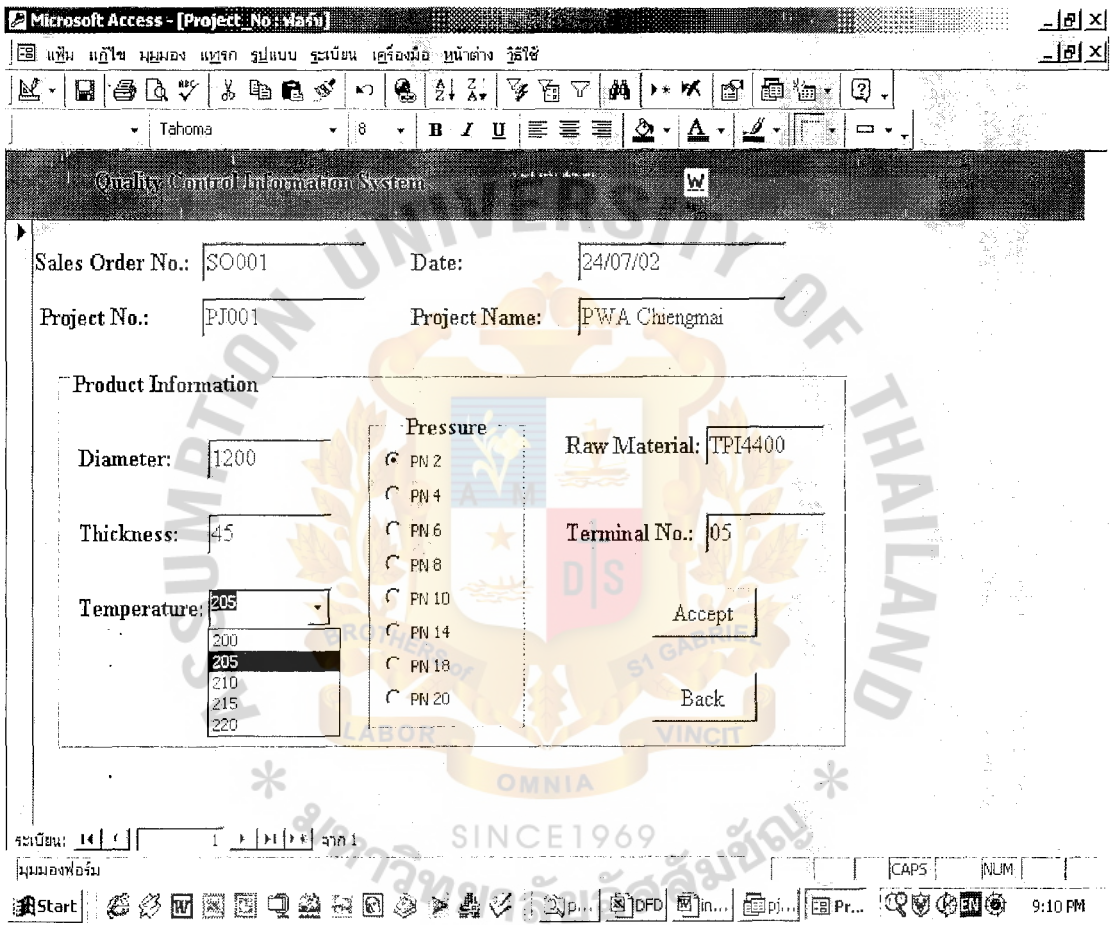

Figure E.3. Product Information.

APPENDIX F

OUTPUT DESIGN

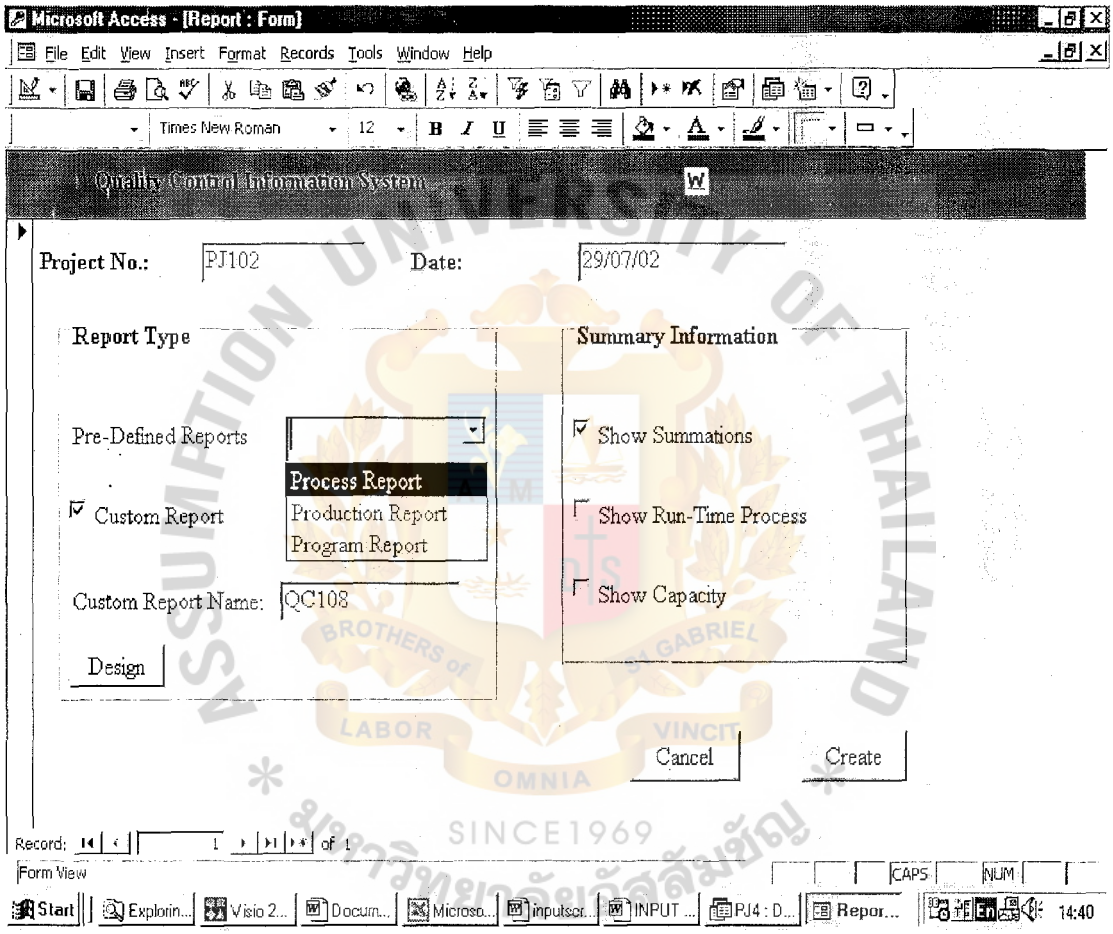

Figure F.1. Report.

APPENDIX G

DATA DICTIONARY

Table G.1. Sales Order.

Relation	Attribute	Type	Primary Key	Foreign Key
Sales Order No.	SO_No	Numeric(8)	Yes	-
Date	Date	Date	-	-
Product Requirement	Pro_Req	Char(100)	-	-
Quantity	Qnty	Numeric(8)	-	-
Unit	Unit	Numeric(8)	-	-
Unit Price	UP	Numeric(8)	-	-
Total Price	TP	Numeric(8)	-	-
Note	Note	Char(100)	-	-

Table G.2. Production.

Relation	Attribute	Type	Primary Key	Foreign Key
Production No.	Pro_No	Numeric(8)	Yes	-
Date	Date	Date	-	-
Product Type	Pro_Type	Char(100)	-	-
Diameter	Dia	Numeric(8)	-	-
Thickness	Thk	Numeric(8)	-	-
Pressure	Prs	Numeric(8)	-	-
Standard	Std	Char(100)	-	-
Raw Material	RM	Char(100)	-	-
Supervisor ID	Sup_ID	Numeric(8)	-	-
Machine No.	Mac_No	Numeric(8)	-	-
Produced Date	Pro_Dt	Date	-	-
Sent Date	Sent_Dt	Date	-	-
Produced Time	Pro_Tm	Time	-	-

Table G.3. Program.

Relation	Attribute	Type	Primary Key	Foreign Key
Program No.	Prog_No	Numeric(8)	Yes	-
Terminal No.	Ter_No	Numeric(8)	-	-
Production No.	Pro_No	Numeric(8)	-	Yes
Date	Date	Date	-	-
IT Officer ID	ITOff_ID	Numeric(8)	-	-

Table G.4. Process Report.

Relation	Attribute	Type	Primary Key	Foreign Key
Process Report No.	ProcRp_No	Numeric(8)	Yes	-
Date	Date	Date	-	-
Supervisor ID	Sup_ID	Numeric(8)	-	-
Machine No.	Mac_No	Numeric(8)	-	-
Produced Pressure	Pro_Prs	Numeric(8)	-	-
Produced Temperature	Pro_Tmp	Numeric(8)	-	-
Produced Date	Pro_Dt	Date	-	-
Produced Time	Pro_Tm	Time	-	-
Note	Note	Char(100)	-	-
Machine No.	Mac_No	Numeric(8)	-	-

Table G.5. Production Report.

Relation	Attribute	Type	Primary Key	Foreign Key
Production Report No.	ProRp_No	Numeric(8)	Yes	-
Date	Date	Date	-	-
Supervisor ID	Sup_ID	Numeric(8)	-	-
Machine No.	Mac_No	Numeric(8)	-	-
Produced Pressure	Pro_Prs	Numeric(8)	-	-
Produced Temperature	Pro_Tmp	Numeric(8)	-	-
Produced Date	Pro_Dt	Date	-	-
Produced Time	Pro_Tm	Time	-	-
Last Modify	L_Mdf	Date	-	-
Status	Status	Char(20)	-	-
Note	Note	Char(100)	-	-

Table G.6. QC Report.

Relation	Attribute	Type	Primary Key	Foreign Key
QC Report No.	QCRp_No	Numeric(8)	Yes	-
Production Report No.	ProRp_No	Numeric(8)	-	Yes
Inspector ID	Insp_ID	Numeric(8)	-	-
Date	Date	Date	-	-
Product Type	Pro_Type	Char(20)	-	-
Tested Tensile Strength	Tst_Tens	Char(20)	-	-
Tested Pressure	Tst_Prs	Char(20)	-	-
Tested Temperature	Tst_Tmp	Char(20)	-	-
Tested Ultra Sound	Tst_US	Char(20)	-	-
Last Modify	L_Mdf	Date	-	-
Status	Status	Char(20)	-	-
Note	Note	Char(100)	-	-

Table G.7. Final Report.

Relation	Attribute	Type	Primary Key	Foreign Key
Final Report No.	FinRp_No	Numeric(8)	Yes	-
Date	Date	Date	-	-
Sales Order No.	SO_No	Numeric(8)	-	-
Production Report No.	ProRp_No	Numeric(8)	-	Yes
Last Modify	L_Mdf	Date	-	-
Status	Status	Char(20)	-	-
Note	Note	Char(100)	-	-

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