Customer Service Information System for Unity Progress Co., Ltd.

by

Mr. Kwanta Lertpongpaibool

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

July 2004

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Project Title	Customer Service System
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Academic Year	July 2004

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

The project is a study of Customer Service System for the proposed company that will sell IT products and has a Service Department to perform the after sales service functions. The existing system of the company is a manual system, which creates many problems in controlling the flow of documents and also provides unreliable, inaccurate and inadequate information. Ineffectively, the existing system consumes more time and is more costly. From the study, it was found that the proposed system should provide users with full computerized information system that will help to provide continuous information.

This project aims to improve the existing system of operations at the Service Department and Stock Department. The emphasis is on computerization as to decrease time and cost of the operation and to provide the right information at the right time. Reports can also be generated as output of integrated data for planners and management to use as a tool in planning forecasting and decision making.

The new system is developed in accordance with the systems analysis and design techniques. The new system project is designed to respond to the users' needs. The project will discuss about the user requirements, system design, system implementation hardware and software requirements, security and control systems including the user training, etc. Sybase PowerBuilder 7.0 and Sybase SQL Anywhere 6.0 are chosen as the program development tools on the computer network. The purpose of selecting this application is the ease of use and modification.

ACKNOWLEDGEMENTS

This system development project has required cooperation from the several people. Without them, this project cannot be absolutely completed. The writer would like to take this opportunity to express gratitude to all these people who sacrificed their valuable time to provide the needed information for this system project.

First, I would like to express gratitude to my project advisor, Dr. Boonyarit Pokrud for his constant encouragement and invaluable suggestions and guidance.

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I. INTRODUCTION

1.1 Background of the Project

Unity Progress Co.,Ltd. (UPC) was established in 1974. UPC business, started from Chinese printing processing service and Chinese typewriter, was the first company in Thailand. After that, UPC was authorized to be Apple Authorized Dealer, to sell the Apple Macintosh computer products. In1992, UPC was also authorized by UMAX Data System Inc to be UMAX Authorized Distributor, which sells UMAX Scanner. UPC was also authorized to be Service Center from Apple and UMAX. Most of the customers are business organizations and individuals.

In the past, UPC operated manually and now the company would like to upgrade their operations to computer usage due to its effectiveness such as speed, cost and information. UPC believes that computer will decrease their work time and increase more great projects and services to serve the best to the customer.

The main department of the company that needs to be upgraded is the service department which usually works manually. Computerization of the system will keep all the work and record organized and easy to work on. This will lead to less time consuming process of this department. Eventually, the whole company will be organized as one and be ready to serve the customer with its best service.

1.2 Objectives of the Project

The objectives of the Customer Service System are as follows:

(1) To analyze, design and implement the existing system from being a manual system to a new computerized system for more effective work.

(2) To identify user requirements and business requirements this can solve the existing problem and improve efficiency of the Customer Service System.

(3) To support the ever increasing data within the organization.

(4) To control customer services and organize the information that is necessary for the whole system.

(5) To reduce duplicated activities and increase control of the overall operations.

(6) To reduce costs and time in operations.

(7) To create a computer based customer service and inventory information system to replace the manual system.

1.3 Scope of the Project

This project will cover the basic requirements of Customer Service System, which are summarized as follows:

(1) To get the customer order and record all Sales order transactions.

(2) To create application collecting customer information and service record.

(3) To create application collecting product and spare part.

(4) To issue service charged invoice.

(5) To provide and update the customers, products and spare parts information.

(6) To generate all necessary reports about customers, product and spare part.

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1.4 Deliverables

(a) Project scope and objectives

(b) System scope and objectives

(c) Business requirements

(d) Technology requirements

(e) Design specification

(f) Context diagram

(g) Data flow diagram

(h) Hardware and software requirement

(i) Cost and benefit analysis

(j) Program source code and compiled program

(k) Test plan and result

(l) Document

1.5 Project Implementation

This project plan of the Customer Service System for Unity Progress Co.,Ltd. is given in Figure 1.1.

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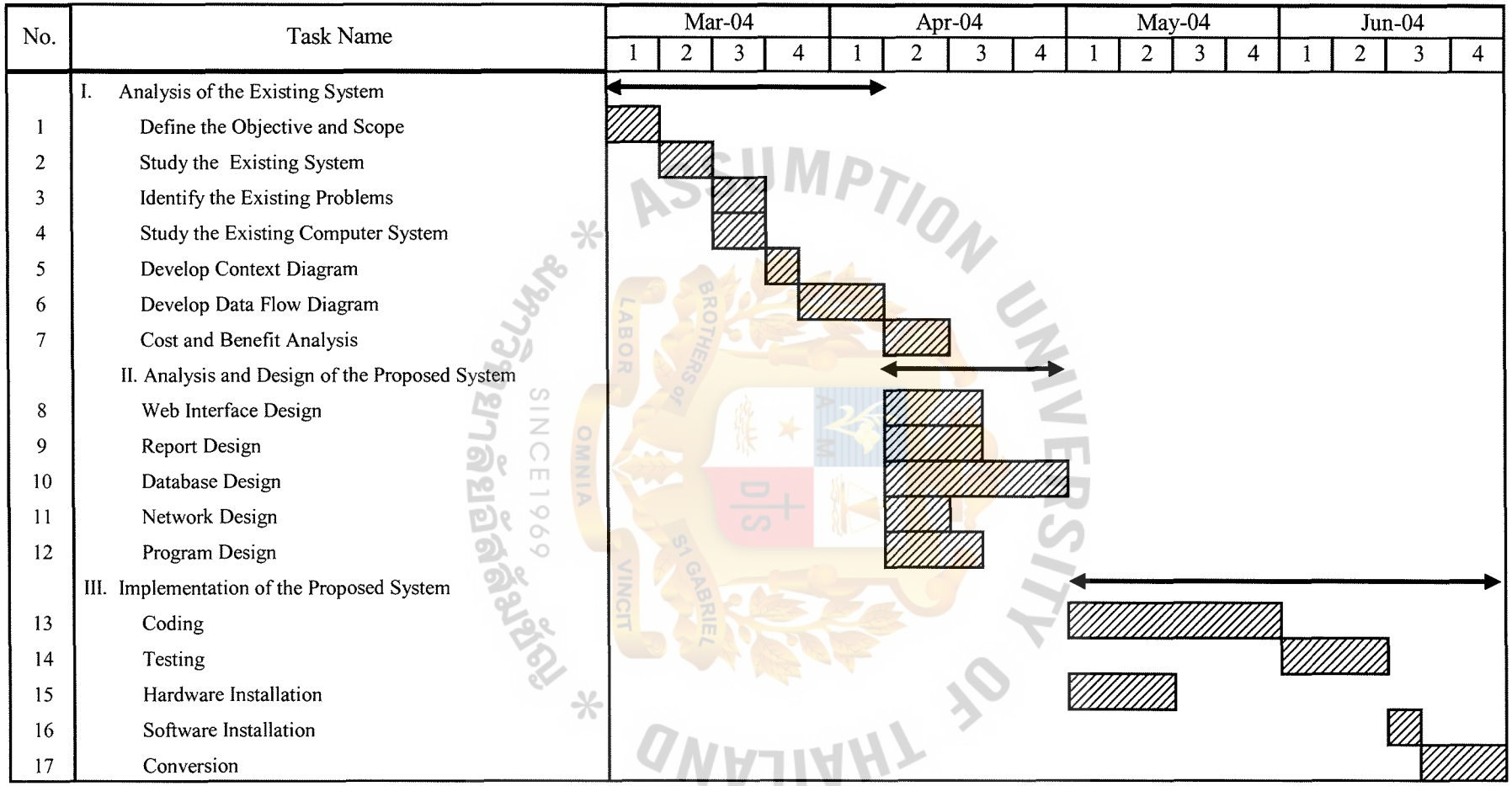

Figure 1.1. Project Plan of Customer Service System.

II. EXISTING SYSTEM

2.1 Background of the Organization

Unity Progress Co.,Ltd. (UPC) was established in 1974 with a capital of 500,000 baht at startup. UPC business, started from Chinese printing processing service and important Chinese typewriter, was the first company in Thailand. After that, UPC increased the capital to be 15,000,000 baht and expanded into computer business in 1987. UPC was authorized to be Apple Authorized Dealer, which sells the apple Macintosh computer products. In1992, UPC was also authorized from UMAX Data System Inc to be UMAX Authorized Distributor, which sells UMAX Scanner. Not only offers computers and other related products to consumers and also offers repair and checking services.

UPC has always operated the company with the manual system and now since computer is a major technology, UPC has decided to alter the manual system to a computerized system to gain more overall efficient workflow. The organization chart of the company is show in Figure 2.1.

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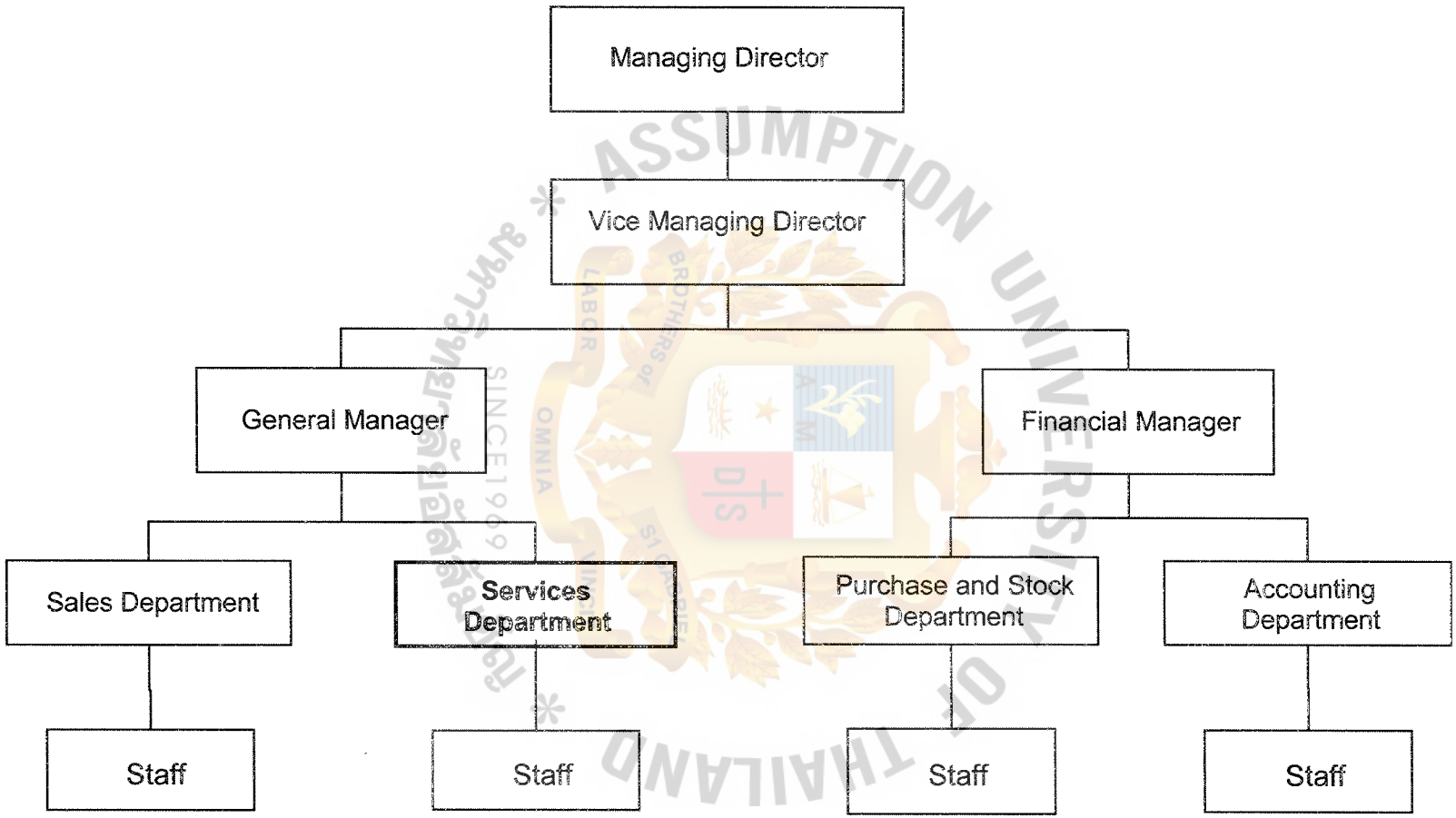

Figure 2.1. Organization Chart of Unity Progress Co.,Ltd.

2.2 Existing Business Functions

Unity Progress Co,.Ltd is using the manual system to operate all the works and processes in the company. Company is based on paper system and paper filing. The existing functions of the Customer Service System are as follows:

(1) Get customer information

Customer service officers get the information that is required from the customer to check the general information about the customer such as names and address to proceed to another process.

(2) Process the job to engineers

After getting all the information they need the customer service officers process the job to the technician department to get the job done, such as repair the product or change spare parts.

(3) Keep record

Customer service officers keep all the records of customers, products and jobs in paper files. These records will be used as reference when needed.

(4) Report

Reports about customers and everyday work are produced in paper form and sent to management department to use in decision-making process.

(5) Delivery

Prepare delivery and install to the customers when they required. Receive the service charge in case out of warranty.

The context and Data Flow Diagram of the existing system are shown in Figure 2.2 and 2.3.

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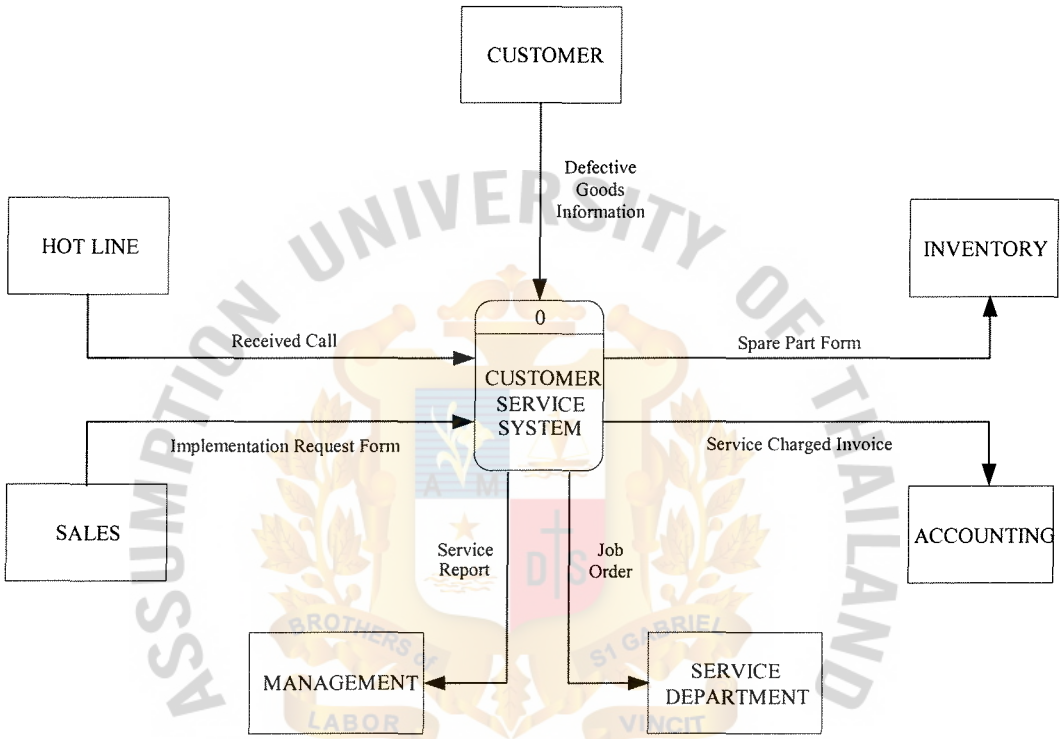

Figure 2.2. Context Diagram of the Existing System.

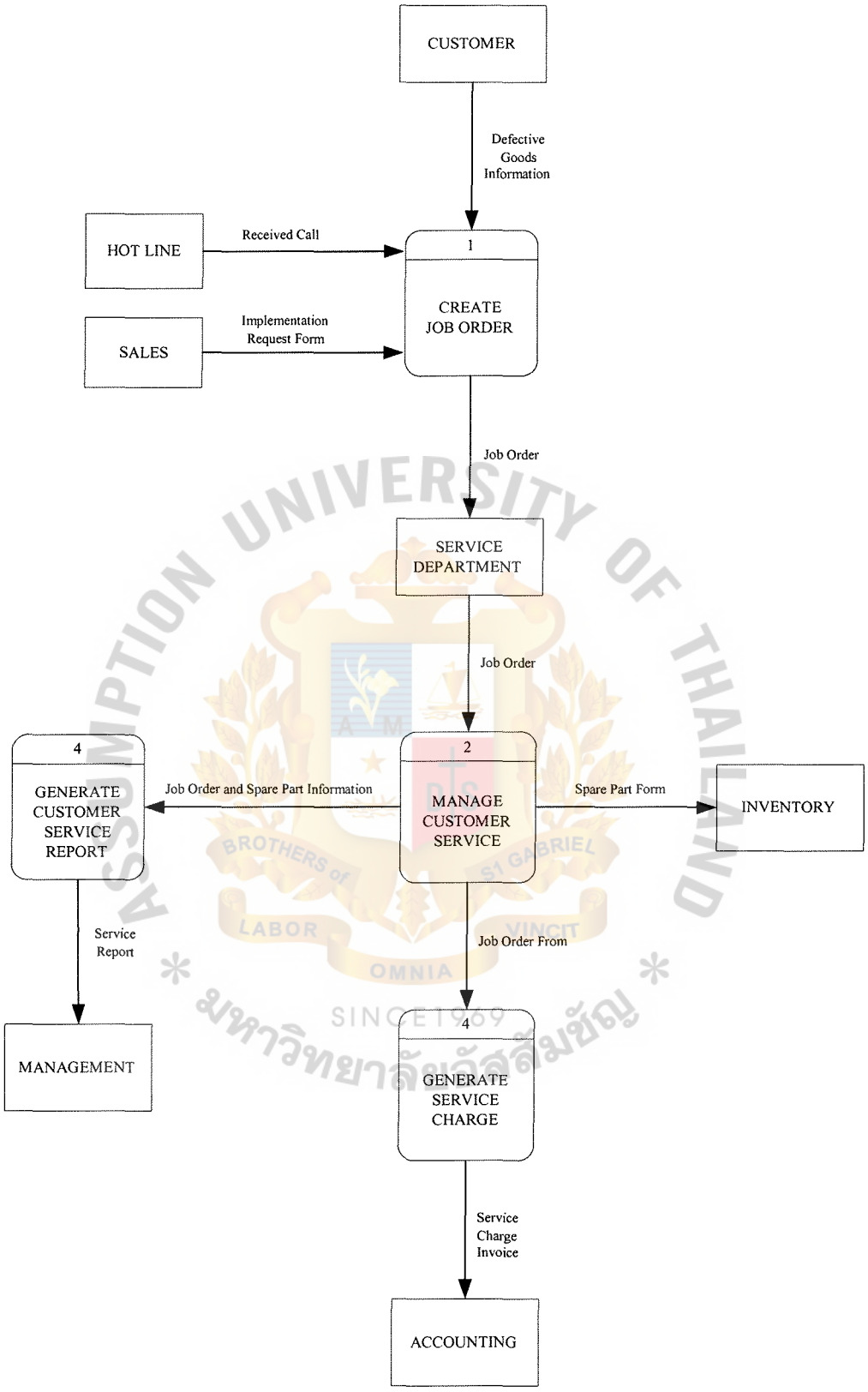

Figure 2.3. Data Flow Diagram of the Existing System.

2.3 Current Problems and Areas of Improvement

The existing manual system causes many problems as follows:

(1) The existing system is a manual system. It takes more time and is a higher cost to operate. Furthermore, there is work overload in the Customer Service Department because the working processes are so complex and duplicated. It might cause a lack of effective control within the Department.

(2) The company has no database system to support the use of the computerized system. The information cannot be shared between department since each department has its own filling system and this delay work. It also difficult to prepare the information and report on time. Hence, the information may be incorrect and inaccurate.

(3) There are lot of mistakes and confusion between the customer and the Customer Service Department of the company about returning the purchased product and warranty for repairing. These cause slowness of the job. Moreover sometimes they send list of spare parts to manufacturers for claim and they cannot claim, since they lack the details of warranty terms and spare part number.

(4) Customer service and engineer need a better record and information management that is always updated and available. The organized information will be beneficial to these departments to serve the better service to customers and also affect the overall performance of the customer.

(5) It takes time to check the proof from the customer and sometimes the proof is not valid. The company needs more efficient ways to handle this situation.

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(6) Customer Service cannot check the status of the job to inform the customers. This cause makes the customers get no satisfaction and also results in complaints.

(7) No sufficient information for management to plan and forecast the company's long range plans of spare parts.

(8) Relational Database is recommended in order to be easy for updating, or changing any information. In addition, it can prevent data redundancy.

(9) Security and control system must be developed in order to protect the confidential information from unauthorized persons.

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III. PROPOSED SYSTEM

3.1 System Specification

3.1.1 User Requirements

The user requirements are obtained from the users, which are the following:

(1) Retrieve customer information.

(2) Order details included all the necessary information such as product name, order date, warranty range, problem and customer information.

(3) Automatically issue date, time and operator name on the record as created.

(4) The new system should be on an on-line system so the customer service operators can follow the service and produce reports by request.

(5) Invoice and all transaction forms are produced in printed standard form to create organized-filed environment and prevent confusion of any kinds.

(6) Only authorized users can access and operate programs and database in the Customer Service System.

(7) User-friendly programs and interfaces for the ease of uses.

3.1.2 System Requirement

The new system should meet the user requirement, which is defined by the users of the new system, and also the system requirement. The following proposals are made for the improvement of the system requirement so it is called a proposed system.

(1) The system should have security control in operations by having a password to verify the authorization.

(2) The system accessing should be menu driven to assist the users to get used to a new system gradually and easily.

(3) A relational database should be implemented to the new system.

(4) The system should have high stability and consistencies to guarantee the effectiveness of the work.

(5) The form and output reports generated by the new system should be standardized.

(6) The new system should not cause any problem as the existing system.

(7) The proposed system should suit the work conditions of the company.

3.1.3 Network Requirement

The design is based on LAN with star topology. The nodes in a star topology interconnect directly with the central system. It means that each workstation, terminal on computer can communicate only with the central site and not with other nodes in the network.

For the star topology, it is easy to maintain by connecting workstation and server to hub with UTP cables. A star topology uses a central controller device as the hub of the network, all device are wired directly back to the hub, and all communication between device passes through the hub. While it can be used with any transmission medium, this design is particularly well suited to twisted-pair wiring because most building wiring runs from desktops back to central wiring closets. Implementation of star topology could be as simple as installing the controller in a wiring closet and connecting the appropriate twisted pairs to the hub and to user devices.

Network design for the proposed system concerns 4 related departments. The design is shown in Figure 3.1 Network Design.

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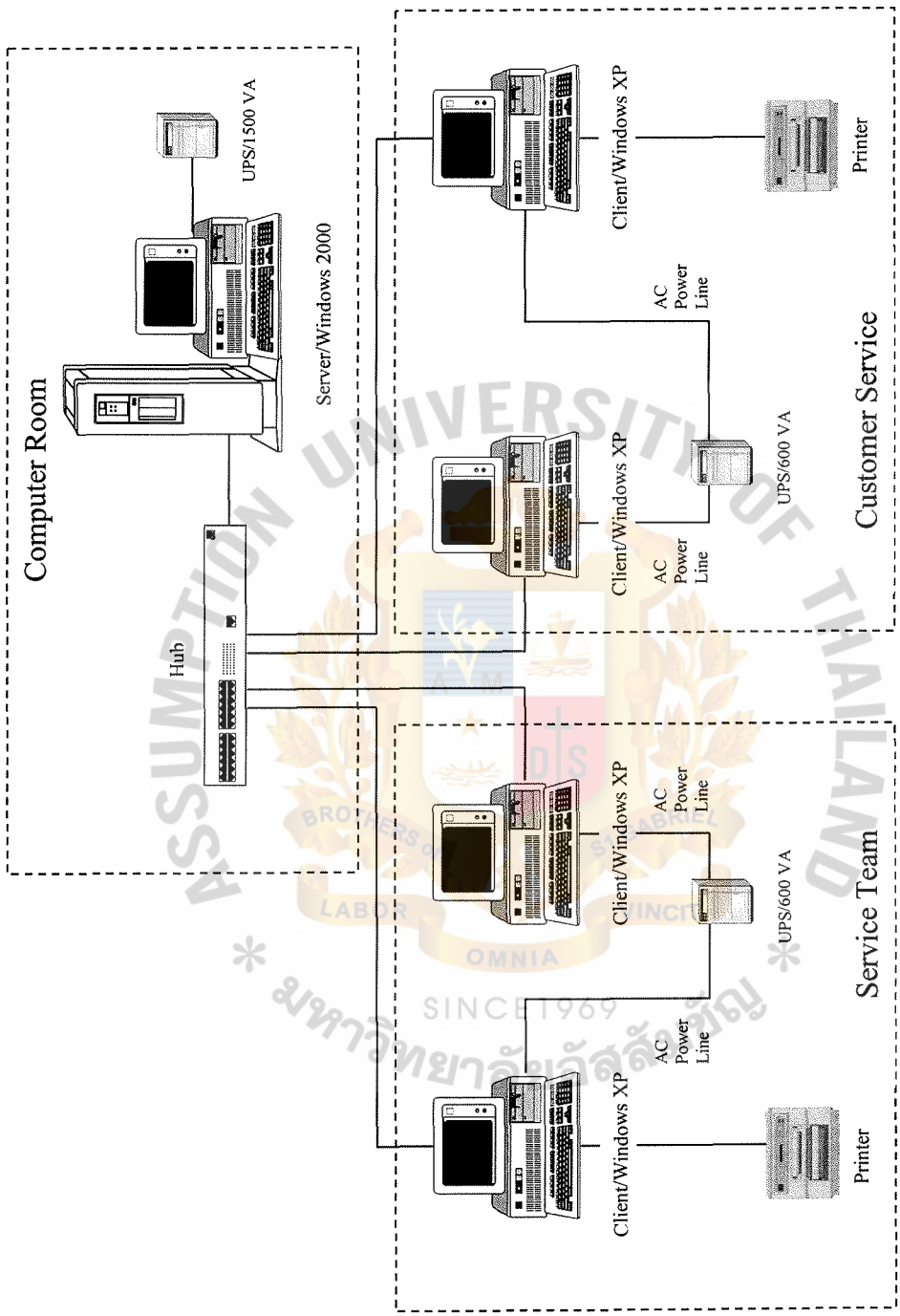

Figure 3.1. The Network Configuration of Proposed System.

3.2 The Proposed System

After we have studied the existing system together with additional requirements, we find that there are several main functions that will be done in the system. The following are the list of events for the proposed system of Customer Service System.

Event 1 : Manage Customer Service Information

- Process 1.1 : Gather Customer Information
- Process 1.2 : Create Job Order

Event 2 : Manage Symptom

- Process 2.1 : Manage Customer Information
- Process 2.2 : Check Basic Symptom
- Process 2.3 : Create job Order

Event 3 : Manage Customer Service

- Process 3.1 : Manage Job Order
- Process 3.2 : Manage Service
- Process 3.3 : Manage Spare Part
- Process 3.4 : Manage Finish Goods

Event 4 : Generate Customer Service Report

- Process 4.1 : Generate Transaction Details
- Process 4.2 : Generate Top Ten Report

All related working units and input and output data of this system, can be described with the context diagram Figure 3.2 as follows:

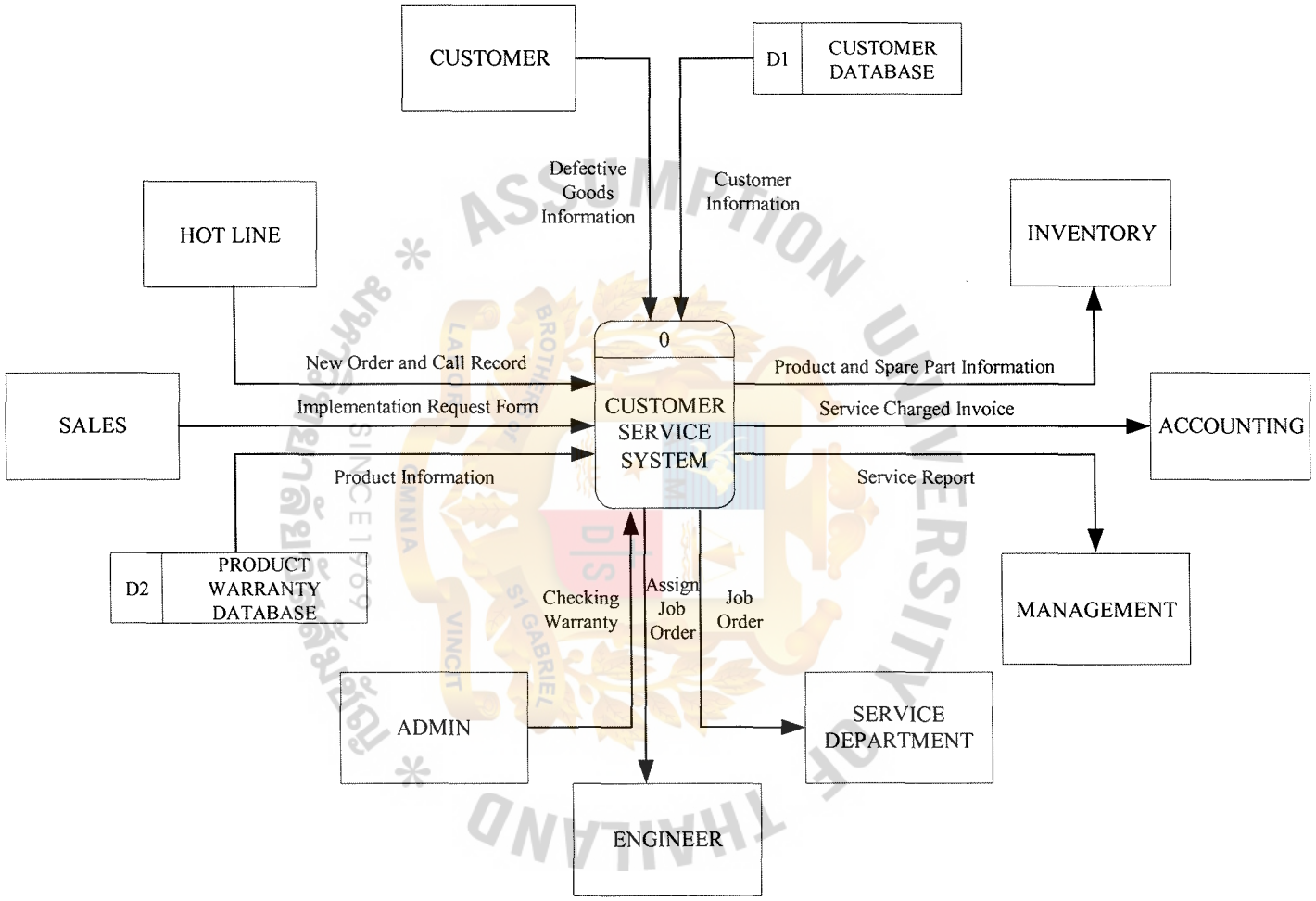

Figure 3.2. Context Diagram of the Customer Service System.

3.3 System Design

3.3.1 Candidate Solution Analysis

Given the business requirement established in the previous section, the alternative candidate solution can be identified from the idea and opinion of the development team and user. Along with reviewing the system specification, the three candidate solutions can be defined for the proposed system. Each solution has its own application development tools and database management system shown as follows:

(1) Candidate 1: MS Visual Basic 6.0 and MS Access 2002 Database

This candidate use Microsoft Access to be database management. This candidate is the easiest candidate to implement and need short time to implement too. Maintenance cost is also cheapest when we compare with another candidate because Microsoft Access 2000 don't need specialist to maintain. Anyway this candidate cannot support huge number of records because Microsoft Access 2000 has limitation of the software. It does not support multi users as well. We have to put the database file to the server and share this database file like another conventional file. We cannot apply strong security features to this candidate because software does not support strong security like the level of authorization, auditing and accounting.

(2) Candidate 2: Developer 2000 and Personal Oracle 8 Database

Developer 2000 and Personal Oracle 8 are used as Development Tool and Database Software respectively. This solution supports the muti-user environment and relational database technology.

Since the existing programmers have little experience of oracle products, a training course is required to guide them in developing the new application with a powerful database server. However, this candidate

provides the best way of developing the new system by introducing the effective development tool and database software.

(3) Candidate 3: PowerBuilder 7.0 and Sybase Database

This candidate is similar to candidate 2 but we change database management software from oracle to be Sybase software. Cost is competitive for this candidate because Sybase software is a lot cheaper than oracle software. PowerBuilder 7.0 is used for application development, because of its rapid application development (RAD) environment. With its visual style, it makes application development easier. Moreover technical staff has full experience with PowerBuilder product therefore, the development process can be done quickly, easily and smoothly. Thus, this candidate takes less time to design and implement in the current environment.

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

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Table 3.1. Candidate System Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Portion of System Computerized Brief description of that portion of the system that would be computerized in this candidate.	Full supports all relevant units that are involved in Customer Service System	Full supports all relevant units that are involved in Customer Service System	Full supports all relevant units that are involved in Customer Service System
Benefits Brief description of the business benefits that would be realized for this candidate.	Application development is easy with fast learning time.	Powerful DBMS and application enable user performing their tasks more efficiently and effectively.	Application development is easy with fast learning time.
Servers and Workstations A description of the servers and workstations needed to support this candidate.	Server: Intel Xeon 3.06 GHz PC: Pentium 4 2.8 GHz	Server: Intel Dual Xeon 3.06 GHz PC: Pentium 4 2.8 GHz	Server: Intel Xeon 3.06 GHz PC: Pentium 4 2.8 GHz
Software tools needed Software tools needed to design and build the candidate (e.g., database management system, emulators, operating systems, languages etc.) Not generally applicable if applications software packages are to be purchased.	Windows 2000 Server Windows XP MS Visual Basic 6 MS SQL Server 7.0	Windows 2000 Server Windows 98 SE Developer 2000 Personal Oracle 8.0	Windows 2000 Server Windows XP PowerBuilder 7.0 Sybase Central DBMS
Application software A description of the software to be purchased, built, accessed, or some combination of these techniques.	Custom Solution	Custom Solution	Custom Solution
Method of data processing Generally some combination of: on-line, batch, deferred batch, remote batch, and real-time	Database stored on server and processed on workstation	Oracle uses a two-tier Client/ Server architecture with a powerful database server	Database stored and process on DBMS server and GUI on workstation
Output Devices and Implications A description of output devices that would be used, special output requirements (e.g., network, preprinted form, etc.), and output considerations (e.g., timing constraints).	Display Monitor HP laser printer	Display Monitor HP laser printer	Display Monitor HP laser printer
Input Devices and Implications A description of input method to be used, input devices (e.g. keyboard, mouse, etc.), special input requirements (e.g., new or revised forms from which data would be input), and input considerations (e.g. timing of actual inputs)	Keyboard and mouse	Keyboard and mouse	Keyboard and mouse
Storage Device and Implications Brief description of what data would be stored, what data would be accessed from existing stores, what storage media would be used, how much storage capacity would be needed, and how data would be organized.	MS Access with 20 GB storage capacity.	Oracle DBMS with 50 GB storage capacity.	Sybase DBMS with 20 GB storage capacity.

3.3.2 Feasibility Analysis

After the candidate solutions are identified, the feasibility analysis can be done for each candidate. The following feasibility criteria should be taking into consideration when the development team wants to select the best solution to implement in the production environment.

(1) Operational feasibility

It is a measure of how well the urgency of problems or the acceptability of a solution will work in the organization. It is also a measure of how people feel about the system. All candidates are fully supporting the current business process but Candidate 3 is the most feasible because it can be implemented very quickly without additional software installation and hardware upgrades.

(2) Technical feasibility

It is a measure of the practicality of a specific technical solution and the availability of technical resources and expertise. Candidate 2 is the most difficult to implement because the current staff have little experience about its development tool, whereas Candidate 3 is easy to design and implement because the current programmers are fully experienced with PowerBuilder and Candidate 1 is also easy to develop.

(3) Economic feasibility

It is a measure of the cost-effectiveness of a project or solution. Candidate 2 is the most expensive solution because it requires a database specialist and a powerful hardware to implement and maintain it. In contrast, Candidate 1 and 3 require only a medium hardware and a system analyst to implement and operate the developed system.

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(4) Schedule feasibility

It is a measure of how reasonable the project timetable is. Candidate 3 and Candidate 1 take the least time to implement because current technical staff have sufficient experience. Candidate 1 takes a bit more time than Candidate 3 but it is also a quickly implemented solution. Conversely, Candidate 2 consumes the most time to design and implement the proposed system because Oracle is very complicated and difficult to learn without any training course from Oracle Company.

Once all feasibility criteria are evaluated, the weight of each criteria must be identified for evaluating the candidate solution. Candidate 3 is the most suitable alternative for the proposed system, because it takes the lowest development time and cost with acceptable performances.

Table 3.2 shows the completed feasibility analysis matrix for each candidate. In addition, the full details of cost-benefit calculations (Economic Feasibility) are shown in Appendix E, which are all Candidate Cost tables, Payback table and graph and Net Present Value (NPV) table.

Table 3.2. Feasibility Analysis Matrix.

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3
Operational Feasibility **Functionality.** A description of to what degree the candidate would benefit the organization and how well the system would work. **Political.** A description of how well received this solution would be from both user management, user, and organization perspective	30%	Fully supports user required functionality. **Score: 90**	Only supports Customer Service System requirements and current business processes would have to be modified to take advantage of software functionality **Score: 70**	Fully supports user required functionality. **Score: 90**
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%	Although current technical staff has a little experience with Microsoft product but finding experienced MS Visual Basic programmers will be easier than finding PowerBuilder or Oracle programmers. **Score: 80**	Oracle product needs specialist to develop the software and staff needs the training course. That make the installation and training take long time. **Score: 65**	Current technical staff has full experience with PowerBuilder therefore, the development process can be done easily and smoothly. **Score: 90**
Economic Feasibility **Cost of develop:** **Payback period (discounted):** **Net present value:** **Detailed calculations:**	20%	Approximately 1,369,500 baht Approximately 2.2 Years Approximately 2,568,909.20 baht See Appendix E **Score: 90**	Approximately 1,720,000 baht Approximately 2.9 Years Approximately 1,997,066.03 baht See Appendix E **Score: 75**	Approximately 1,310,600 baht Approximately 2 Years Approximately 2,627,809.20 baht See Appendix E **Score: 95**
Schedule Feasibility An assessment of how long the solution will take to design and implement.	20%	6-9 months **Score: 90**	9-12 months **Score: 85**	6 months **Score: 95**
Ranking	**100%**	**87**	**72.5**	**92**

3.4 Hardware and Software for the System

3.4.1 Hardware

The main requirements in respect of hardware are I/O peripherals and communication equipment for supporting an interactive system. In the system, all computers are connected on LAN network. File server will be used in order to store the data and share the data for all work stations. Hardware requirement estimations for related department are presented as follows:

Table 3.3. Hardware Specification for Database Server.

Device	Specification
HP ProLiant Server ML350 G3	
Processor Type and Speed	Intel Dual Xeon 3.06 GHz or higher
Cache Memory	512 KB L2
Primary Memory	1 GB DDR SDRAM
Hard disk Capacity	72 GB U320 15k. / Hot Plug
SCSI Controller	Integrated Dual Channel Wide Ultra3 SCSI
CD-ROM	48X
NIC	Gigabit Auto Switching Network (10/100/1000)
Expandable	4 PCI (64-bit), 1 PCI (32-bit)
Display Monitor	HP 17" LCD Monitor
3COM Enterprise Baseline Switches	
Network Adapter	3COM SS 3 Baseline 24(10/100), 2(10/100/1000)
UPS APC Smart 1500	
Technology	Line Interactive
VA	1500VA
Software	Powerchute Plus
Back Up	
Tape Backup	HP 24 GHz

Table 3.4. Hardware Specification for Each Workstation.

Device	Specification
HP Pavillion t558d	
Processor Type and Speed	Intel Pentium 4 2.8 GHz HT, FSB-800
Cache Memory	1 MB L2
Primary Memory	512 GB DDR
Hard disk Capacity	80 GB (7200rpm)
CD-ROM	8X DVD+RW/R&CD-RW ComboDrive (DVD-Writer)
Fax/ Modem	56K
NIC	Integrated 10/100Base-T Network
Expandable	3 PCI, 7 USB 2.0, 2 IEEE 1394
Display Monitor	HP 17" CRT Monitor
HP LaserJet Printers 1300N	
Resolution	1200x1200 dpi
Memory	16 MB
Media sized	A4, legal
Interface	Parallel, USB 2.0
Epson DotMatrix Printer LQ300+	
Speed	300 cps, 24 pin
Memory	32 KB
Media sized	A4, legal
Interface	Parallel

3.4.2 Software

To implement an interactive system, the computer system must contain interactive capabilities. The selling information system has to run on Microsoft Windows ME operating system, using PowerBuilder as an implementing program. It supports the user to interface with database and also control on-line database. Additionally, it allows multiple accesses to data and control concurrently running user application program serving many users. Hence, the system software will be prepared for running on the network system. The software requirements of the system are considered as follows:

Table 3.5. Software Specification for Database Server.

Device	Specification
Operating System	Microsoft Windows 2000 Server
Application Server	PowerBulider 7.0
Database Server	Sybase Central DBMS

Table 3.6. Software Specification for Each Workstation.

Device	Specification
Operating System	Microsoft Windows XP
Application Server	Microsoft Office XP

3.5 Cost and Benefit Analysis

When the purposed system is developed to replace the existing system, the details of both cost and benefits of the new system when compared with the old system must be illustrated. Therefore, the tables and figures of cost information are constructed to provide a clear picture of the comparison of both systems costs. Furthermore, the benefits of the new system are presented in both tangible and intangible terms. Finally, the analysis techniques, which are break-even analysis and payback period, are applied to show the benefits over the cost after the implementation of the purposed system.

3.5.1 Cost Analysis

(1) Costs of Manual System

The existing system is operated manually, and incurs both fixed cost and annual operating cost. For fixed cost, there is only office equipment cost, and, for annual operating cost, it includes salary cost and office supplies and miscellaneous expense.

The details of the existing system cost are summarized on Table 3.7.

Table 3.7. Manual System Cost Analysis, Baht.

Cost Items		Years				
		1	2	3	4	5
Fixed Cost						
Type writer	3 units @ 10,000	6,000	6,000	6,000	6,000	6,000
Telephone	5 units @ 3,500	3,500	3,500	3,500	3,500	3,500
Calculator	4 units @ 2,000	8,000	-	-	-	-
Total Fixed Cost (Baht)		**17,500**	**9,500**	**9,500**	**9,500**	**9,500**
Operating Cost						
People-Ware Cost:						
Customer Service	3 persons @ 12,000	36,000	39,600	43,560	47,916	52,708
Admin	3 persons @ 8,000	24,000	24,000	24,000	24,000	24,000
Total Monthly Salary Cost (Baht)		60,000	63,600	67,560	71,916	76,708
Total Annual Salary Cost (Baht)		**720,000**	**763,200**	**810,720**	**862,992**	**920,491**
Office Supplies & Miscellaneous Cost:						
Stationary	per annual	28,000	30,800	33,880	37,268	40,995
Paper	per annual	68,000	74,800	82,280	90,508	99,559
Utility	per annual	8,000	8,800	9,680	10,648	11,713
Miscellaneous	per annual	12,000	13,200	14,520	15,972	17,569
Total Annual Office Supplies & Miscellaneous Cost (Baht)		**116,000**	**127,600**	**140,360**	**154,396**	**169,836**
Total Manual System Cost (Baht)		***853,500***	***900,300***	***960,580***	***1,026,888***	***1,099,827***

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

Year	Total Manual Cost (Baht)	Accumulated Cost (Baht)
1	853,500.00	853,500.00
2	900,300.00	1,753,800.00
3	960,580.00	2,714,380.00
4	1,026,888.00	3,741,268.00
5	1,099,826.80	4,841,094.80
Total	**4,841,094.80**	-

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(2) Costs of proposed System

The proposed system cost is also classified into fixed cost and annual operating cost. Fixed cost includes hardware cost and software cost, people-ware cost (only the salary cost of specialized persons who are involved in developing the new system), maintenance cost (both hardware and software) and implementation cost, whereas annual operating cost has the same cost category as incurred in the existing system cost.

With the newly computerized system, there is no office equipment cost but it requires some investment in computer hardware and software. The maintenance cost for new hardware and software is also paid to the vendor with the proposed option to have the free maintenance charge in first year of system implementation. The additional salary cost is paid to the people who are involved in the system development process. Before implementing the proposed system, the training and installation costs are spent according to the project budget.

The new system reduces the number of customer service and admin staff in the operation. Two customer service and admin are reduced, the rest of staff can operate the system without any workloads. But the number of engineer still the same as existing system. The system administrator acts as the consultant for the system user in case of any problem with system function, maintains the computerized system and is also responsible for maintaining the network connection of the developed system.

The details of the proposed system cost are summarized on Table 3.7.

Table 3.9. Computerized System Cost Analysis, Baht.

Cost Items		Years				
		1	2	3	4	5
Fixed Cost						
Hardware Cost:						
Database Server	1 unit @ 190.000	38,000	38,000	38,000	38,000	38,000
Work Station	9 units @ 45,000	81,000	81,000	81,000	81,000	81,000
Laser Printer	1 unit @ 32,000	6,400	6,400	6,400	6,400	6,400
Dot Matrix Printer	1 unit @ 9,900	1,980	1,980	1,980	1,980	1,980
UPS	1 unit @ 15,900	3,180	3,180	3,180	3,180	3,180
Network Product		5,500	5,500	5,500	5,500	5,500
Tape Backup		6,600	6,600	6,600	6,600	6,600
Total Hardware Cost (Baht)		***142,660***	***142,660***	***142,660***	***142,660***	***142,660***
Software Cost:						
Window 2003 server	1 unit @ 43,000	8,600	8,600	8,600	8,600	8,600
Window XP Pro	9 units @ 9,300	16,740	16,740	16,740	16,740	16,740
Microsoft Office XP	9 units @ 18,000	32,400	32,400	32,400	32,400	32,400
Power Builder 7 Pro		4,800	4,800	4,800	4,800	4,800
Sybase ASE Small Business Edition 12.5		11,920	11,920	11,920	11,920	11,920
Total Software Cost (Baht)		***74,460***	***74,460***	***74,460***	***74,460***	***74,460***
People-Ware Cost:						
System Analyst	6 months @ 20,000	120,000	-	-	-	-
Programmer	2 months @ 40,000	80,000	-	-	-	-
Network Specialist	1 months @ 18,000	18,000	-	-	-	-
Total Implementation Cost (Baht)		***218,000***	**0**	**0**	**0**	**0**
Implementation Cost:						
Training Cost		30,000	-	-	-	-
Installation Cost		20,000	-	-	-	-
Total Implementation Cost (Baht)		***50,000***	**0**	**0**	**0**	**0**
Maintenance Cost:						
Hardware Maintenance Cost		-	13,000	13,000	13,000	13,000
Software Maintenance Cost		-	5,000	5,000	5,000	5,000
Total Implementation Cost (Baht)		***0***	**18,000**	**18,000**	**18,000**	**18,000**
Total Fixed Cost (Baht)		**485,120**	**235,120**	**235,120**	**235,120**	**235,120**
Operating Cost						
People-Ware Cost:						
Customer Service	1 persons @ 12,000	12,000	13,200	14,520	15,972	17,569
Admin	1 persons @ 8,000	8,000	8,800	9,680	10,648	11,713
System Administration	1 persons @ 13,000	13,000	14,300	15,730	17,303	19,033

Table 3.9. Computerized System Cost Analysis, Baht. (Continued)

Cost Items		Years				
		1	2	3	4	5
Total Annual Salary Cost (Baht)		**396,000**	**435,600**	**479,160**	**527,076**	**579,784**
Office Supplies & Miscellaneous Cost:						
Stationary	per annual	24,000	26,400	29,040	31,944	35,138
Paper	per annual	59,000	64,900	71,390	78,529	86,382
Utility	per annual	6,000	6,600	7,260	7,986	8,785
Miscellaneous	per annual	10,000	11,000	12,100	13,310	14,641
Total Annual Office Supplies & Miscellaneous Cost (Baht)		**99,000**	**108,900**	**119,790**	**131,769**	**144,946**
Total Annual Cost (Baht)		**495,000**	**544,500**	**598,950**	**658,845**	**724,730**
Total Computerized System Cost (Baht)		***980,120***	***779,620***	***834,070***	***893,965***	***959,850***

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

Year	Total Computerized Cost (Baht)	Accumulated Cost (Baht)
1	980,120.00	980,120.00
2	779,620.00	1,759,740.00
3	834,070.00	2,593,810.00
4	893,965.00	3,487,775.00
5	959,849.50	4,447,624.50
Total	**4,447,624.50**	-

(3) The Comparison of the System.

After both the existing system cost and proposed system cost are identified, the comparison table is constructed to reveal the cost saving after implementing the proposed system. The comparison of the system costs are summarized on Table 3.11.

Table 3.11. The Comparison of the System Cost in Baht.

Year	Accumulated Manual Cost (Baht)	Accumulated Computerized Cost (Baht)
1	853,500.00	980,120.00
2	1,753,800.00	1,759,740.00
3	2,714,380.00	2,593,810.00
4	3,741,268.00	3,487,775.00
5	4,841,094.80	4,447,624.50
Total	**13,904,042.80**	**13,269,069.50**

3.5.2 Benefit Analysis

We can classify the benefits into 2 groups. The first one is tangible benefits and the second one is intangible benefits. Tangible benefit is the benefit that can be quantified and assigned a monetary value where as intangible benefits are not easily quantified.

(1) Tangible benefits.

Tangible benefits are usually measured in terms of monthly or annual savings or of profit to the firm. The tangible benefit of the proposed system is shown on Table 3.12.

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Table 3.12. Tangible Benefit of Proposed System, Baht.

Benefit Item	Price
Cost Saving:	
Salary Cost:	
Reduction of human labor	
- Customer Service 2 persons (12,000 baht per month)	288,000.00
- Admin 2 persons (8,000 baht per month)	192,000.00
Salary Cost:	*480,000.00*
Office Supplies and Miscellaneous Cost:	
- Stationary (4,000 baht per month)	48,000.00
- Paper (9,000 baht per month)	108,000.00
- Utility (2,000 baht per month)	24,000.00
- Miscellaneous (2,000 baht per month)	24,000.00
Total Office Supplies and Miscellaneous Cost:	*204,000.00*
Operation Time of Staff Improvement:	
- Customer Service (9,000 baht per month)	108,000.00
- Clerk (6,000 baht per month)	72,000.00
Total Operation Time Improvement:	*180,000.00*
Operation Improvement:	
- Elimination of Customer Reduce Orders (12,000 baht per month)	144,000.00
- Elimination of loss of business (10,000 baht per month)	120,000.00
Total Operation Time Improvement:	*264,000.00*
Total Tangible Benefit	**1,128,000.00**

(2) Intangible Benefit

The intangible benefit of the proposed system is customer satisfaction, improved customer goodwill, improved employee morale, better service to community and better decision making. The tangible benefit of the proposed system is summarized as follows:

(a) Reduce the redundant routine work.

(b) Increase efficiency and accuracy in working process.

(c) Eliminate any unnecessary cluster of paperwork.

(d) Improve decision making.

(e) Better information for management.

(f) Better and more information given to customers.

3.5.3 Breakeven Analysis

Breakeven analysis is a technique, which is used to find the period where accumulated cost of the current system is equal to accumulated cost of the new system. The point where they equal is called breakeven point. The comparison of the system costs between the computerized costs and the manual costs is shown in Table 3.13. Breakeven point between the current system and the proposed system is shown in Figure 3.3.

Table 3.13. Comparison Cost of the Existing System and the Proposed System.

Cost Items	Years				
	1	2	3	4	5
Existing system	853,500.00	1,753,800.00	2,714,380.00	3,741,268.00	4,841,094.80
Proposed system	980,120.00	1,759,740.00	2,593,810.00	3,487,775.00	4,447,624.50
Difference	-517,800.00	-187,660.00	195,170.00	635,959.00	1,140,503.00

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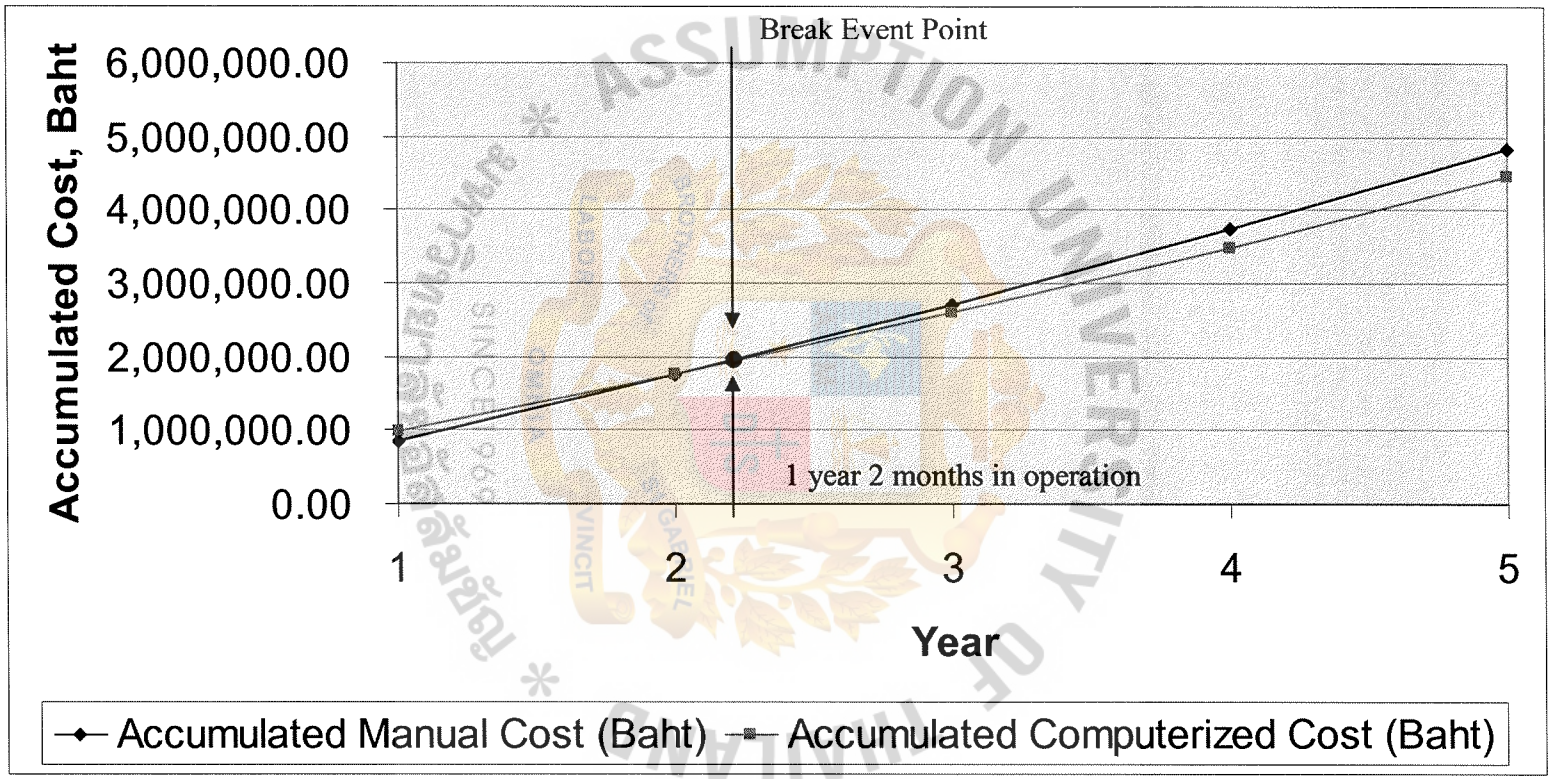

Figure 3.3. Break Even Analysis.

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3.5.4 Payback Period

Payback period is a simple and popular 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. Payback analysis determines how much time will lapse before accrued benefits overtake accrued and continuing costs. In other words, it measures how quickly the project will return its original investment, the maximum pay back period must be specified. The specified payback period is based on the management perspectives on size of investment, which is around three to five years.

Nevertheless, payback period is not accountable for time value of money concept that reflects the real value of investment. Thus, time value of money concept should apply in the payback period analysis. The discount rare must be specified for calculating discount value of all cash inflows and outflows at present year. It normally refers to interest rates of saving account or opportunity cost that investment amount in other project or would receive if the investment is not made.

For the proposed system, the desired payback period is assumed to be three years and the discount rate is 3.00% per annum as per the current deposit interest rate. The analysis results show that payback period of the proposed system is 2.1 years, thus its payback period is acceptable.

The detail calculation of payback period for each candidate solution is illustrated in Appendix E. The payback period of the proposed system is indicated in Figure 3.4.

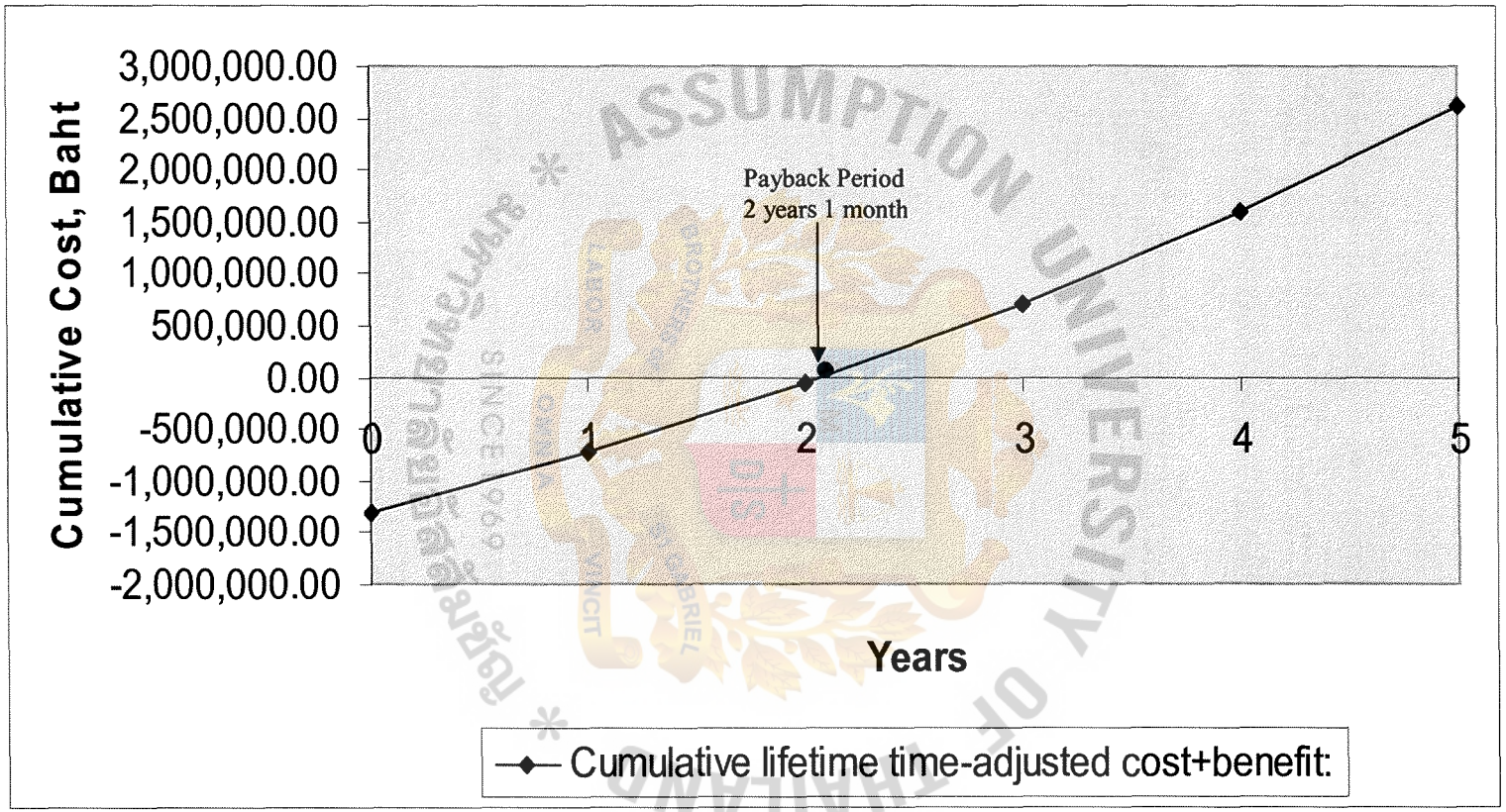

Figure 3.4. Payback Period.

3.5.5 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 form the system implementation.

With this technique, the discount rate must be set for calculating the present value of all cash flows in the project. The discount rate is the required rate of return on investment (ROI) that is a percentage rate to measure the relationship between the amount the business gets back from an investment and the amount interested.

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, the decision will be based on the net present value. Whichever alternative gives the highest net value, that alternative will be selected.

For the proposed system, the required rate of return is equal to current deposit interest rate or 3.00% per annum. The analysis indicates that net present values of all candidates are positive. But candidate 3 gives net present value of 2,627,809,20 baht, which is the highest value among all alternatives. The detailed calculation of net present value analysis for each candidate is shown in Appendix E.

3.6 Security Control

The existing system has problems of data inaccuracy and availability and data security, security control is needed for a new computerized system. Management has to realize the importance of information accuracy and secrecy so protection tools to prevent the system from unauthorized persons accessing in data and program are needed. The security control for the proposed system will be set up in the form of:-

3.6.1 Log-in Security

The system has the log-in interface to determine the right to access the program and data. It must have the unique user ID and administrative system ID. Only authorized users will have password to enter the program or database to read, update or edit the content and protect unauthorized users to access all programs and database. The user password must be changed every 6 months.

The user name, operation time and date will be kept in the file in order to be used audit trail for Systems Manager and Systems Administrator to have a control over the usage.

3.6.2 File Access Security.

This function is used in order to protect the data files and program from unintentional activity together with protection from the unauthorized person. The system must define the authorized level of all users based on the accessing area in advance according to the sensitivity of data and software. The user will be classified into several levels with different access authority as follows:-

Table 3.14. Access Authority Levels.

Level	Authorized Access	
	Program	Data
System Manager	All	All
System Administrator	All	All
Programmer	R/W/A	All
User	R/A	R/W/A

Where : R = Read W = Write

A = Access D = Delete

3.6.3 Auditing

The system must have an audit trail that records all transactions of each user. It is used for investigating unauthorized access and alteration in the system. It must be reviewed on a consistent basis by the authorized person.

3.7 Back-up and Recovery

3.7.1 Back-up process

Back-up process is one of the most important parts in computer processing because at the time that any malfunction or error occurs, the damaged part of information can be recovery. If there is no back-up, any damage cannot be recovered and may cause the loss of valuable corporate data.

For the Customer Service System, we prepared back-up process as follow:-

Daily Back-up

Everyday staff have to process batch at the end of the day, transaction data will be saved to tape before issuing daily reports. If some problems occur while processing, the damage will not be great. Staff can restore back-up data and process only changes or create new data.

Monthly Back-up

The staff have to save data like daily process and also as a monthly process, the additional part is master file back-up. The reason why master file is saved at the end of the month is because master files have a new change between months and once a month is enough.

3.7.2 Recovery planning

If information is damaged, the staff have to restore the back-up data file from back-up tape or master file to computer and reprocessing, after that users can continue processing without any problem.

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IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

An implementation plan has been designed for the customer service system to help developing a system. Implementing this computerized system consists of 5 processes:-

(1) Prepare conversion plan

(2) Install database

(3) Train system users

(4) Convert to new system

(5) Post-implementation review

During conversion time, the system has to be carefully planned and executed. It describes all activities that are needed for developing the new system and converts it into daily operation by using the design specifications for the new system. While the system is installed, the system need fully populated the new systems databases with existing data from the old system. System users are necessary to be in training and a user manual is also provided in order to be a guide for them to manage the system. After the completion of system implementation, the system utilization should be evaluated. It helps defining if the system is working accurately. The tools for evaluating the system may be in the form of questionnaires, conversation and surveys. The review not only values how well the system is designed but also estimates effective resource allocation.

4.2 Test Plan

System testing occurs after the installation, when all hardware, software and computer facilities have been tested. The system sets to be a main process to operate customer service activities by user, including the test of database management and system analysis capability.

First, programmers test the system while developing. After the system development is complete, testing and modification needs to be done to ensure that it would operate properly. The database has also been tested with the existing data. The system users will then test the system and determine if the test provides good results. If the result is good, then it proves that the system is developed in a right way but if not, we need testing and modification by the programmers once again until it achieves a good result.

4.3 User Training and Documentation

Before the proposed system is fully implemented, the training package and documentation must be prepared for users and system administrators. Any useful document must be collected for using as reference in preparing the user manual.

The user manual must clearly identify how to use the proposed system in the work areas. In addition, all system features must be described for system administrators for them to be able to configure it correctly.

Users are the important judges of the quality of the system. Whether the users are satisfied with the system is a sign of system evaluation. Training for users is to make them understand and be more familiar with the new system and also provide documentation that guides them through using the new system. Training plans are as follows:-

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(1) System objectives

(2) Overview of existing system and current problems

(3) Overview of the proposed system

(4) Comparison of existing and proposed system

(5) System training

(6) User's question solutions

4.4 Conversion

The changing from the existing manual system to the proposed computerized system is a sophisticated job. Computers are installed in the form of network that has been designed beforehand. The system is implemented by using these following steps:-

(1) Install all hardware and software components and build system network as the network configuration.

(2) Identify data and create new database files needed for the new system.

(3) Design all input, outputs and interfaces for the system depending on the user and system requirements.

(4) Determine responsibilities and control in the conversion processes.

(5) Verify the new system.

It is not only the completeness of the project development that makes the conversion into computerized system become successful, but also the co-ordination of the staff between departments as well as the staff between each division. Many projects fail because their staff (both below and middle level) does not understand the changes. So, in this project, the management makes recommendations or makes their staff understand the need of the system and realize the importance of information. Besides, they should point out the benefits that the company will get from the new system. Another important thing is to make them understand clearly that they do not lose their

power or importance. The preparation of some basic knowledge of computers is recommended too. There should be some training course to enable their staffs to operate the new system. Any useful document must be collected for using as reference in preparing the user manual.

For the new system implementation, the proposed system should be operated parallelly with the existing system. This is done to ensure that all major problems in the proposed system have been discovered and solved before the existing system is discarded. The operational results should be checked weekly and monthly so that unexpected problems can be corrected in time. Thus, the company can improve its service functions into full scale computerized system, utilizing the database, provide better reports and provide accurate information to customer such as screen interface which makes users to input the raw data easily.

4.5 System Support

Once the proposed system is launched, ongoing maintenance of the system needs to be done. The four major areas of system support are as follows:-

(1) System Maintenance

It aims to fix the errors that occur during the system design and implementation phase. It also tries to avoid the possibilities that program fix causes the system to behave differently. Therefore, testing must be done to ensure that program fix will not adversely affect the system operation.

Testing is the same as in system implementation stage. However another test, regression test, should be done. It extrapolates program correction impact, throughput and the response time from before and after results using the test data and current performance.

(2) System Recovery

As system failure is inevitable, it generally results in system crash and possible loss of data. Thus, a recovery plan must be specified to identify the roles and responsibilities of each unit in recovering the system.

(3) End-User Assistance

Although the training session has been conducted, users still need assistance in day-to-day operations of the system. It includes observing the system usage, conduct user satisfaction survey, change procedures, provide additional training, etc.

(4) System Enhancement

After the system is implemented for some time, it should be adapted to the present situation. The objective is to modify the proposed system to respond to the new requirements, technology and maintenance costs.

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V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The efficiency of the performance of Customer Service System in Unity Progress Company is significant. There are a lot of problems confronted when using the existing manual system which relies on the paper system, such as, the confusion and mistakes that happen between the customers and the customer service department of the company. The confusion is caused by an unavailability of necessary information when needed and also by inaccurate information retrieved from the database which causes overall effects on the performance of the department, the company and especially the satisfaction of the customer. Therefore, the full computerized system is designed and developed in order to solve these problems, achieve the objectives and reduce manual work. The computerized system will create and manage the database. Moreover, the new system will get rid of the problems mentioned above and improve the entire performance to create better work environment and then more efficiency of work will flow.

The new computerized system is called "Customer Service System" for Unity Progress Company". The proposed computerized system contains processes that are designed to operate on company work process and to achieve the objectives of this proposed system. Moreover, the proposed system can reduce the duplication in many processes and many reports can provide valuable information for management. The system also provides security and control, which will control the security of the system by allowing only authorized users to access and work on the system. The implementation plan of the system contains system conversion, user training and post implementation review.

Table 5.1. Shows the time spent on each process of the proposed system compared to the manual existing system.

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

Process	Existing System	Proposed System
Data Entry (per customer)	30 Minutes	5 Minutes
Job Status Checking	30 Minutes	5 Minutes
Warraty checking	30 Minutes	10 Minutes
Report Generation	1 Hour	10 Minutes

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

(1) Data Entry: The existing system spends 30 minutes to input the customer and product data into MS Excel. In contrast, the proposed system provides the graphical user interface to ease the input process of customer and product data through job order form.

(2) Job Status Checking: In the existing, the customer service spends too much time in searching the job status in hard copy document. The proposed system will provide the job order transaction in the report form. This process make the customer get satisfaction.

(3) Warranty checking: The existing system is takes to much time around 30 minutes to check the warranty of the product in the MS Excel. On the other hand, the computerized system reduces time to search product information in the report form.

(4) Report Generation: The existing system uses MS Excel to prepare the report and distributes to the relevant departments. It consumes too much time to finish the report because the data must be rearranged into predefined format, and the result must be checked with the raw data before printing the report. The process can be improved through the report generation feature embedded in the proposed system. The report can be selected and generated automatically according to user requirement.

5.2 Recommendations

Above those mentioned, beside the new system will have many more recommendations for future that we cannot overlook. This proposed system is the first step in converting to the computerized system. The developed system may be expanded to support the related process such as issuing Sales Order, Purchase Order and Inventory input and output, etc.

In the future, the company looks forward to implementing the computerized system on the internet where everyone can access to the company from anywhere. Therefore, the proposed system should be developed in the near future. A company web site will create more communication and act as a channel between the company customers and suppliers, which will lead, to more profits and success of the company.

APPENDIX A

DATA FLOW DIAGRAMS

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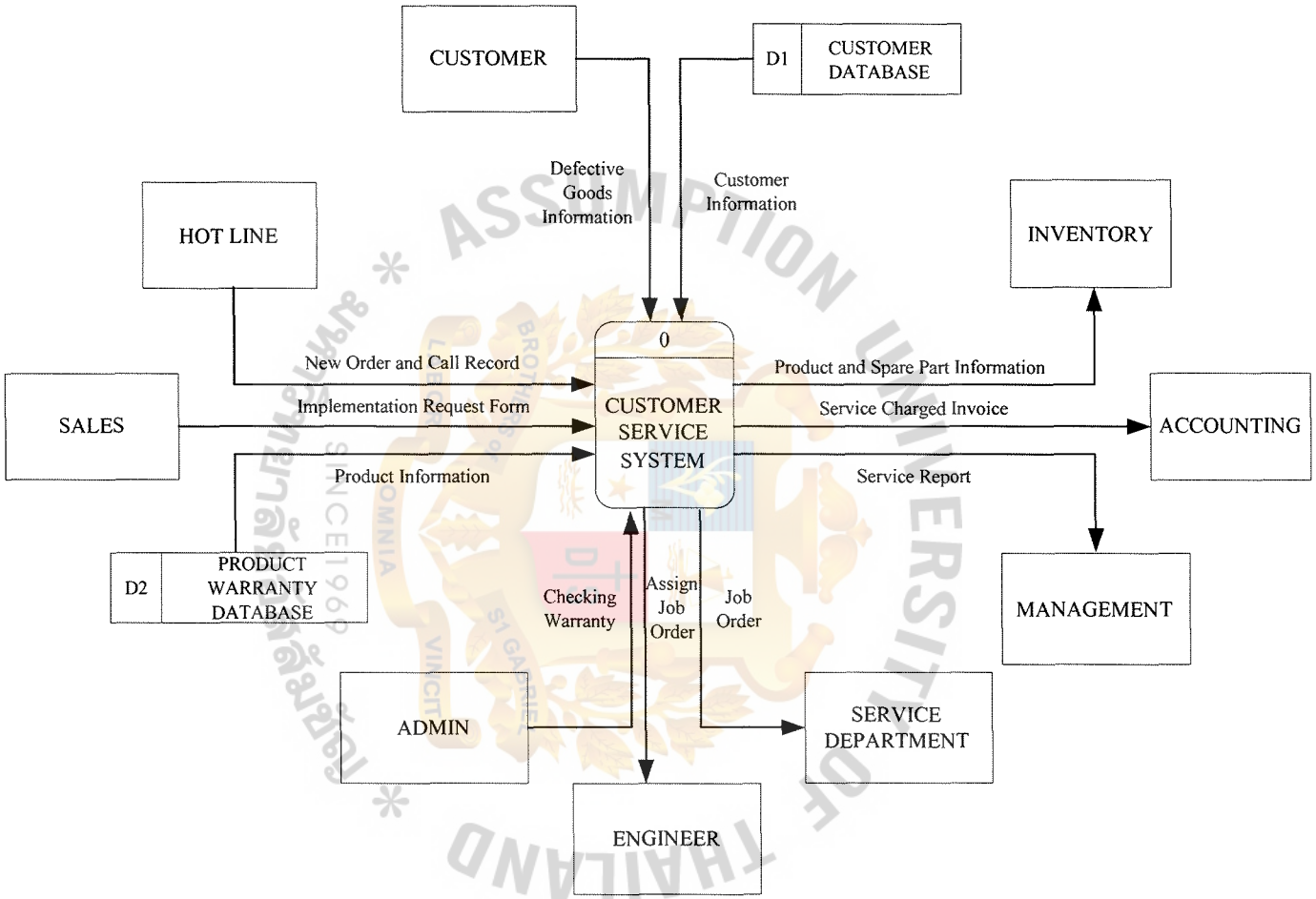

Figure A.1. Customer Service System.

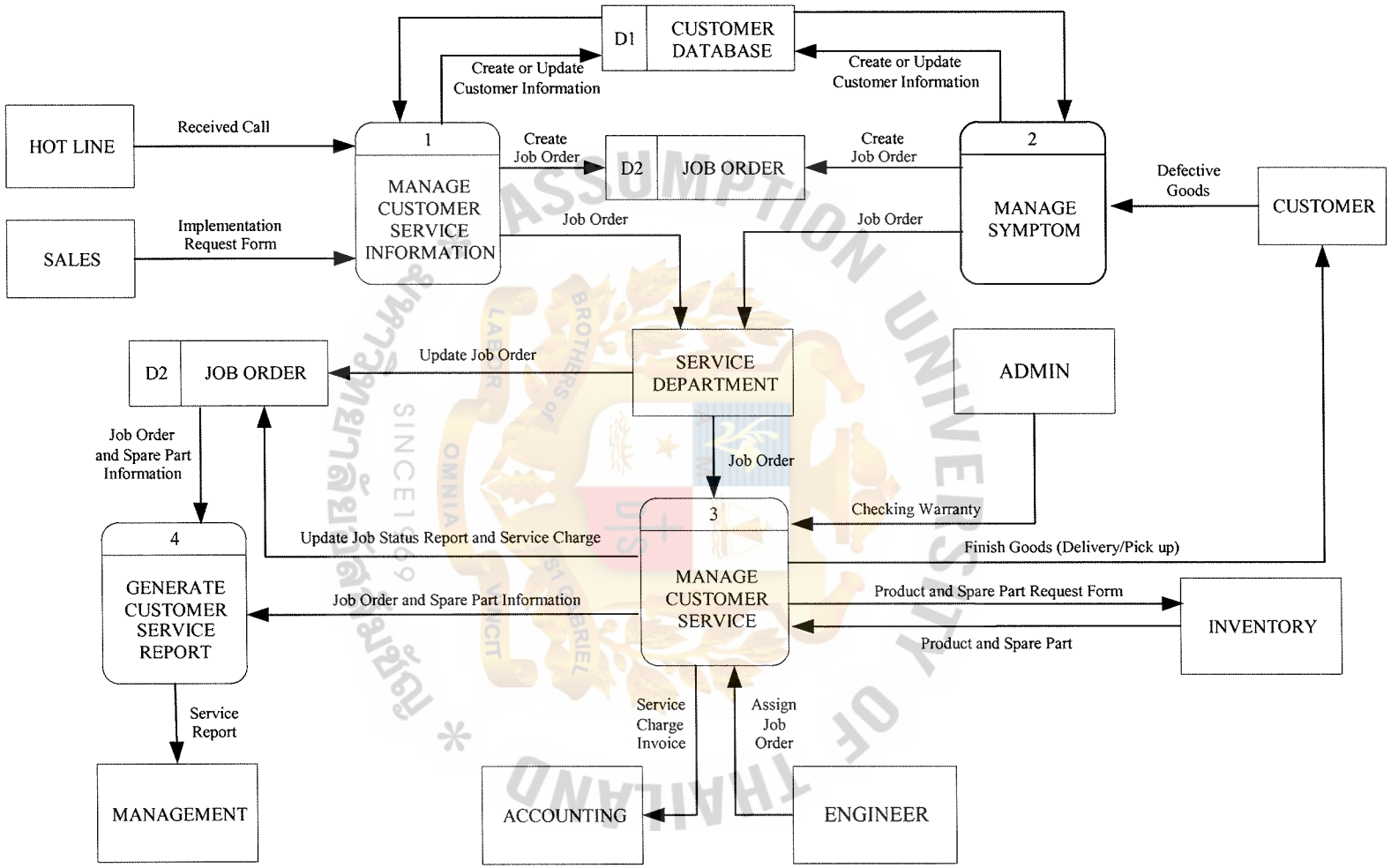

Figure A.2. Level 0 Data Flow Diagram of Customer Service System.

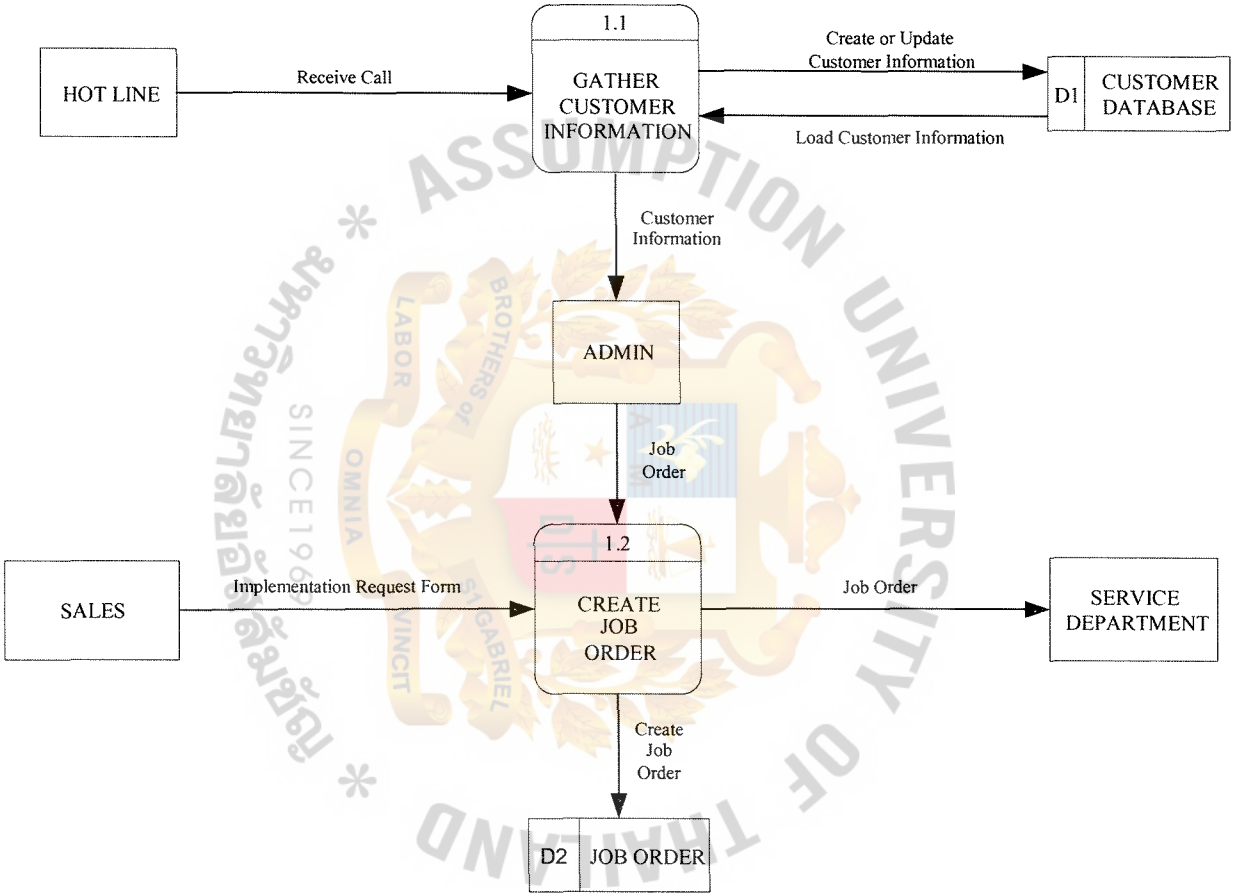

Figure A.3. Level 1 Data Flow Diagram of Manage Customer Service Information.

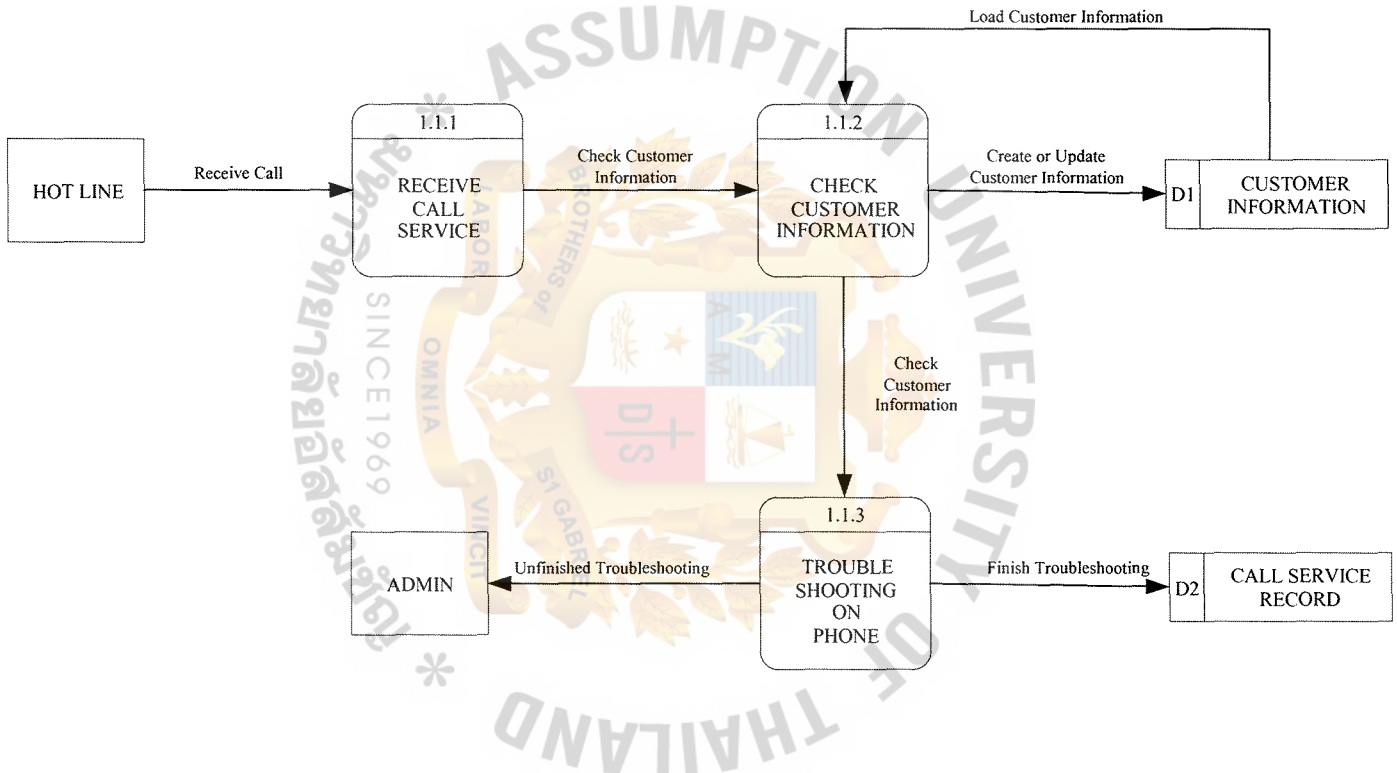

Figure A.4. Level 2 Data Flow Diagram of Gather Customer Information.

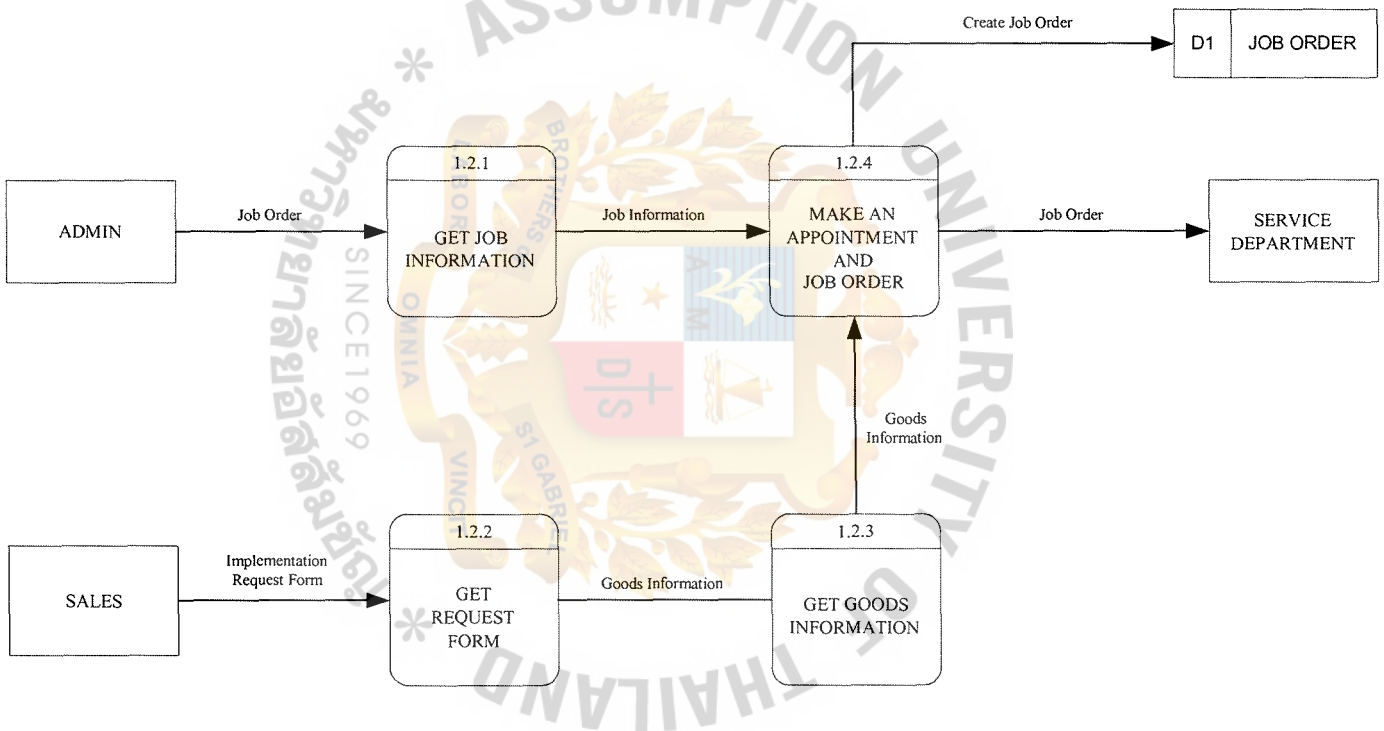

Figure A.5. Level 2 Data Flow Diagram of Create Job Assignment.

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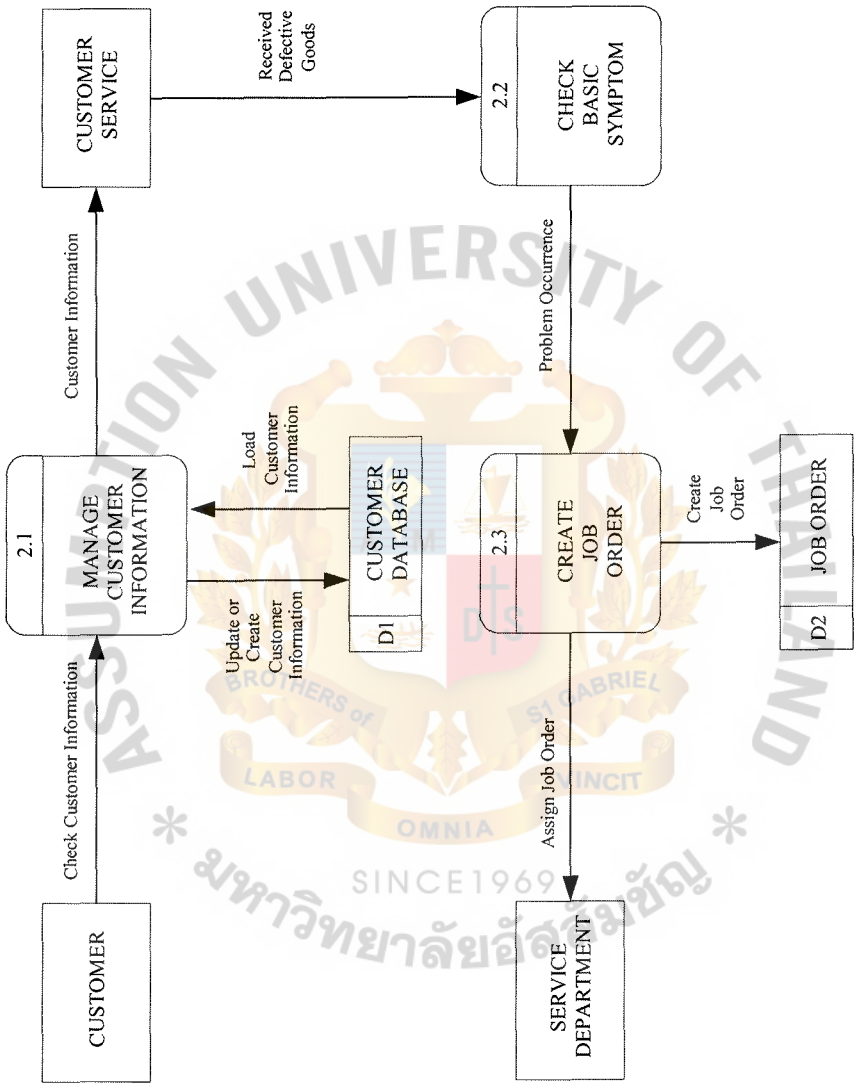

Figure A.6. Level 1 Data Flow Diagram of Manage Symptom.

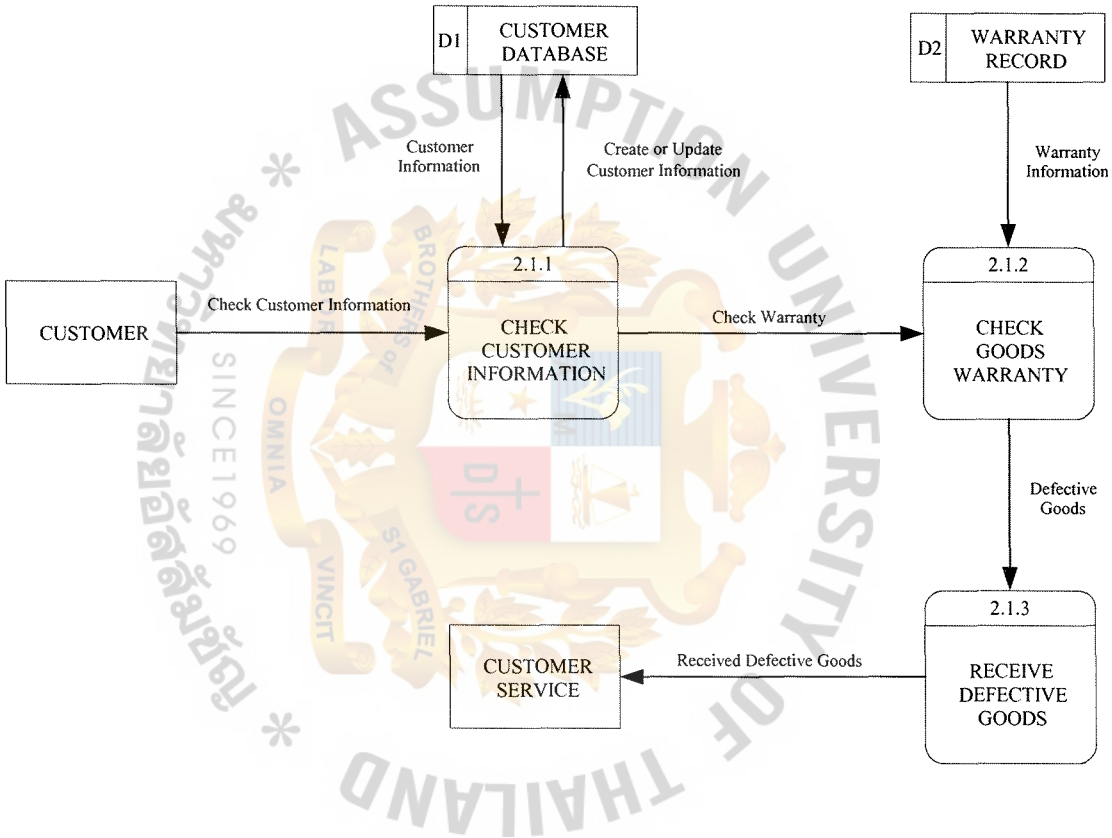

Figure A.7. Level 2 Data Flow Diagram of Manage Customer Information.

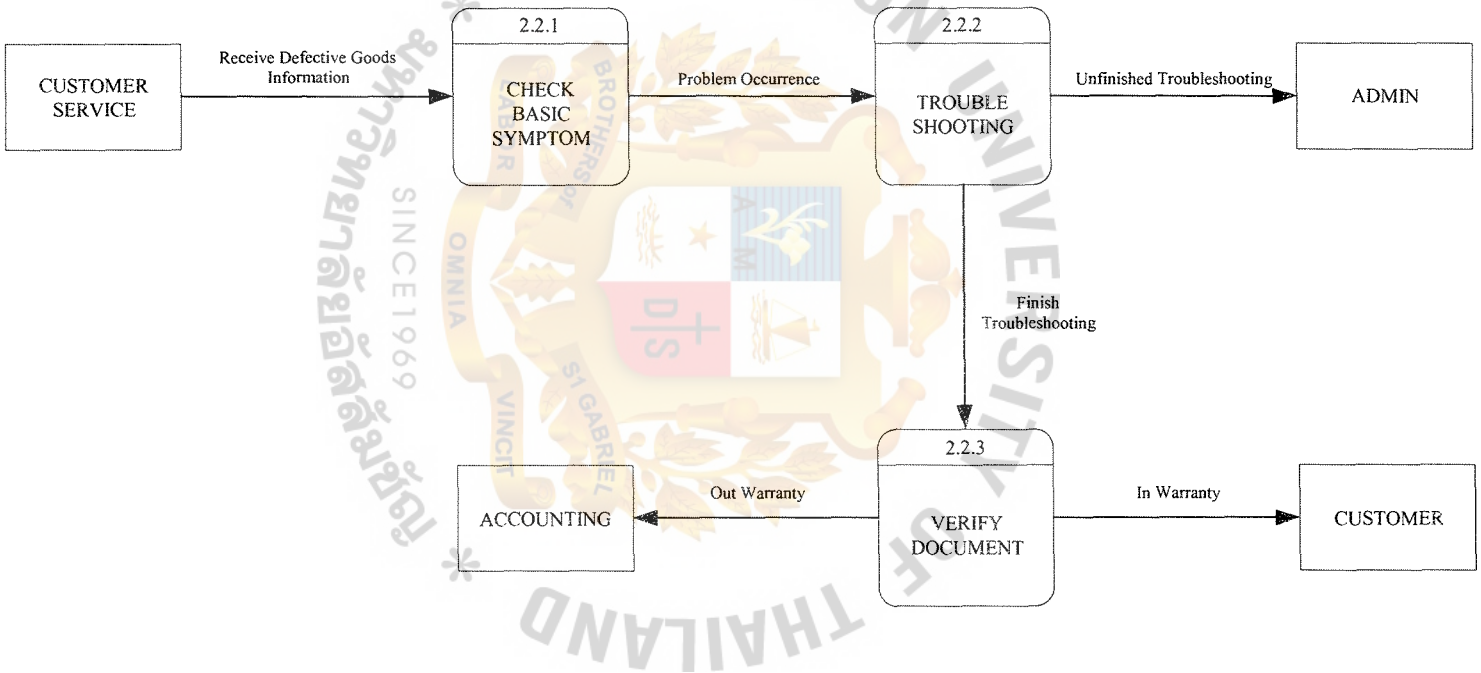

Figure A.8. Level 2 Data Flow Diagram of Check Basic Symptom.

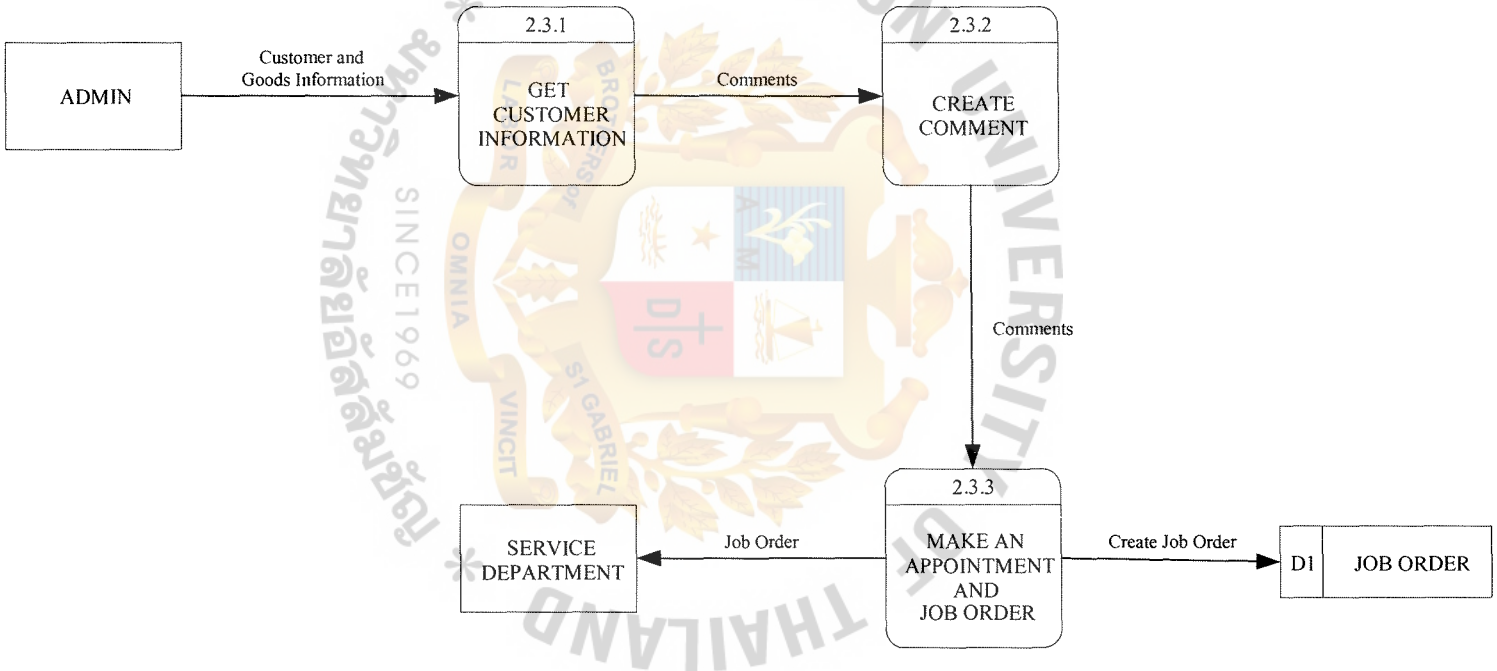

Figure A.9. Level 2 Data Flow Diagram of Create Job Order.

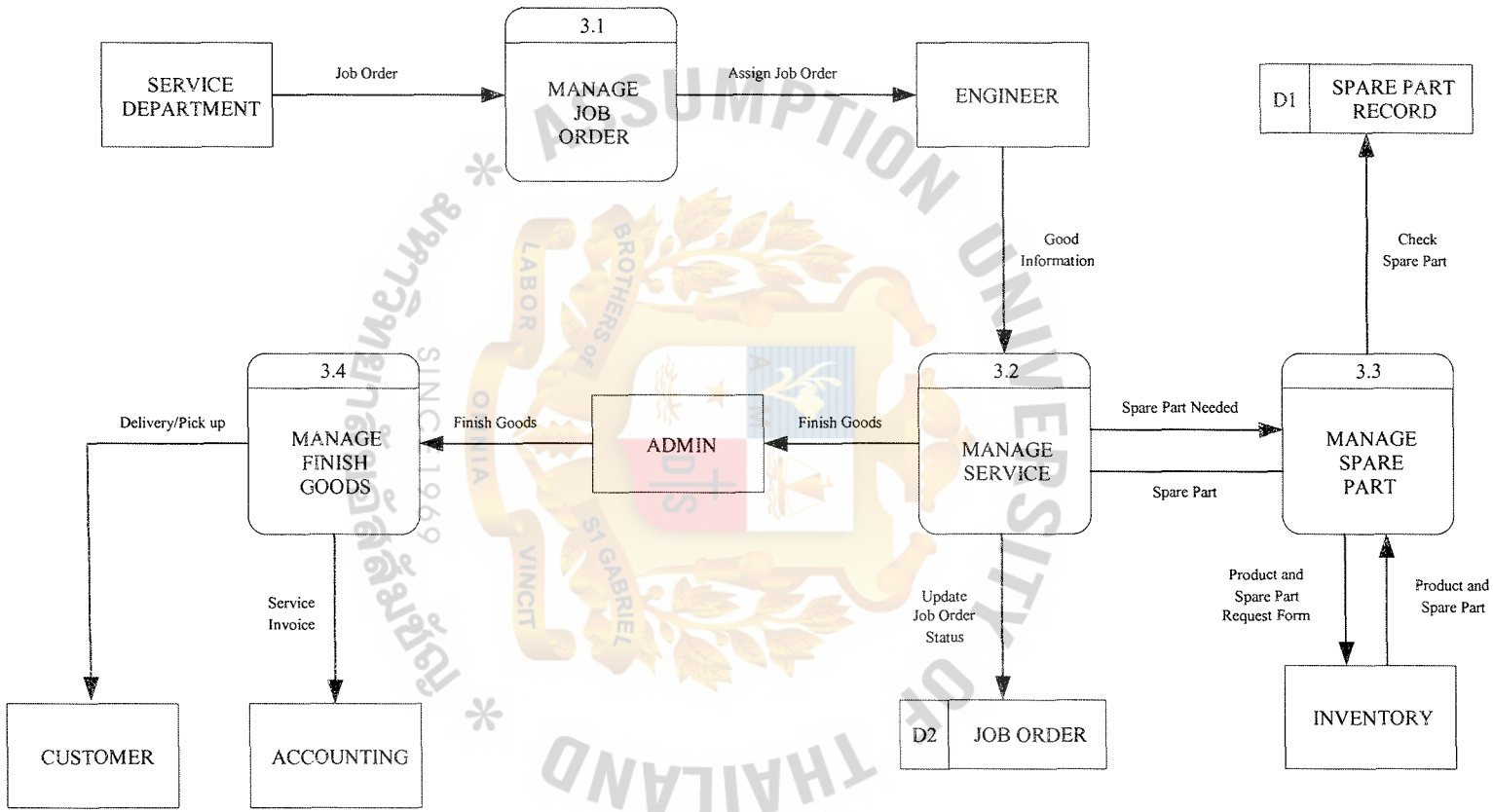

Figure A.10. Level 1 Data Flow Diagram of Manage Customer Service.

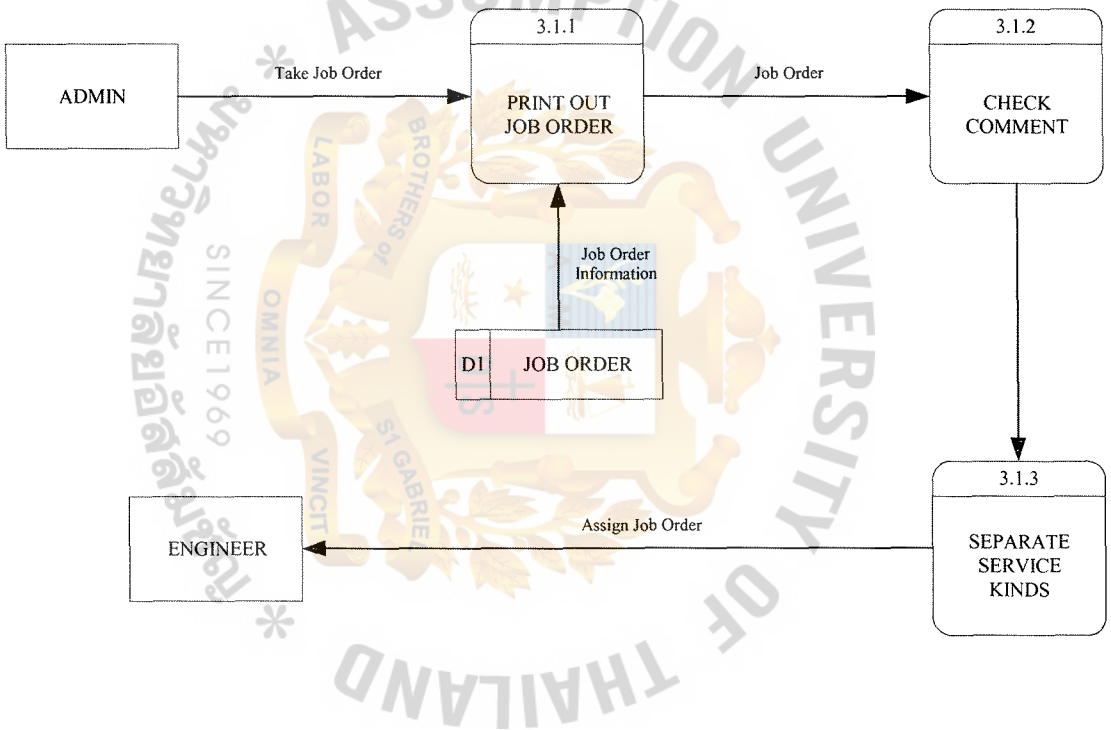

Figure A.11. Level 2 Data Flow Diagram of Manage Job Order.

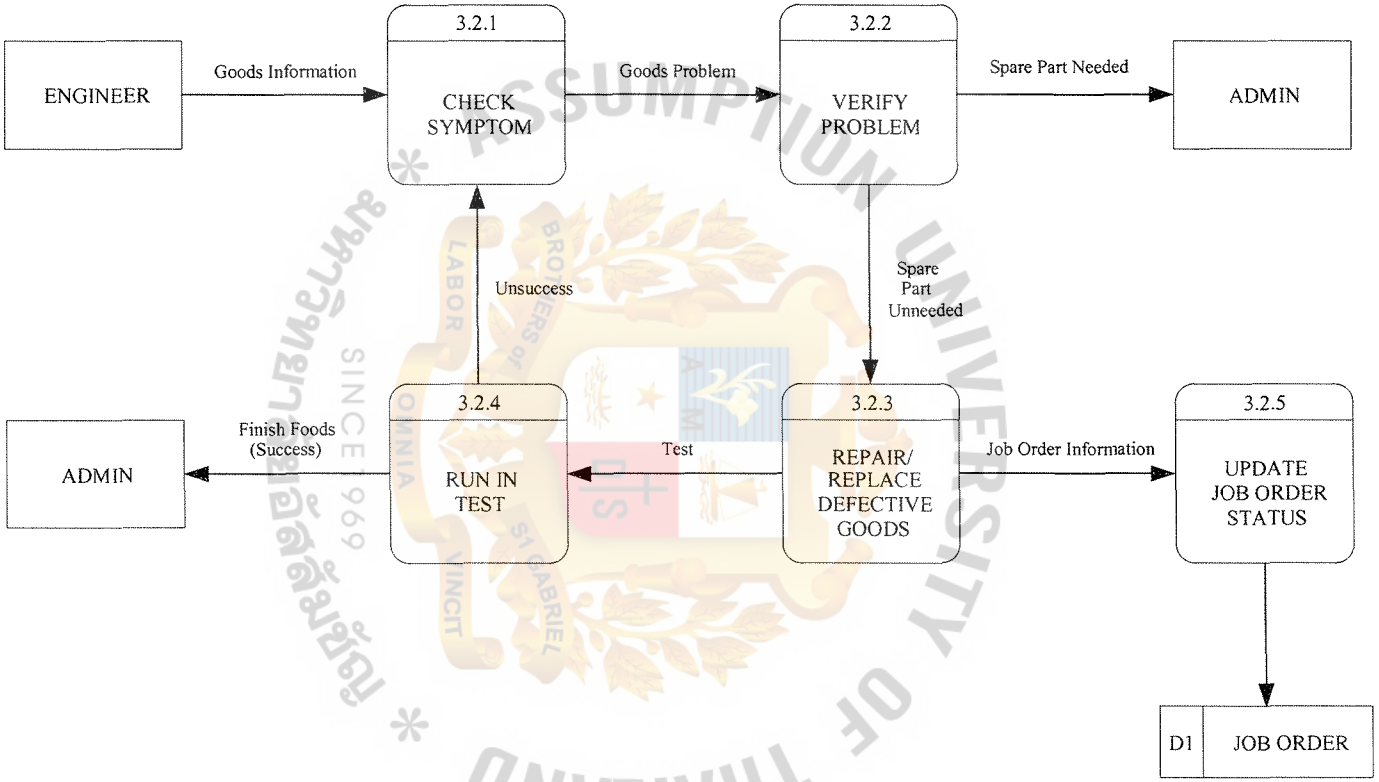

Figure A.12. Level 2 Data Flow Diagram of Manage Service.

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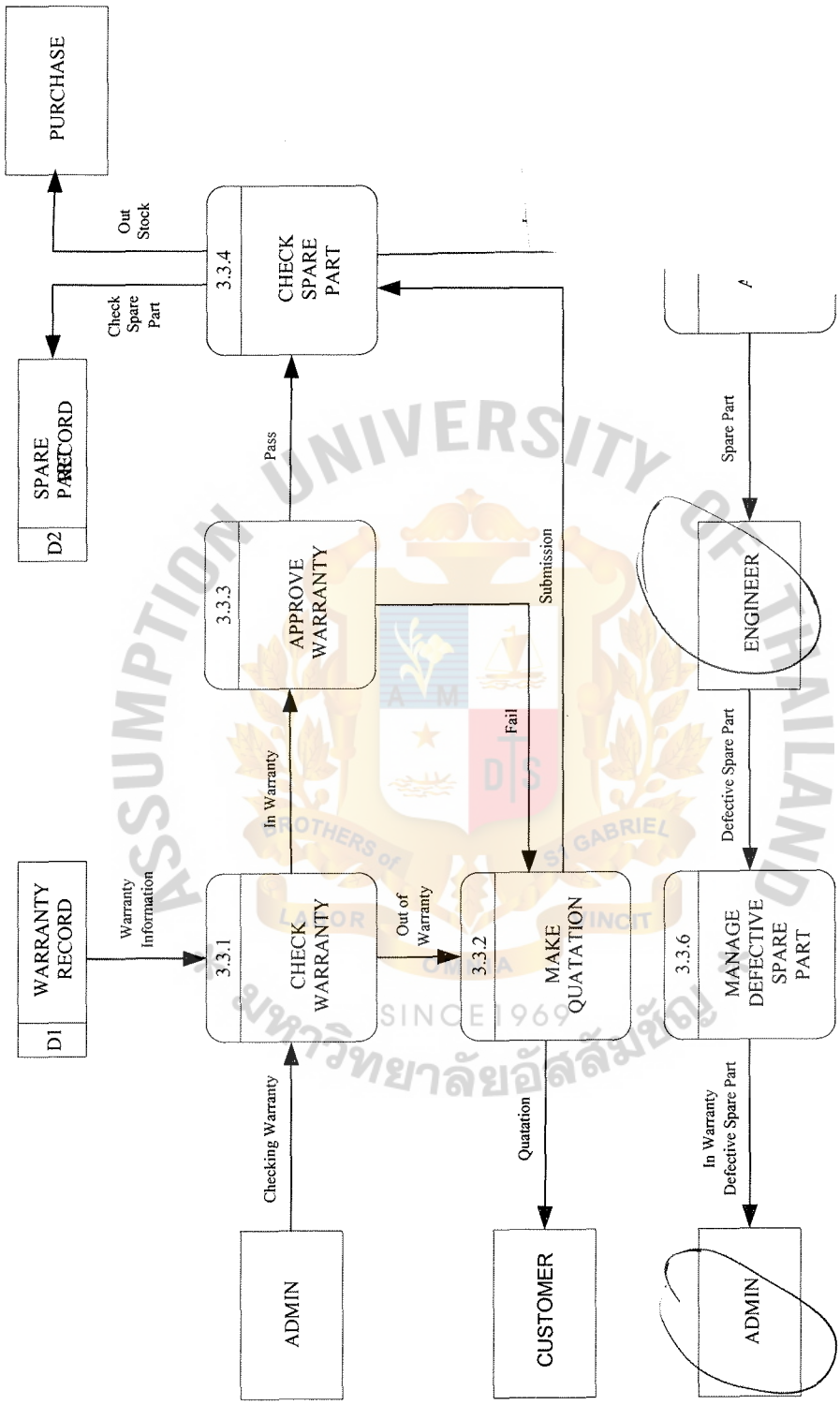

Figure A.13. Level 2 Data Flow Diagram of Manage Spare I

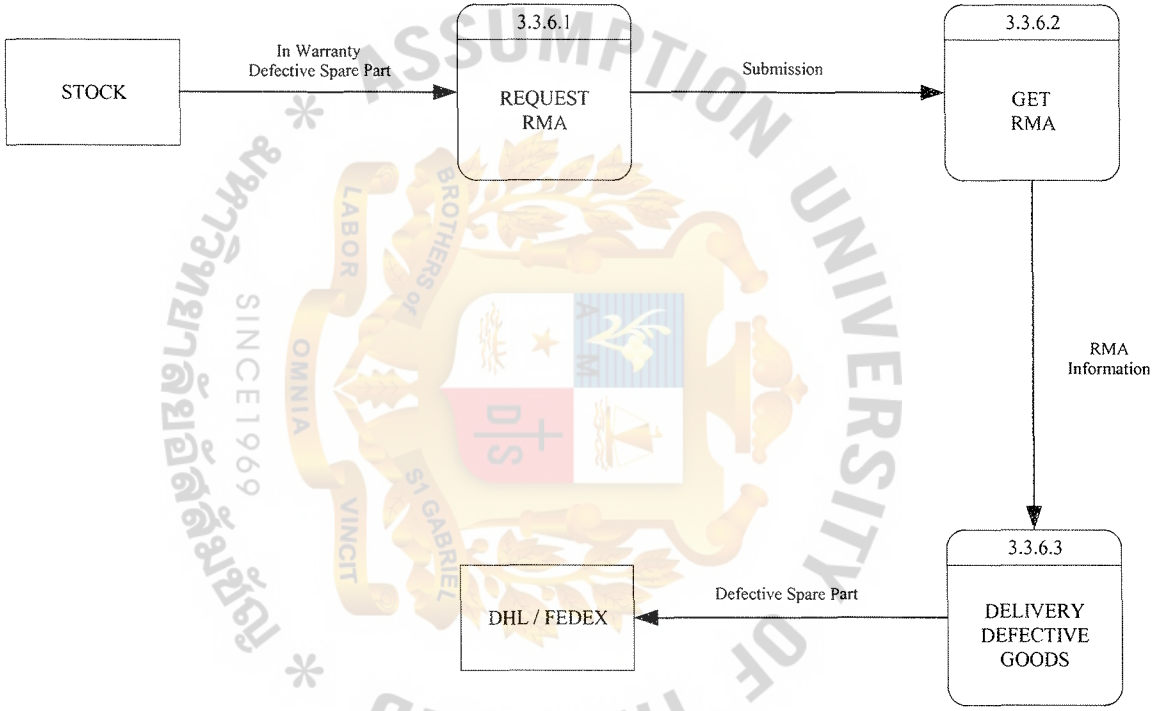

Figure A.14. Level 3 Data Flow Diagram of Manage Defective Spare Part.

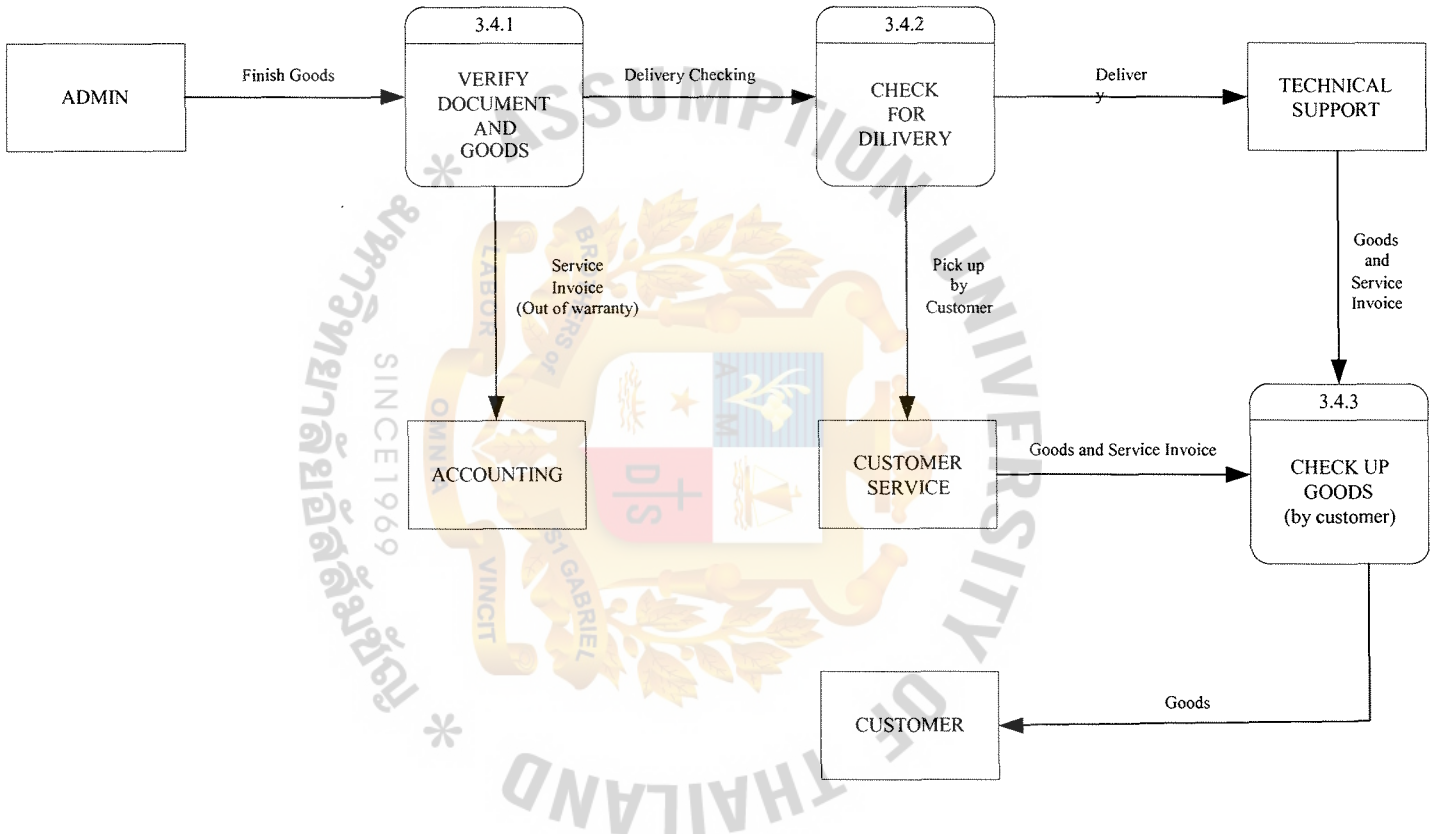

Figure A.15. Level 2 Data Flow Diagram of Manage Finish Goods.

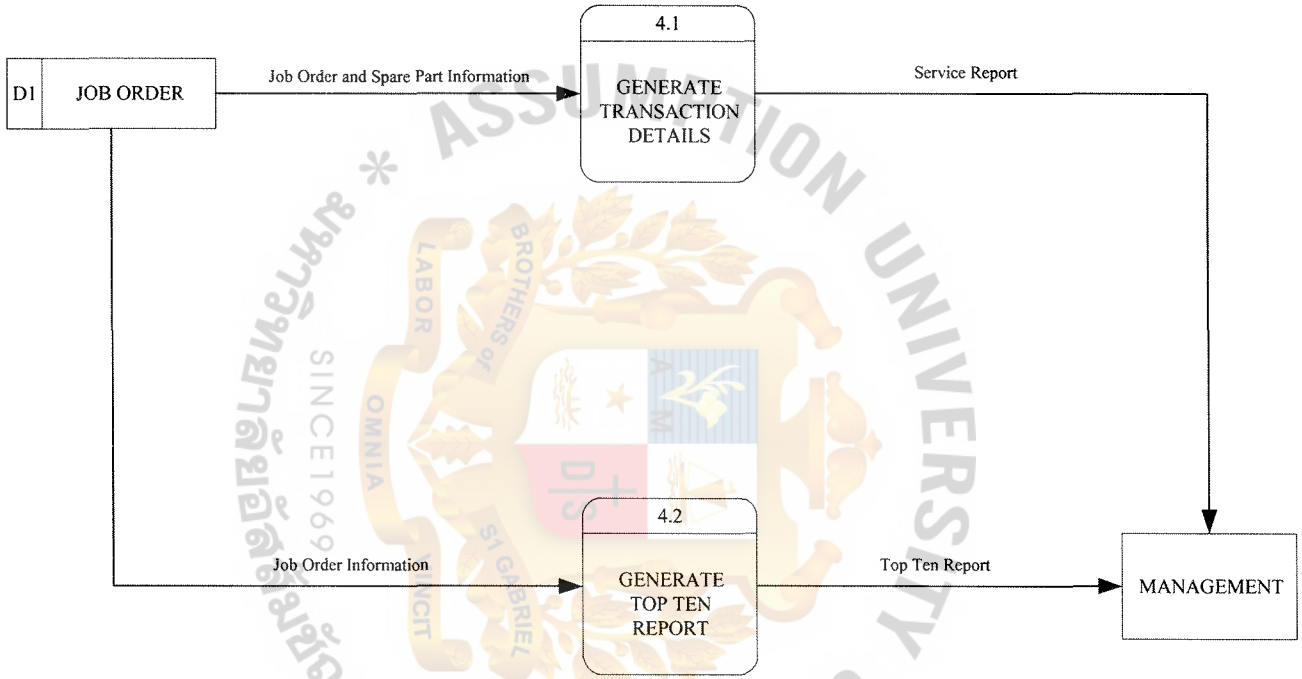

Figure A.16. Level 1 Data Flow Diagram of Generate Customer Service Report.

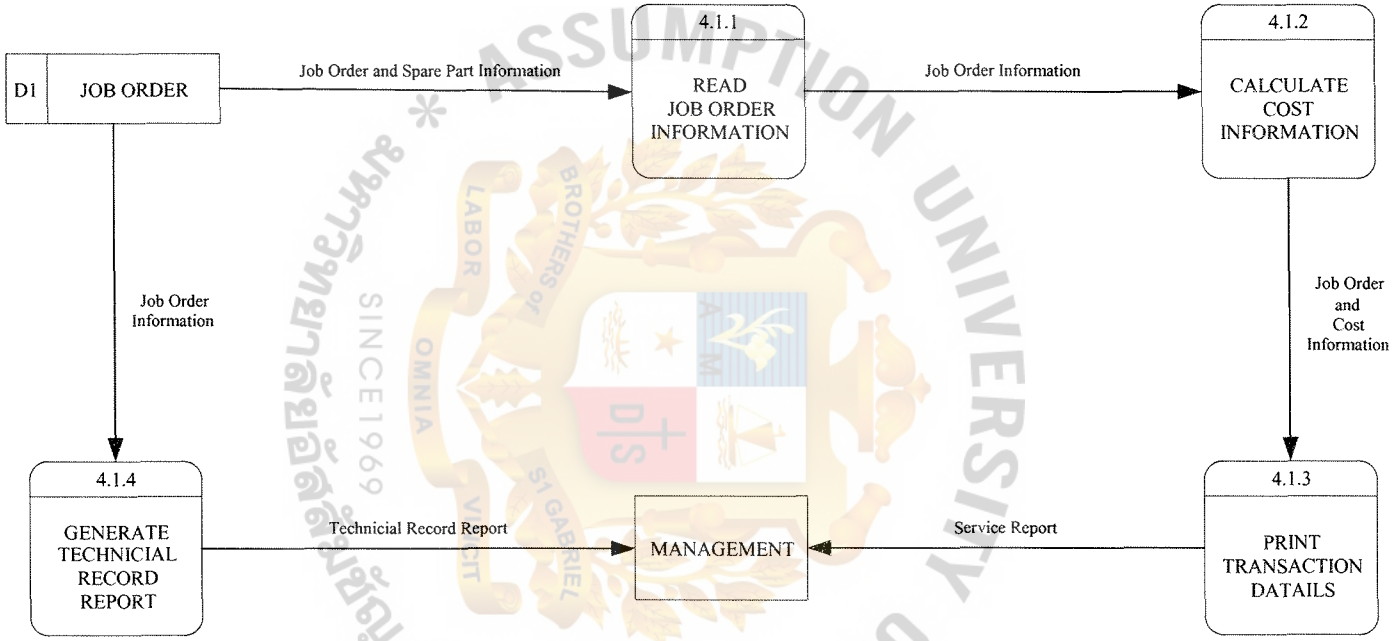

Figure A.17. Level 2 Data Flow Diagram of Generate Transaction Details.

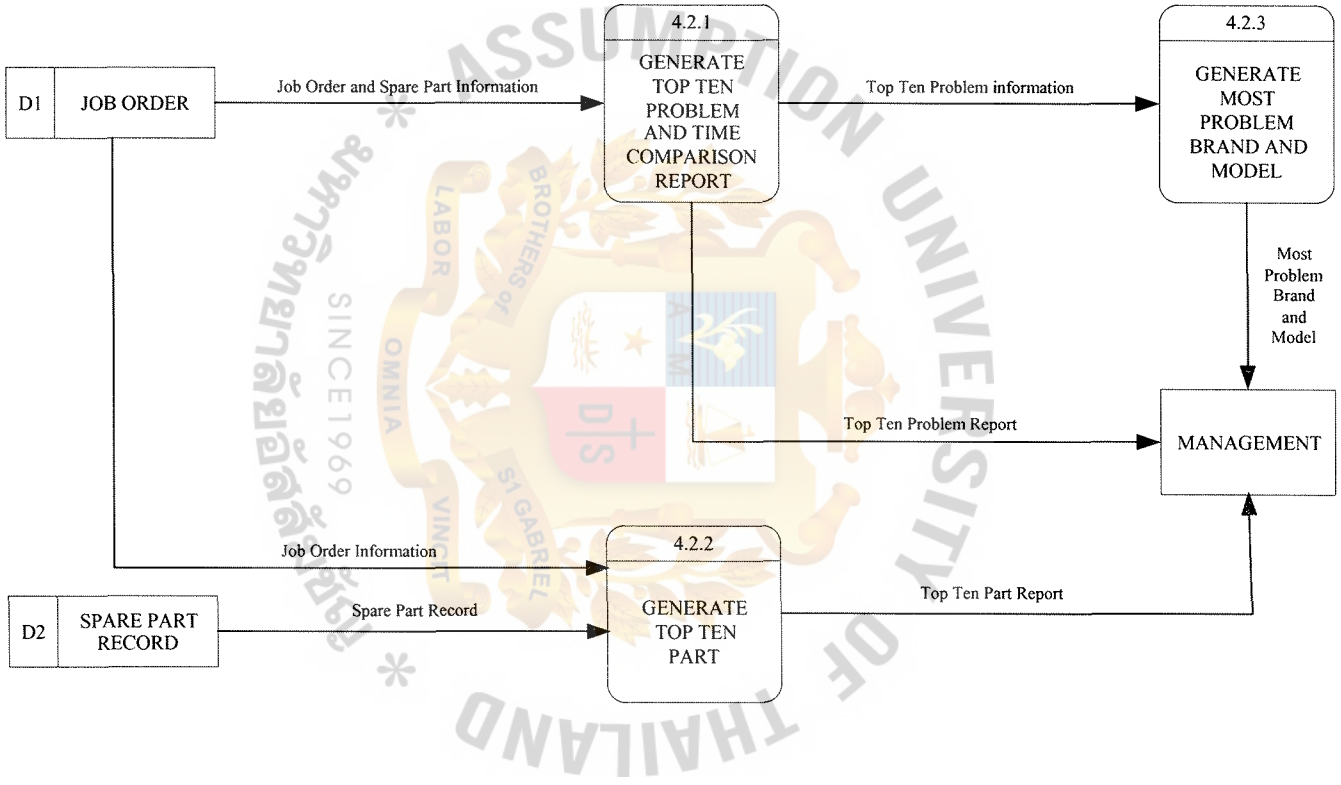

Figure A.18. Level 2 Data Flow Diagram of Generate Top Ten Report.

APPENDIX B

STRUCTURE CHARTS

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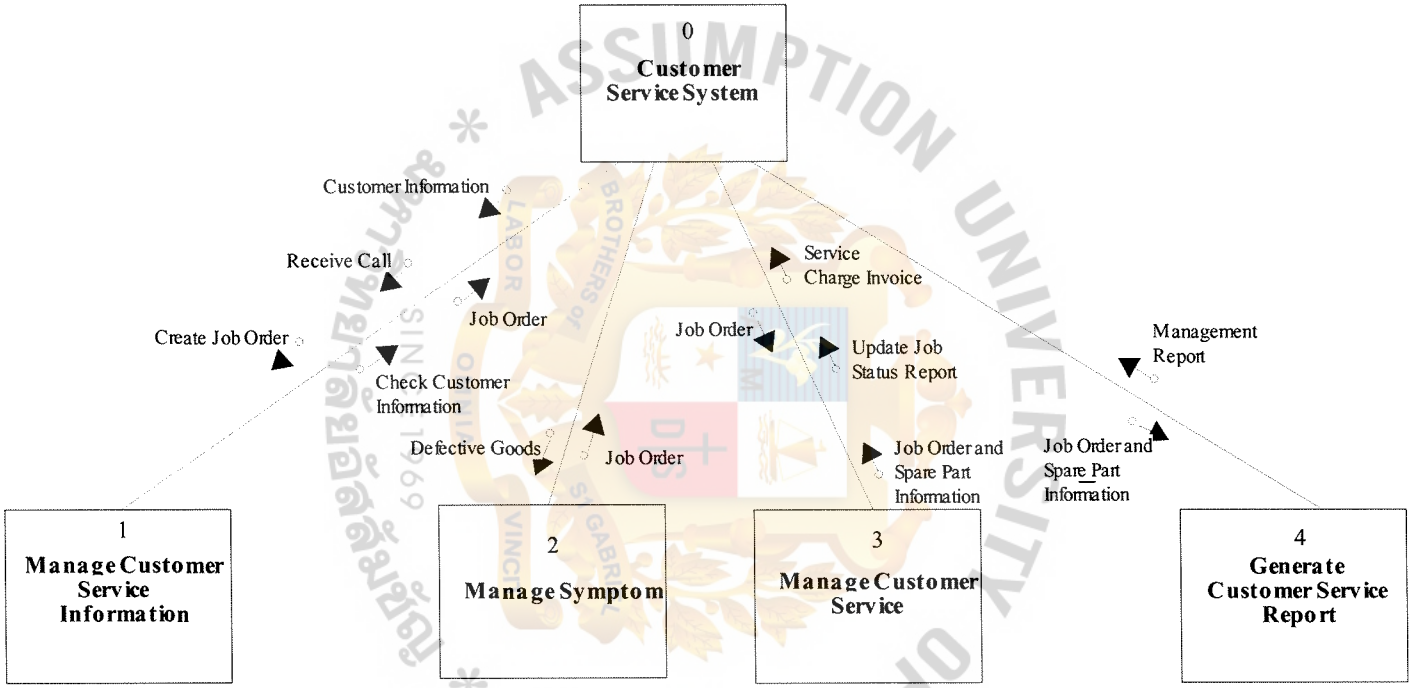

Figure B.1. Structure Chart of Customer Service System.

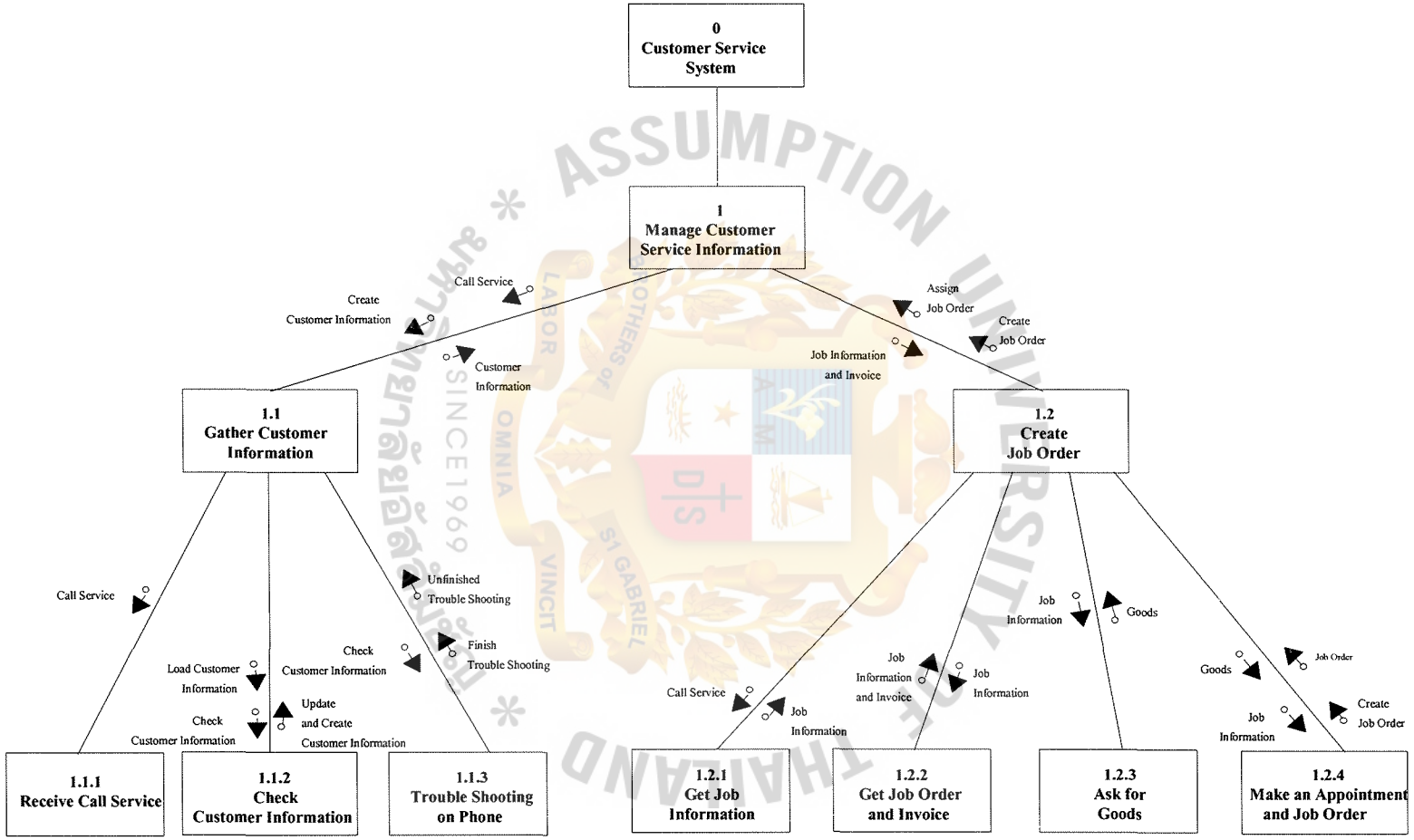

Figure B.2. Structure Chart of Manage Customer Service Information.

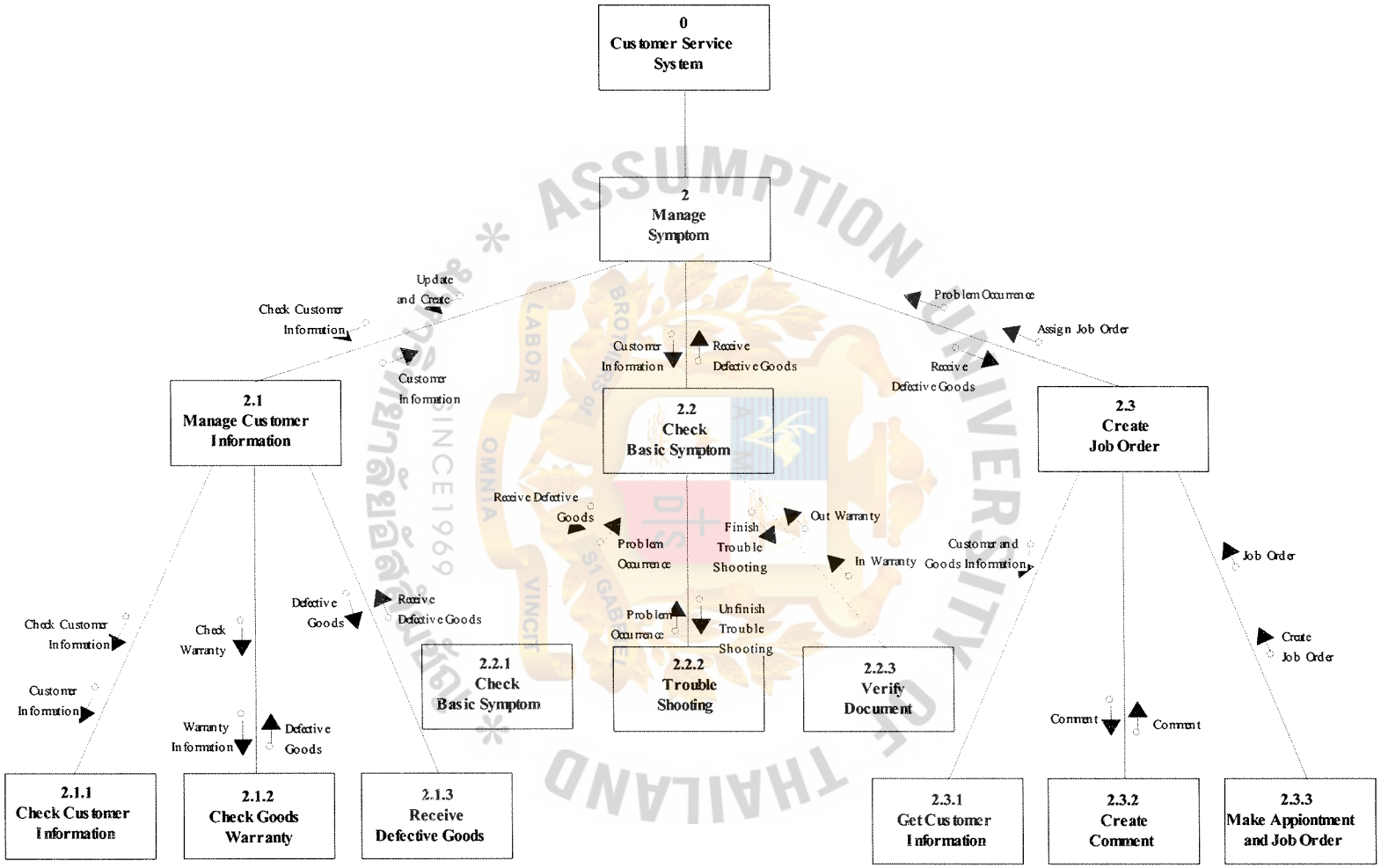

Figure B.3. Structure Chart of Manage Symptom.

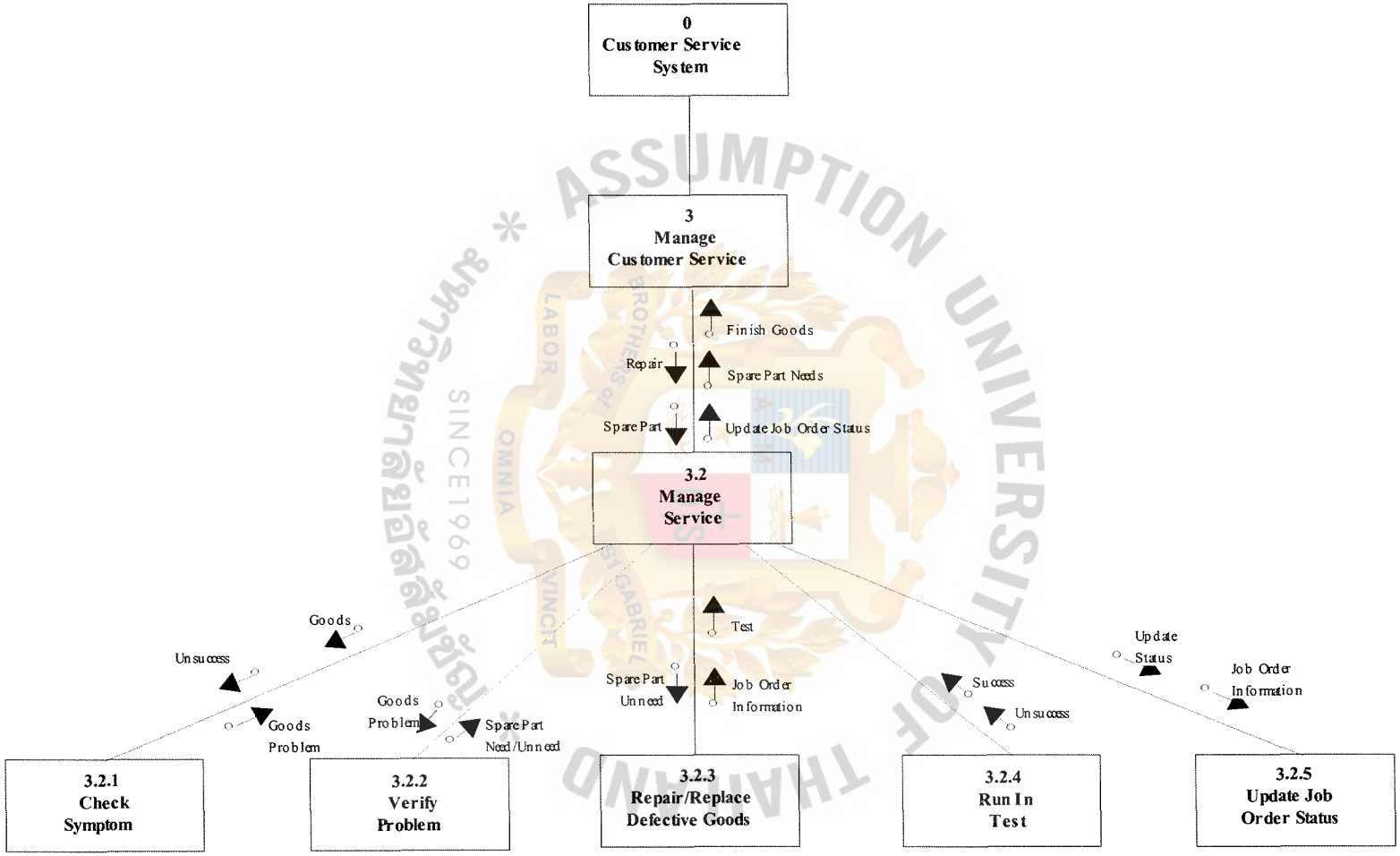

Figure B.4. Structure Chart of Manage Customer Service. (Manage Service)

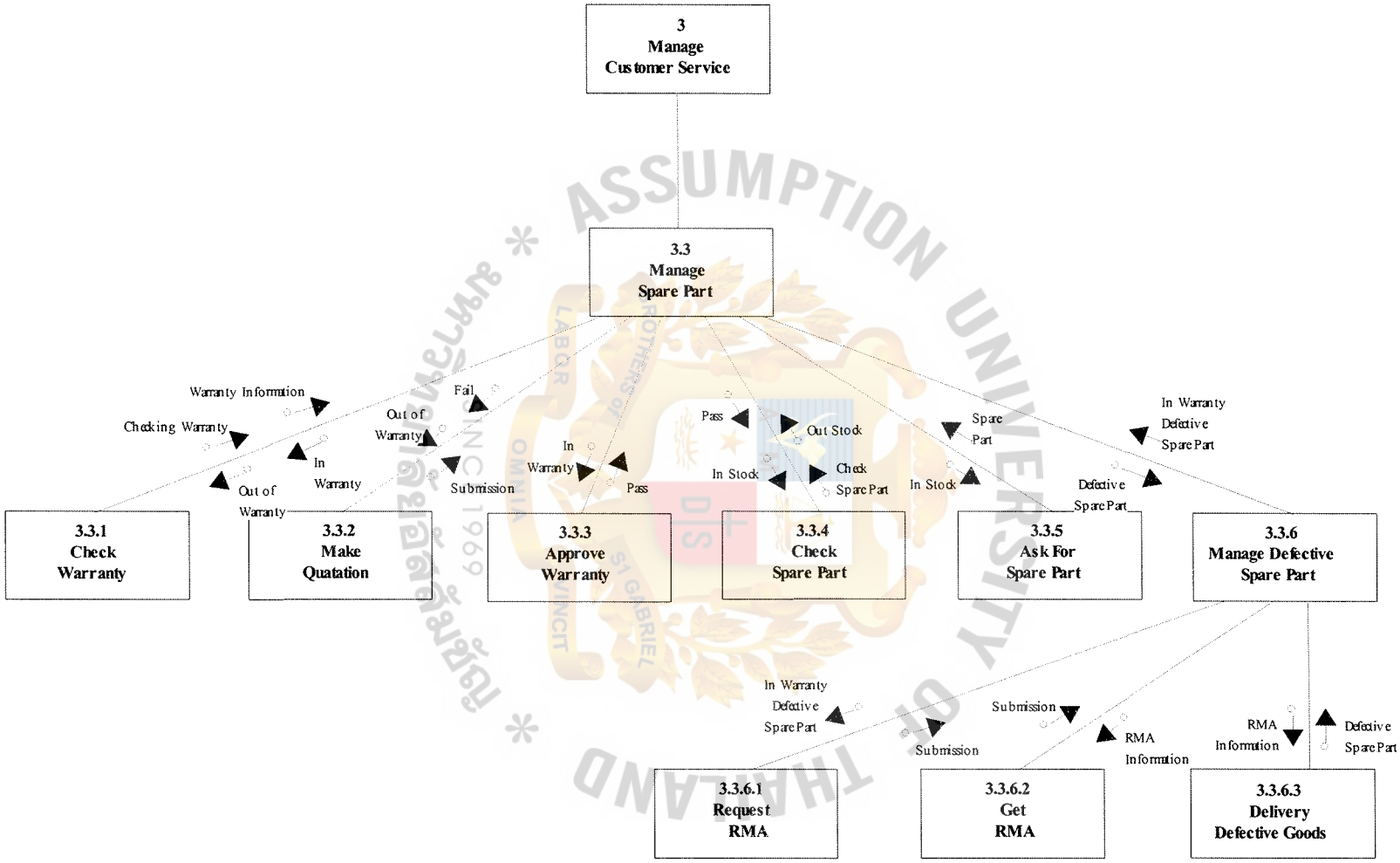

Figure B.5. Structure Chart of Manage Customer Service. (Manage Spare Part)

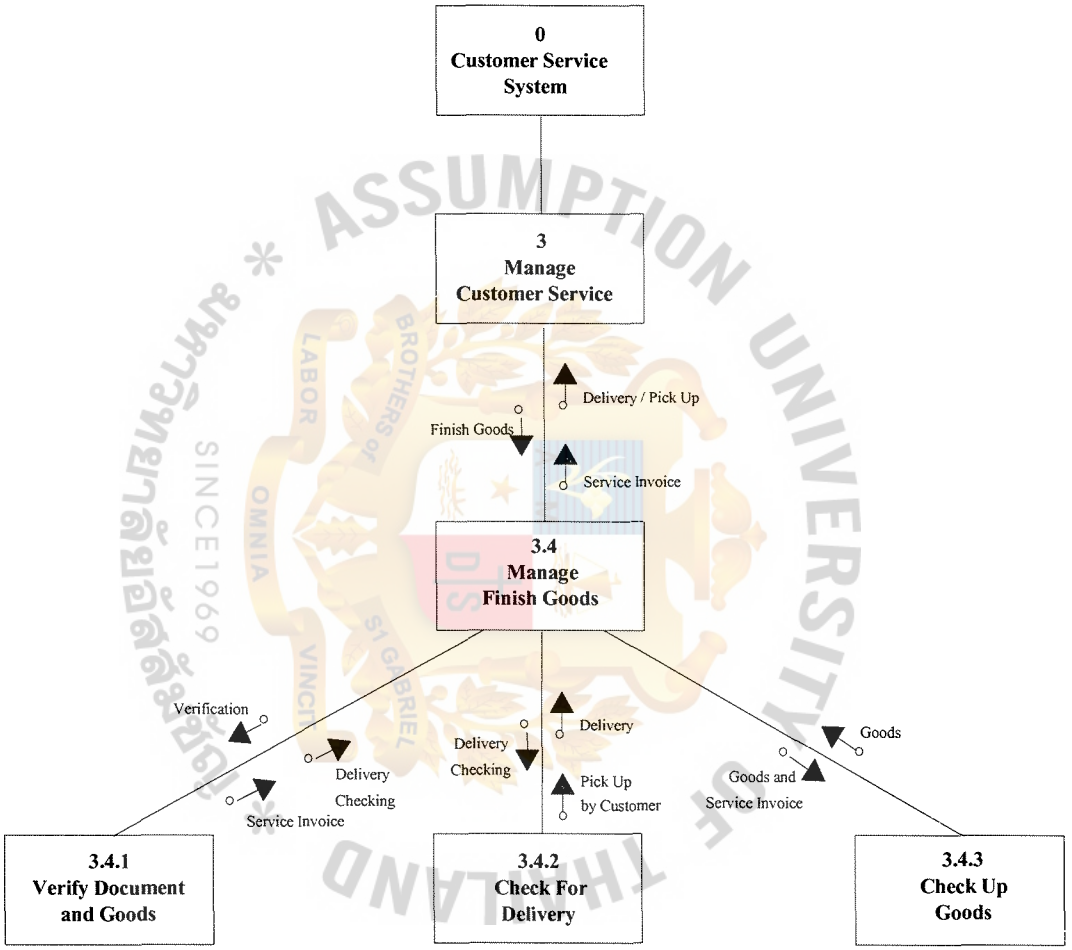

Figure B.6. Structure Chart of Manage Customer Service. (Manage Finish Goods)

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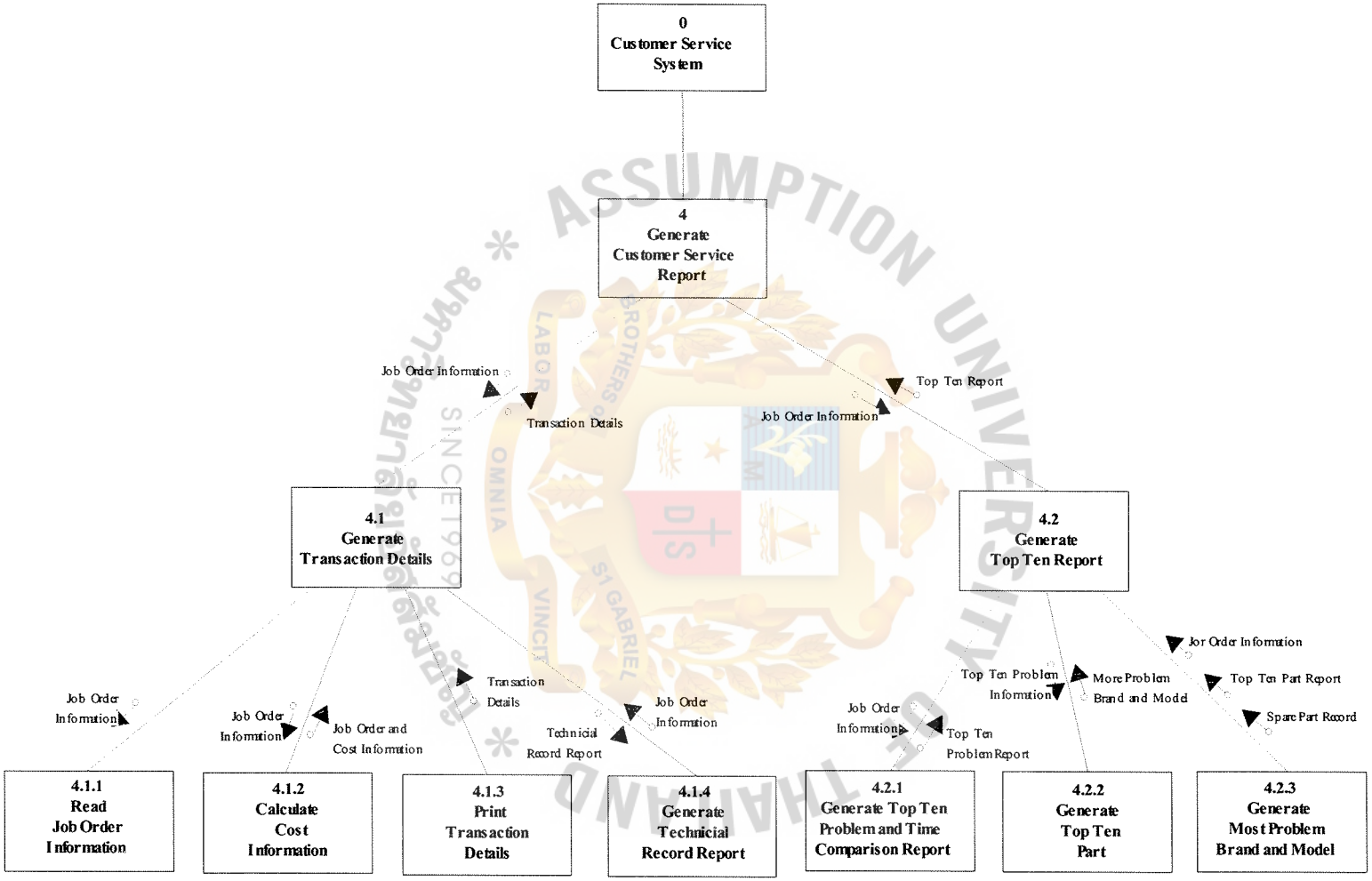

Figure B.7. Structure Chart of Generate Customer Service Report.

APPENDIX C

ENTITY RELATIONSHIP DIAGRAMS

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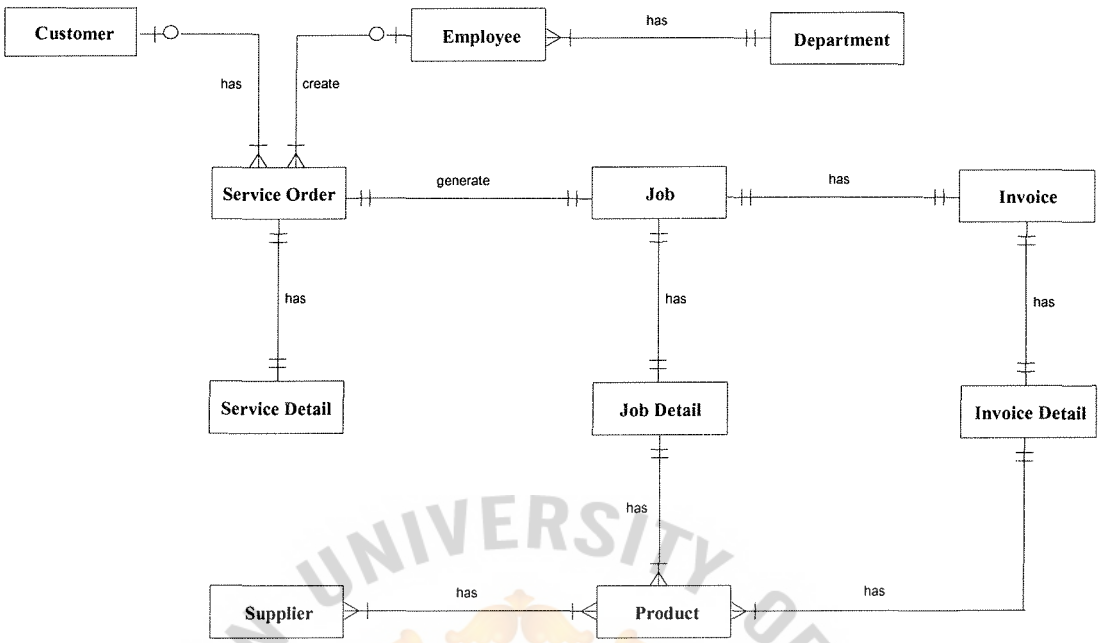

Figure C.1. Relationship Diagram of the Proposed System.

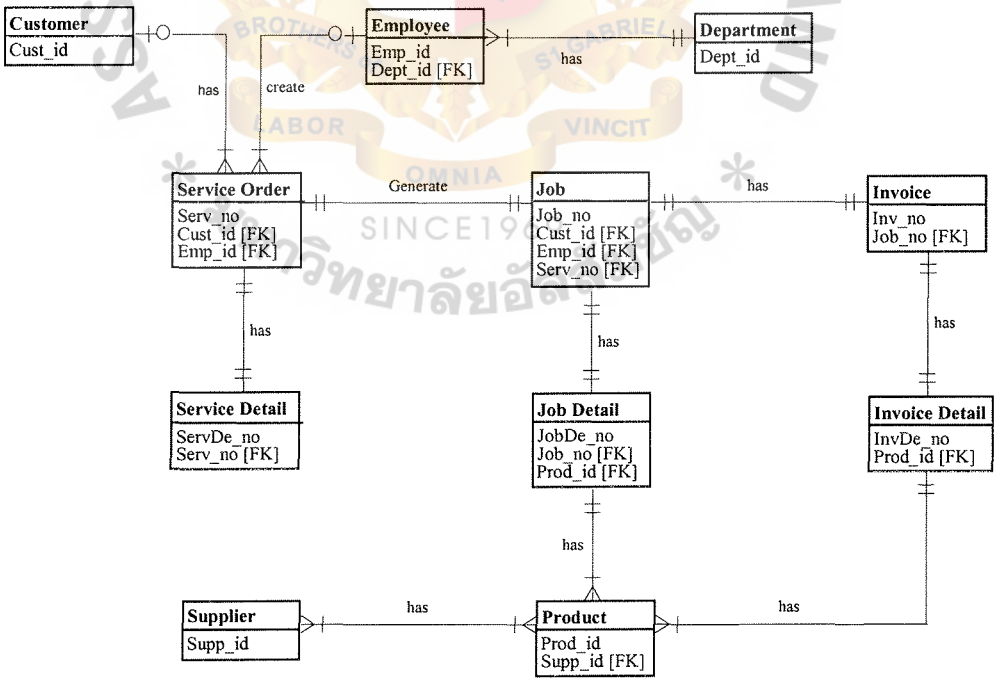

Figure C.2. Key-Based Entity Relationship Diagram.

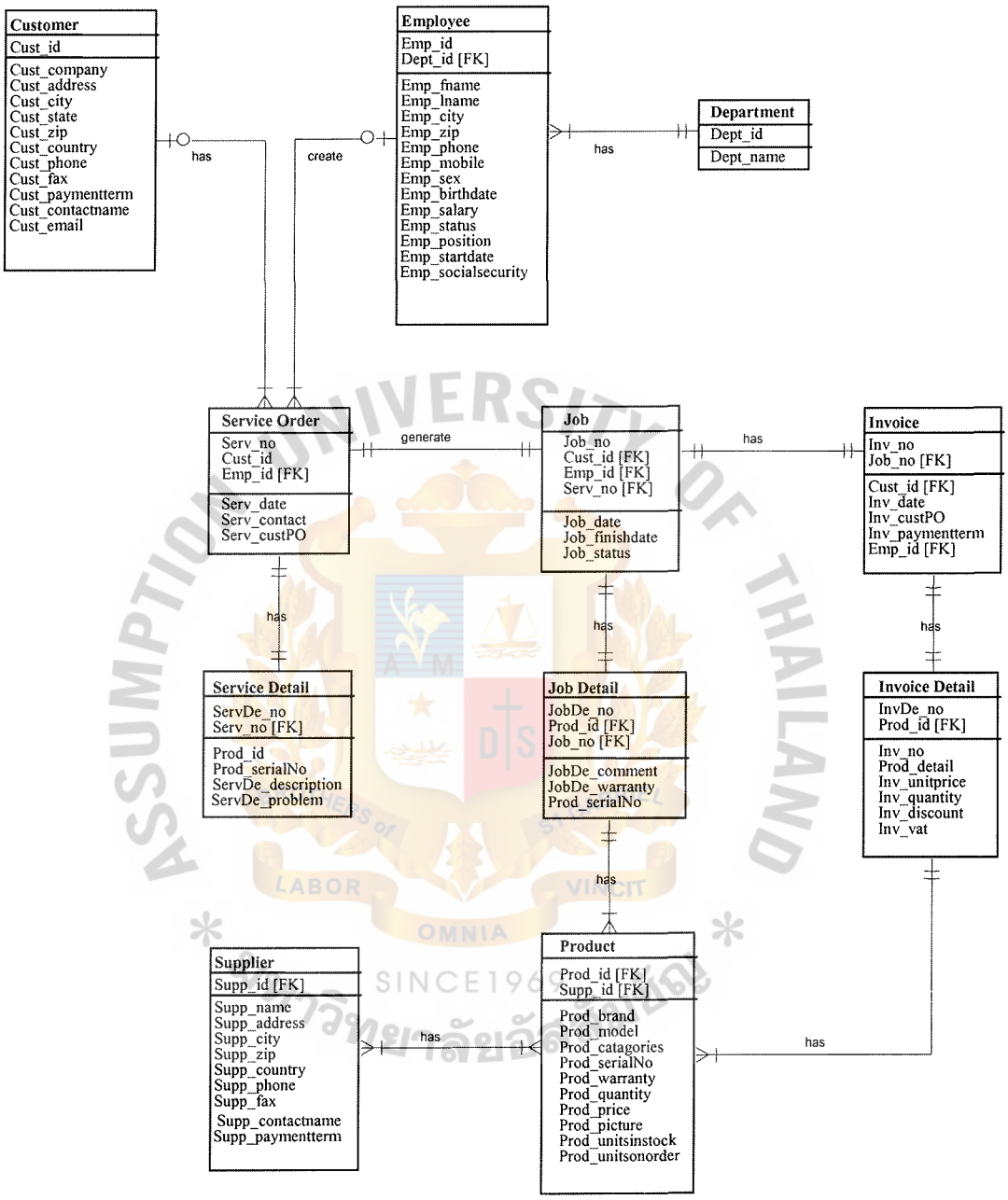

Figure C.3. Fully Attribute Entity Relationship Diagram.

APPENDIX D

DATABASE DESIGN

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Table D.1. Structure of Customer Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Cust_id	Integer	6	Primary Key	Not	Service Order Table Job Table Invoice Table
Cust_company	Varchar	50	Attribute	Not	
Cust_address	Varchar	200	Attribute	Null	
Cust_city	Varchar	2	Attribute	Null	
Cust_state	Varchar	2	Attribute	Null	
Cust_country	Varchar	2	Attribute	Null	
Cust_zip	Varchar	5	Attribute	Null	
Cust_phone	Integer	20	Attribute	Null	
Cust_fax	Integer	20	Attribute	Null	
Cust_contactname	Varchar	50	Attribute	Not	

Table D.2. Structure of Employee Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Emp_id	Integer	6	Primary Key	Not	Service Order Table Job Table Invoice Table
Emp_fname	Varchar	20	Attribute	Not	
Emp_lname	Varchar	50	Attribute	Not	
Emp_address	Varchar	200	Attribute	Null	
Emp_city	Varchar	2	Attribute	Null	
Emp_state	Varchar	2	Attribute	Null	
Emp_country	Varchar	2	Attribute	Null	
Emp_zip	Varchar	5	Attribute	Null	
Emp_phone	Integer	20	Attribute	Not	
Emp_mobile	Integer	20	Attribute	Null	
Emp_sex	Integer	2	Attribute	Not	
Emp_birthdate	Date	6	Attribute	Null	
Emp_salary	Integer	7	Attribute	Not	
Emp_status	Integer	10	Attribute	Null	
Emp_position	Integer	2	Attribute	Not	
Emp_startdate	Date	6	Attribute	Not	
Emp_socialsecurity	Varchar	12	Attribute	Null	
Dept_id	Integer	2	Foreign Key	Not	

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Table D.3. Structure of Department Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Dept_id	Integer	2	Primary Key	Not	Employee Table
Dept_name	Varchar	20	Attribute	Not	

Table D.4. Structure of Service Order Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Serv_no	Integer	6	Primary Key	Not	Service Detail Table
Cust_id	Integer	6	Attribute	Not	
Emp_id	Integer	6	Attribute	Not	
Serv_date	Date	6	Attribute	Not	
Serv_contact	Varchar	20	Attribute	Not	
Serv_custPO	Varchar	10	Attribute	Not	

Table D.5. Structure of Service Detail Table.

Name	Type	Length	Key Type	Null	Foreign Key to
ServDe_no	Integer	6	Primary Key	Not	
Serv_no	Integer	6	Attribute	Not	
Prod_id	Integer	6	Attribute	Not	
Prod_serialno.	Integer	6	Attribute	Not	
ServDe_decript	Varchar	20	Attribute	Not	
ServDe_problem	Varchar	10	Attribute	Not	

Table D.6. Structure of Job Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Job_no	Integer	6	Primary Key	Not	Job Table
Cust_id	Integer	6	Attribute	Not	
Emp_id	Integer	6	Attribute	Not	
Serv_no	Integer	6	Attribute	Not	
Job_date	Date	6	Attribute	Not	
Job_finishdate	Date	6	Attribute	Not	
Job_status	Varchar	20	Attribute	Not	

Table D.7. Structure of Job Detail Table.

Name	Type	Length	Key Type	Null	Foreign Key to
JobDe_no	Integer	6	Primary Key	Not	
Job_no	Integer	6	Attribute	Not	
Prod_id	Integer	6	Attribute	Not	
JobDe_comment	Varchar	30	Attribute	Not	
JobDe_warranty	Integer	5	Attribute	Null	
Prod_serialno	Integer	6	Attribute	Not	

Table D.8. Structure of Invoice Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Inv_no	Integer	6	Primary Key	Not	Invoice Detail Table
Job_no	Integer	6	Attribute	Not	
Cust_id	Integer	6	Attribute	Not	
Inv_date	Date	6	Attribute	Not	
Inv_custPO	Varchar	10	Attribute	Not	
Inv_paymentterm	Varchar	2	Attribute	Null	
Emp_id	Integer	6	Attribute	Not	

Table D.9. Structure of Invoice Detail Table.

Name	Type	Length	Key Type	Null	Foreign Key to
InvDe_no	Integer	6	Primary Key	Not	
Inv_no	Integer	6	Attribute	Not	
Prod_id	Integer	6	Attribute	Not	
Prod_decript	Varchar	20	Attribute	Null	
Inv_quantity	Integer	2	Attribute	Not	
Inv_unitprice	Integer	2	Attribute	Null	
Inv_discount	Integer	6	Attribute	Not	
Inv_vat	Integer	2	Attribute	Not	

Table D.10. Structure of Product Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Prod_id	Integer	6	Primary Key	Not	Supplier Table Service Detail Table Job Detail Table Invoice Detail Table
Prod_brand	Varchar	2	Attribute	Not	
Prod_decript	Varchar	20	Attribute	Null	
Prod_catagories	Varchar	20	Attribute	Null	
Prod_serialno	Varchar	15	Attribute	Not	
Prod_quantity	Integer	2	Attribute	Not	
Prod_unitprice	Integer	2	Attribute	Null	
Prod_warranty	Integer	5	Attribute	Null	
Prod_picture	Image	20	Attribute	Null	
Prod_unitinstock	Integer	20	Attribute	Null	
Prod_unitonorder	Integer	50	Attribute	Null	

Table D.11. Structure of Brand Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Bran_id	Integer	2	Primary Key	Not	Product Table
Bran_name	Varchar	20	Attribute	Not	

Table D.12. Structure of Supplier Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Supp_id	Integer	6	Primary Key	Not	
Supp_name	Varchar	20	Attribute	Not	
Supp_address	Varchar	200	Attribute	Null	
Supp_city	Varchar	2	Attribute	Null	
Supp_state	Varchar	2	Attribute	Null	
Supp_country	Varchar	2	Attribute	Null	
Supp_zip	Varchar	5	Attribute	Null	
Supp_phone	Integer	20	Attribute	Not	
Supp_fax	Integer	20	Attribute	Null	
Supp_contactname	Varchar	50	Attribute	Null	
Supp_paymentterm	Varchar	2	Attribute	Null	

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Table D.13. Structure of City Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Cit_id	Integer	2	Primary Key	Not	Customer Table Employee Table Supplier Table
Cit_name	Varchar	20	Attribute	Not	

Table D.14. Structure of Country Table.

Name	Type	Length	Key Type	Null	Foreign Key to
Cou_id	Integer	2	Primary Key	Not	Customer Table Employee Table Supplier Table
Cou_name	Varchar	20	Attribute	Not	

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APPENDIX E

COST-BENEFIT AND FEASIBILITY ANALYSIS

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

Cost Items	Years				
	1	2	3	4	5
Fixed Cost					
Hardware Cost:					
Database Server 1 unit @ 190.000	38,000	38,000	38,000	38,000	38,000
Work Station 9 units @ 45,000	81,000	81,000	81,000	81,000	81,000
Laser Printer 1 unit @ 32,000	6,400	6,400	6,400	6,400	6,400
Dot Matrix Printer 1 unit @ 9,900	1,980	1,980	1,980	1,980	1,980
UPS 1 unit @ 15,900	3,180	3,180	3,180	3,180	3,180
Network Product	5,500	5,500	5,500	5,500	5,500
Tape Backup	6,600	6,600	6,600	6,600	6,600
Total Hardware Cost (Baht)	***142,660***	***142,660***	***142,660***	***142,660***	***142,660***
Software Cost:					
Window 2003 server 1 unit @ 43,000	8,600	8,600	8,600	8,600	8,600
Window XP Pro 9 units @ 9,300	16,740	16,740	16,740	16,740	16,740
Microsoft Office XP 9 units @ 18,000	32,400	32,400	32,400	32,400	32,400
Microsoft VB.Net Standard 2003	29,500	29,500	29,500	29,500	29,500
Total Sofware Cost (Baht)	***87,240***	***87,240***	***87,240***	***87,240***	***87,240***
People-Ware Cost:					
System Analyst 6 months @ 20,000	120,000	-	-	-	-
Programmer 2 months @ 40,000	80,000	-	-	-	-
Network Specialist 1 months @ 18,000	18,000	-	-	-	-
Total Implementaion Cost (Baht)	***218,000***	**0**	**0**	**0**	**0**
Implementation Cost:					
Trainning Cost	30,000	-	-	-	-
Installation Cost	15,000	-	-	-	-
Total Implementaion Cost (Baht)	***45,000***	**0**	**0**	**0**	**0**
Maintenance Cost:					
Hardware Maintenance Cost	-	13,000	13,000	13,000	13,000
Software Maintenance Cost	-	5,000	5,000	5,000	5,000
Total Implementaion Cost (Baht)	***0***	**18,000**	**18,000**	**18,000**	**18,000**
Total Fixed Cost (Baht)	**492,900**	**247,900**	**247,900**	**247,900**	**247,900**
Operating Cost					
People-Ware Cost:					
Customer Service 1 persons @ 12,000	12,000	13,200	14,520	15,972	17,569
Admin 1 persons @ 8,000	8,000	8,800	9,680	10,648	11,713
System Administration 1 persons @ 13,000	13,000	14,300	15,730	17,303	19,033
Total Monthly Salary Cost (Baht)	33,000	36,300	39,930	43,923	48,315
Total Annual Salary Cost (Baht)	**396,000**	**435,600**	**479,160**	**527,076**	**579,784**
Office Supplies & Miscellaneous Cost:					
Stationary per annual	24,000	26,400	29,040	31,944	35,138
Paper per annual	59,000	64,900	71,390	78,529	86,382
Utility per annual	6,000	6,600	7,260	7,986	8,785
Miscellaneous per annual	10,000	11,000	12,100	13,310	14,641
Total Annual Office Supplies & Miscellaneous Cost (Baht)	**99,000**	**108,900**	**119,790**	**131,769**	**144,946**
Total Annual Cost (Baht)	**495,000**	**544,500**	**598,950**	**658,845**	**724,730**
Total Computerized System Cost (Baht)	***987,900***	***792,400***	***846,850***	***906,745***	***972,630***

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

Cost Items		Years				
		1	2	3	4	5
Fixed Cost						
Hardware Cost:						
Database Server	1 unit @ 190.000	38,000	38,000	38,000	38,000	38,000
Work Station	9 units @ 45,000	81,000	81,000	81,000	81,000	81,000
Laser Printer	1 unit @ 32,000	6,400	6,400	6,400	6,400	6,400
Dot Matrix Printer	1 unit @ 9,900	1,980	1,980	1,980	1,980	1,980
UPS	1 unit @ 15,900	3,180	3,180	3,180	3,180	3,180
Network Product		5,500	5,500	5,500	5,500	5,500
Tape Backup		6,600	6,600	6,600	6,600	6,600
Total Hardware Cost (Baht)		***142,660***	***142,660***	***142,660***	***142,660***	***142,660***
Software Cost:						
Window 2003 server	1 unit @ 43,000	8,600	8,600	8,600	8,600	8,600
Window XP Pro	9 units @ 9,300	16,740	16,740	16,740	16,740	16,740
Microsoft Office XP	9 units @ 18,000	32,400	32,400	32,400	32,400	32,400
Developer 2000		7,000	7,000	7,000	7,000	7,000
Oracle Standard Edition		52,000	4,800	4,800	4,800	4,800
Oracle Programer Suite		8,000	11,920	11,920	11,920	11,920
Total Sofware Cost (Baht)		***124,740***	***81,460***	***81,460***	***81,460***	***81,460***
People-Ware Cost:						
System Analyst	6 months @ 20,000	120,000	-	-	-	-
Programmer	2 months @ 44,000	88,000	-	-	-	-
Database Specialist	3 months @ 40,000	120,000	-	-	-	-
Network Specialist	1 months @ 18,000	18,000	-	-	-	-
Total Implementaion Cost (Baht)		***346,000***	**0**	**0**	**0**	**0**
Implementation Cost:						
Trainning Cost		50,000	-	-	-	-
Installation Cost		30,000	-	-	-	-
Total Implementaion Cost (Baht)		***80,000***	**0**	**0**	**0**	**0**
Maintenance Cost:						
Hardware Maintenance Cost		-	13,000	13,000	13,000	13,000
Software Maintenance Cost		-	10,000	10,000	10,000	10,000
Total Implementaion Cost (Baht)		***0***	**23,000**	**23,000**	**23,000**	**23,000**
Total Fixed Cost (Baht)		**693,400**	**247,120**	**247,120**	**247,120**	**247,120**
Operating Cost						
People-Ware Cost:						
Customer Service	1 persons @ 12,000	12,000	13,200	14,520	15,972	17,569
Admin	1 persons @ 8,000	8,000	8,800	9,680	10,648	11,713
System Administration	1 persons @ 16,000	16,000	17,600	19,360	21,296	23,426
Total Monthly Salary Cost (Baht)		36,000	39,600	43,560	47,916	52,708
Total Annual Salary Cost (Baht)		**432,000**	**475,200**	**522,720**	**574,992**	**632,491**
Office Supplies & Miscellaneous Cost:						
Stationary	per annual	24,000	26,400	29,040	31,944	35,138
Paper	per annual	59,000	64,900	71,390	78,529	86,382
Utility	per annual	6,000	6,600	7,260	7,986	8,785
Miscellaneous	per annual	10,000	11,000	12,100	13,310	14,641
Total Annual Office Supplies & Miscellaneous Cost (Baht)		**99,000**	**108,900**	**119,790**	**131,769**	**144,946**
Total Annual Cost (Baht)		**531,000**	**584,100**	**642,510**	**706,761**	**777,437**
Total Computerized System Cost (Baht)		***1,224,400***	***831,220***	***889,630***	***953,881***	***1,024,557***

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

Cost Items	Years				
	1	2	3	4	5
Fixed Cost					
Hardware Cost:					
Database Server 1 unit @ 190.000	38,000	38,000	38,000	38,000	38,000
Work Station 9 units @ 45,000	81,000	81,000	81,000	81,000	81,000
Laser Printer 1 unit @ 32,000	6,400	6,400	6,400	6,400	6,400
Dot Matrix Printer 1 unit @ 9,900	1,980	1,980	1,980	1,980	1,980
UPS 1 unit @ 15,900	3,180	3,180	3,180	3,180	3,180
Network Product	5,500	5,500	5,500	5,500	5,500
Tape Backup	6,600	6,600	6,600	6,600	6,600
Total Hardware Cost (Baht)	***142,660***	***142,660***	***142,660***	***142,660***	***142,660***
Software Cost:					
Window 2003 server 1 unit @ 43,000	8,600	8,600	8,600	8,600	8,600
Window XP Pro 9 units @ 9,300	16,740	16,740	16,740	16,740	16,740
Microsoft Office XP 9 units @ 18,000	32,400	32,400	32,400	32,400	32,400
Power Builder 7 Pro	4,800	4,800	4,800	4,800	4,800
Sybase ASE Small Business Editition 12.5	11,920	11,920	11,920	11,920	11,920
Total Software Cost (Baht)	***74,460***	***74,460***	***74,460***	***74,460***	***74,460***
People-Ware Cost:					
System Analyst 6 months @ 20,000	120,000	-	-	-	-
Programmer 2 months @ 40,000	80,000	-	-	-	-
Network Specialist 1 months @ 18,000	18,000	-	-	-	-
Total Implementation Cost (Baht)	***218,000***	**0**	**0**	**0**	**0**
Implementation Cost:					
Training Cost	30,000	-	-	-	-
Installation Cost	20,000	-	-	-	-
Total Implementation Cost (Baht)	***50,000***	**0**	**0**	**0**	**0**
Maintenance Cost:					
Hardware Maintenance Cost	-	13,000	13,000	13,000	13,000
Software Maintenance Cost	-	5,000	5,000	5,000	5,000
Total Implementation Cost (Baht)	***0***	**18,000**	**18,000**	**18,000**	**18,000**
Total Fixed Cost (Baht)	**485,120**	**235,120**	**235,120**	**235,120**	**235,120**
Operating Cost					
People-Ware Cost:					
Customer Service 1 persons @ 12,000	12,000	13,200	14,520	15,972	17,569
Admin 1 persons @ 8,000	8,000	8,800	9,680	10,648	11,713
System Administration 1 persons @ 13,000	13,000	14,300	15,730	17,303	19,033
Total Monthly Salary Cost (Baht)	33,000	36,300	39,930	43,923	48,315
Total Annual Salary Cost (Baht)	***396,000***	***435,600***	***479,160***	***527,076***	***579,784***
Office Supplies & Miscellaneous Cost:					
Stationary per annual	24,000	26,400	29,040	31,944	35,138
Paper per annual	59,000	64,900	71,390	78,529	86,382
Utility per annual	6,000	6,600	7,260	7,986	8,785
Miscellaneous per annual	10,000	11,000	12,100	13,310	14,641
Total Annual Office Supplies & Miscellaneous Cost (Baht)	**99,000**	**108,900**	**119,790**	**131,769**	**144,946**
Total Annual Cost (Baht)	**495,000**	**544,500**	**598,950**	**658,845**	**724,730**
Total Computerized System Cost (Baht)	***980,120***	***779,620***	***834,070***	***893,965***	***959,850***

Table E.4. Payback Period for the Candidate 1, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	-1,369,500.00					
Operation & Maintenance cost:		-513,000.00	-564,300.00	-620,730.00	-682,803.00	-751,083.30
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Time-adjusted costs (adjusted to present value):	-1,369,500.00	-483,551.70	-516,414.44	-551,510.57	-588,991.87	-629,020.44
Commulative time-adjust costs over lifetime:	-1,369,500.00	-1,853,051.70	-2,369,466.14	-2,920,976.71	-3,509,968.57	-4,138,989.01
Benefits derives from operation of new system:	0.00	1,128,000.00	1,297,200.00	1,491,780.00	1,715,547.00	1,972,879.05
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Time-adjusted benefits (adjusted to present value):	0.00	1,063,248.19	1,187,121.76	1,325,427.21	1,479,845.91	1,652,255.14
Commulative time-adjusted benefits over lifetime:	0.00	1,063,248.19	2,250,369.95	3,575,797.15	5,055,643.07	6,707,898.21
Cumulative lifetime time-adjusted cost+benefit:	-1,369,500.00	-789,803.52	-119,096.19	654,820.45	1,545,674.50	2,568,909.20

Table E.5. Net Present Value for the Candidate 1, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	1,369,500.00					
Operation & Maintenance cost:		513,000.00	564,300.00	620,730.00	682,803.00	751,083.30
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Present value of annual costs;	1,369,500.00	483,551.70	516,414.44	551,510.57	588,991.87	629,020.44
Total presentvalue of life time costs:						-4,138,989.01
Benefits derives from operation of new system:	0.00	1,128,000.00	1,297,200.00	1,491,780.00	1,715,547.00	1,972,879.05
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Present value of annual benefits:	0.00	1,063,248.19	1,187,121.76	1,325,427.21	1,479,845.91	1,652,255.14
Total present value of lifetime benefits:						6,707,898.21
Net present value of this alternative:						2,568,909.20

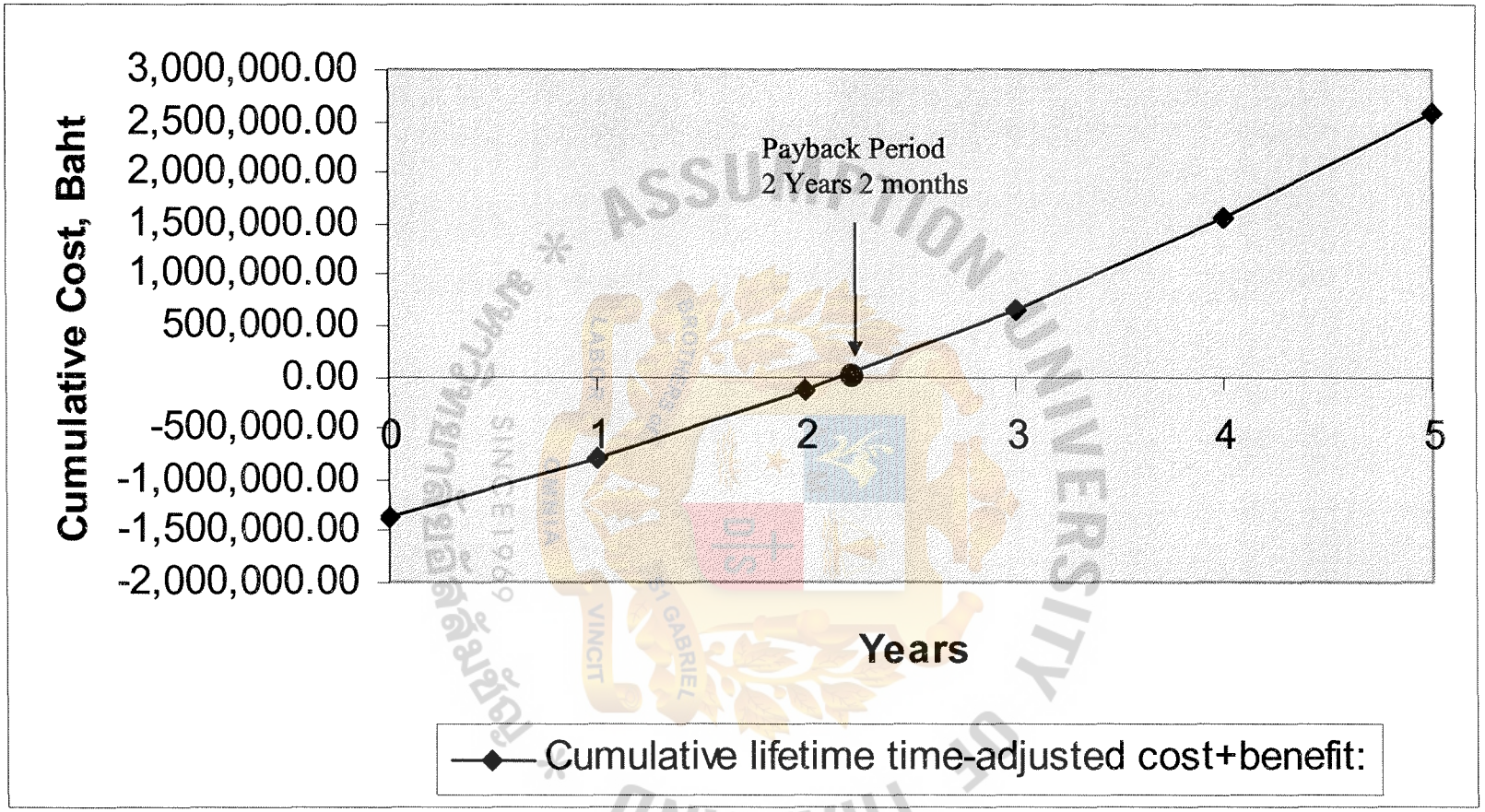

Figure E.1. Payback Period for the Candidate 1.

Table E.6. Payback Period for the Candidate 2, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	-1,720,000.00					
Operation & Maintenance cost:		-554,000.00	-609,400.00	-670,340.00	-737,374.00	-811,111.40
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Time-adjusted costs (adjusted to present value):	-1,720,000.00	-522,198.13	-557,687.33	-595,588.41	-636,065.29	-679,293.03
Commulative time-adjust costs over lifetime:	-1,720,000.00	-2,242,198.13	-2,799,885.46	-3,395,473.87	-4,031,539.16	-4,710,832.19
Benefits derives from operation of new system:	0.00	1,128,000.00	1,297,200.00	1,491,780.00	1,715,547.00	1,972,879.05
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Time-adjusted benefits (adjusted to present value):	0.00	1,063,248.19	1,187,121.76	1,325,427.21	1,479,845.91	1,652,255.14
Commulative time-adjusted benefits over lifetime:	0.00	1,063,248.19	2,250,369.95	3,575,797.15	5,055,643.07	6,707,898.21
Cumulative lifetime time-adjusted cost+benefit:	-1,720,000.00	-1,178,949.95	-549,515.51	180,323.29	1,024,103.91	1,997,066.03

Table E.7. Net Present Value for the Candidate 2, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	1,720,000.00					
Operation & Maintenance cost:		554,000.00	609,400.00	670,340.00	737,374.00	811,111.40
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Present value of annual costs;	1,720,000.00	522,198.13	557,687.33	595,588.41	636,065.29	679,293.03
Total presentvalue of life time costs:						-4,710,832.19
Benefits derives from operation of new system:	0.00	1,128,000.00	1,297,200.00	1,491,780.00	1,715,547.00	1,972,879.05
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Present value of annual benefits:	0.00	1,063,248.19	1,187,121.76	1,325,427.21	1,479,845.91	1,652,255.14
Total present value of lifetime benefits:						6,707,898.21
Net present value of this alternative:						1,997,066.03

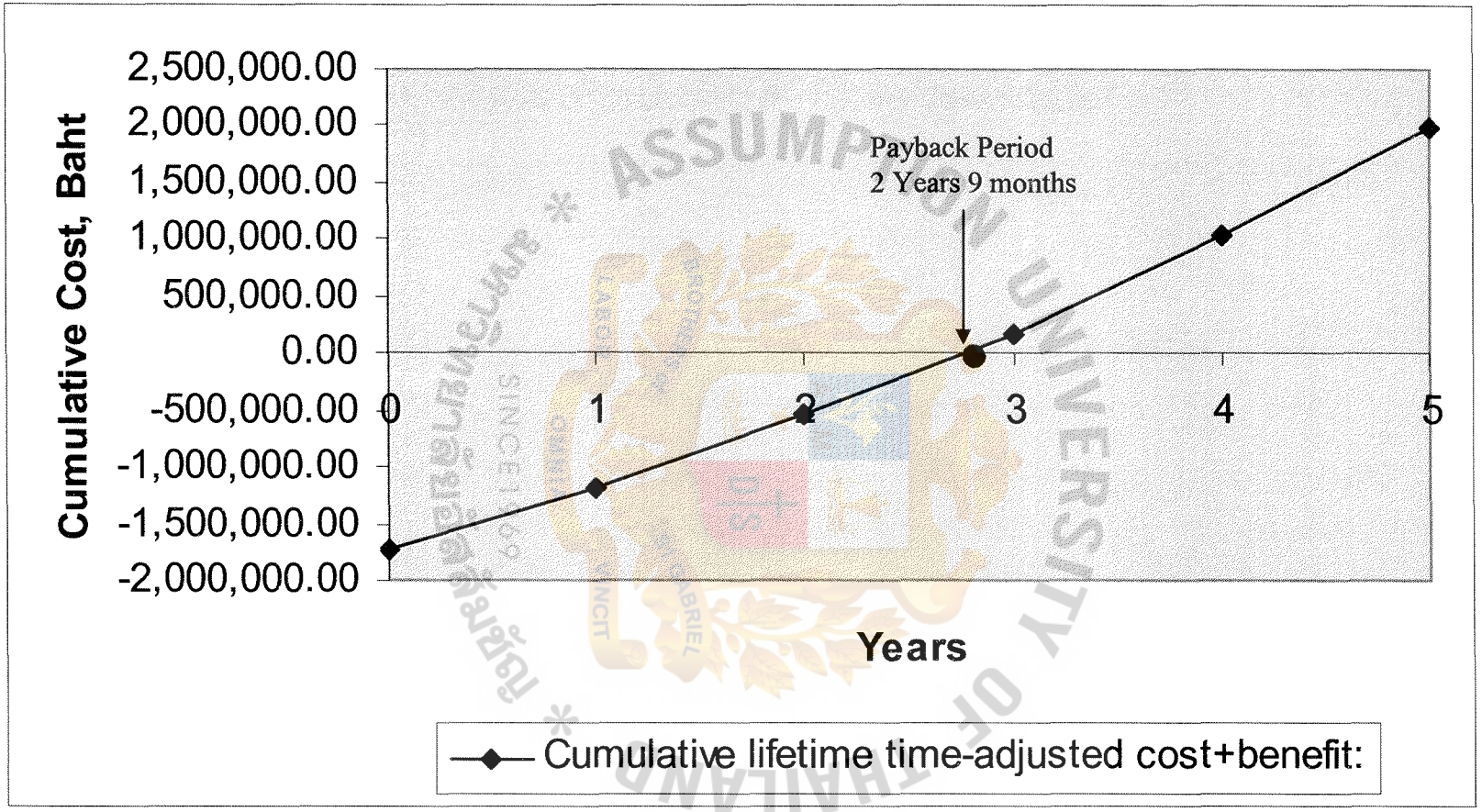

Figure E.2. Payback Period for the Candidate 2.

Table E.8. Payback Period for the Candidate 3, Baht.

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	-1,310,600.00					
Operation & Maintenance cost:		-513,000.00	-564,300.00	-620,730.00	-682,803.00	-751,083.30
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Time-adjusted costs (adjusted to present value):	-1,310,600.00	-483,551.70	-516,414.44	-551,510.57	-588,991.87	-629,020.44
Commulative time-adjust costs over lifetime:	-1,310,600.00	-1,794,151.70	-2,310,566.14	-2,862,076.71	-3,451,068.57	-4,080,089.01
Benefits derives from operation of new system:	0.00	1,128,000.00	1,297,200.00	1,491,780.00	1,715,547.00	1,972,879.05
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Time-adjusted benefits (adjusted to present value):	0.00	1,063,248.19	1,187,121.76	1,325,427.21	1,479,845.91	1,652,255.14
Commulative time-adjusted benefits over lifetime:	0.00	1,063,248.19	2,250,369.95	3,575,797.15	5,055,643.07	6,707,898.21
Cumulative lifetime time-adjusted cost+benefit:	-1,310,600.00	-730,903.52	-60,196.19	713,720.45	1,604,574.50	2,627,809.20

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

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development cost:	-1,310,600.00					
Operation & Maintenance cost:		-513,000.00	-564,300.00	-620,730.00	-682,803.00	-751,083.30
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Present value of annual costs;	-1,310,600.00	-483,551.70	-516,414.44	-551,510.57	-588,991.87	-629,020.44
Total presentvalue of life time costs:						-4,080,089.01
Benefits derives from operation of new system:	0.00	1,128,000.00	1,297,200.00	1,491,780.00	1,715,547.00	1,972,879.05
Discount factors for 3%	1.00	0.94	0.92	0.89	0.86	0.84
Present value of annual benefits:	0.00	1,063,248.19	1,187,121.76	1,325,427.21	1,479,845.91	1,652,255.14
Total present value of lifetime benefits:						6,707,898.21
Net present value of this alternative:						2,627,809.20

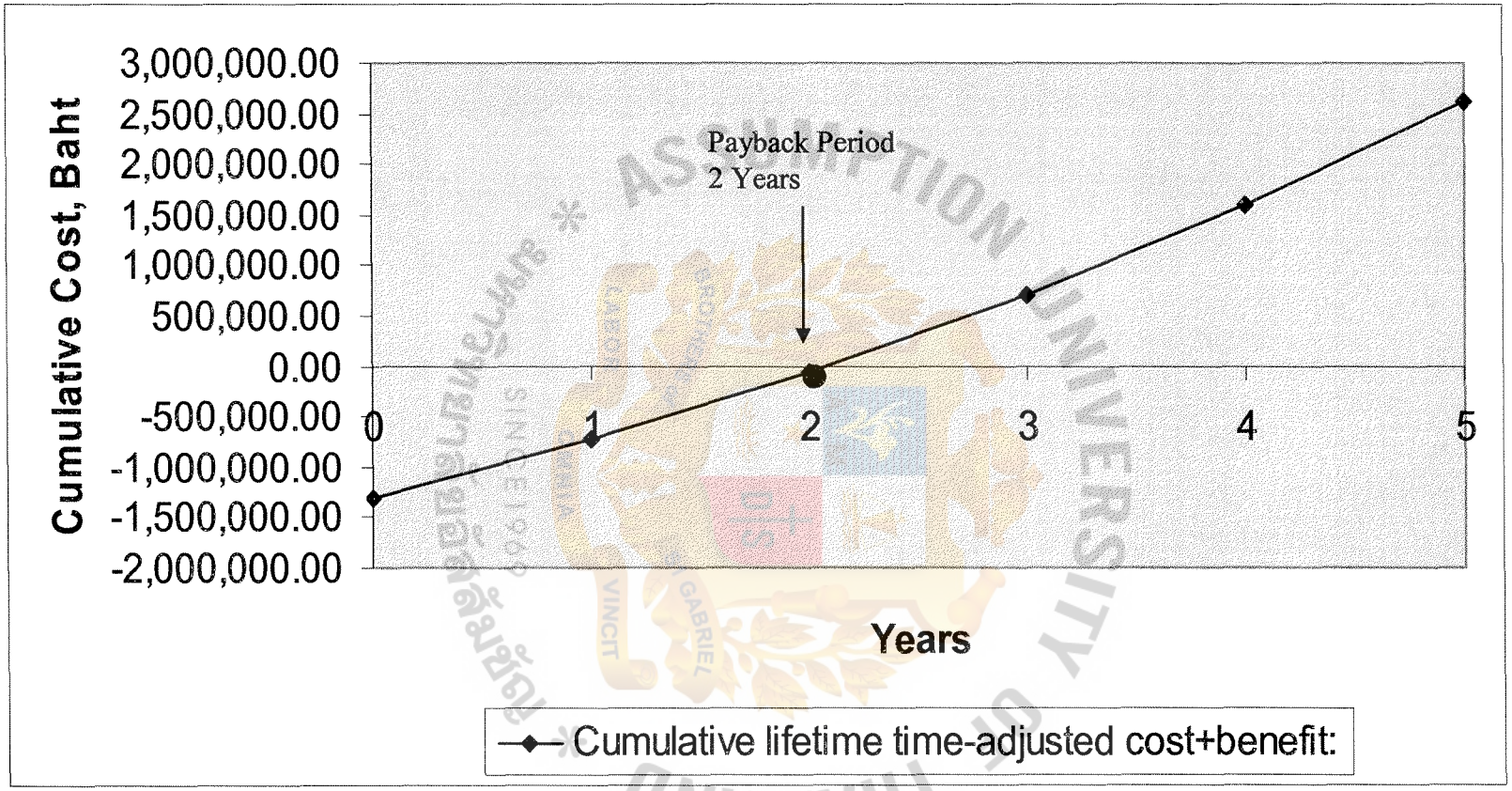

Figure E.3. Payback Period for the Candidate 3.

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APPENDIX F

PROCESS SPECIFICATIONS

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Table F.1. Process Specification of Process 1.

Items	Description
Process Name:	Manage Customer Service Information
Data In:	Customer Information Data
Data Out:	Receive Call Data
	Service Order Data
Process:	(1) Gather Customer Information into Customer Database
	(2) Update Customer Information into Customer Database
	(3) Create Job Order into Job Order Record
Attachment	(1) Customer Database
	(2) Job Order Database

Table F.2. Process Specification of Process 2.

Items	Description
Process Name:	Manage Symptom
Data In:	Service Order Data
	Customer Information Data
Data Out:	Job Order Data
	Goods Data
Process:	(1) Get Customer Information into Customer Database
	(2) Check Goods Warranty from Product Database
	(3) Send Defective Goods information to Check Basic Symptom
	(4) Send Job Order to Manage Service
Attachment	(1) Customer Database
	(2) Job Order Database
	(3) Goods Database
	(4) Defective Goods

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Table F.3. Process Specification of Process 3.

Items	Description
Process Name:	Manage Customer Service
Data In:	Job Order Data
	Customer Information Data
	Goods Data
Data Out:	Job Order Status Data
	Spare Part Data
	Service Charge Data
	Engineer Data
	RMA Data
Process:	(1) Create Job Order Status into Job Order Database
	(2) Verify Goods Warranty from Product Database
	(3) Get Spare Part from Spare Part Database
	(4) Calculate Service Charge of Job Order
	(5) Send Service Charge to Calculate Total Service Cost Process
	(6) Send RMA to Request RMA Process
Attachment	(1) Customer Database
	(2) Job Order Database
	(3) Goods Database
	(4) Spare Part Database
	(5) Stock Database
	(6) Engineer Database
	(7) Spare Part
	(8) Defective Goods

Table F.4. Process Specification of Process 4.

Items	Description
Process Name:	Generate Customer Service Report
Data In:	Job Order Data
	Customer Information Data
	Product Data
	Spare Part Data
	Engineer Data
	Service Cost Data
Data Out:	Top Ten Problem Data
	Top Ten Part Data
Process:	(1) Receive Job Order from Manage Job Order Process
	(2) Generate Top Ten Problem Report
	(3) Generate Top Ten Part Report
	(4) Generate Summary Service Report
	(5) Send Summary Service Report to Service Manager
Attachment	(1) Create Report File
	(2) Manager Service

APPENDIX G

DATA DICTIONARY

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Table G.1. Data Dictionary of Customer Table.

Field Name	Meaning
Cust_id	Unique identification number of the customer
Cust_company	Name of the customer company
Cust_address	Mailing address of the customer
Cust_city	City where the customer is located
Cust_state	State where the customer is located
Cust_country	Country where the customer is located
Cust_zip	Zip Code where the customer is located
Cust_phone	Phone number of the customer
Cust_fax	Fax number of the customer
Cust_contactname	Customer contact name
Cust_email	E-mail of the customer
Cust_paymentterm	Payment term that customer got

Table G.2. Data Dictionary of Employee Table.

Field Name	Meaning
Emp_id	Identification number of the employee
Emp_fname	First name of the employee
Emp_lname	Last name of the employee
Emp_address	Mailing address of the employee
Emp_city	City where the employee is located
Emp_state	State where the employee is located
Emp_country	Country where the employee is located
Emp_zip	Zip Code where the employee is located
Emp_phone	Phone number of the employee
Emp_mobile	Mobile number of the employee
Emp_sex	Male of Female
Emp_birthdate	Birth date of the employee
Emp_salary	Annual salary of the employee
Emp_status	Status of the employee (single, married, divorce)
Emp_position	Position of the employee
Emp_startdate	Date the employee began working
Emp_socialsecurity	Social security number of the employee
Dept_id	Identification number of the department where the employee works

Table G.3. Data Dictionary of Department Table.

Field Name	Meaning
Dept_id	Unique identification code of the department
Dept_name	Name of the department

Table G.4. Data Dictionary of Service Order Table.

Field Name	Meaning
Serv_no	Unique identification number of the service order
Cust_id	Identification number of the customer that the service order is for
Emp_id	Identification number of the employee who create the service order
Serv_date	Date of service order
Serv_contact	Customer cantact name
Serv_custPO	Purchase order of the customer

Table G.5. Data Dictionary of Service Detail Table.

Field Name	Meaning
ServDe_no	Unique identification number of the service detail order
Serv_no	Unique identification number of the service order
Prod_id	Product identification number
Prod_serialno.	Serial number of the defective goods
ServDe_decript	Decription of the defective goods
ServDe_problem	The problem to the defective goods

Table G.6. Data Dictionary of Job Table.

Field Name	Meaning
Job_no	Unique identification number of the job
Cust_id	Identification number of the customer that the job is for
Emp_id	Identification number of the employee who resposiible that job
Serv_no	Identification number of the service order that the job is for
Job_date	Date of job order
Job_finishdate	Date that finish the job
Job_status	Status of the job

Table G.7. Data Dictionary of Job Detail Table.

Field Name	Meaning
JobDe_no	Unique identification number of the job detail
Job_no	Unique identification number of the job
Prod_id	Product identification number
JobDe_comment	The comment from the engineer
JobDe_warranty	The warranty of the spare part
Prod_serialno	Serial number of the spare part

Table G.8. Data Dictionary of Invoice Table.

Field Name	Meaning
Inv_no	Unique identification number of the invoice
Job_no	Unique identification number of the job
Cust_id	Identification number of the customer that the invoice is for
Inv_date	Date of the invoice
Inv_custPO	Purchase order of the customer
Inv_paymentterm	Payment term that customer got
Emp_id	Identification number of the employee who create the invoice

Table G.9. Data Dictionary of Invoice Detail Table.

Field Name	Meaning
InvDe_no	Unique identification number of the service detail
Inv_no	Unique identification number of the invoice
Prod_id	Product identification number
Prod_decript	Decription of the product
Inv_quantity	Amount of the product
Inv_unitprice	Unit price per product
Inv_discount	The discount that customer got
Inv_vat	Calculater the vat of the total cost

Table G.10. Data Dictionary of Product Table.

Field Name	Meaning
Prod_id	Unique identification code of the product
Prod_brand	Brand of the product
Prod_decript	Describes what the product is
Prod_catagories	Catagories of the product
Prod_serialno	Serial nember of each product item
Prod_quantity	Amount of the product
Prod_unitprice	Unit price per product
Prod_warranty	Warranty of the product
Prod_picture	.bmp filename that shows what the product looks like
Prod_unitinstock	Amount of the product in stock
Prod_unitonorder	Amount of the product on order

Table G.11. Data Dictionary of Supplier Table.

Field Name	Meaning
Supp_id	Unique identification number of the supplier
Supp_name	Name of the supplier company
Supp_address	Mailing address of the supplier
Supp_city	City where the supplier is located
Supp_state	State where the supplier is located
Supp_country	Country where the supplier is located
Supp_zip	Zip Code where the supplier is located
Supp_phone	Phone number of the supplier
Supp_fax	Fax number of the supplier
Supp_contactname	supplier contact name
Supp_paymentterm	Payment term that supplier got

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APPENDIX H

INTERFACE DESIGN

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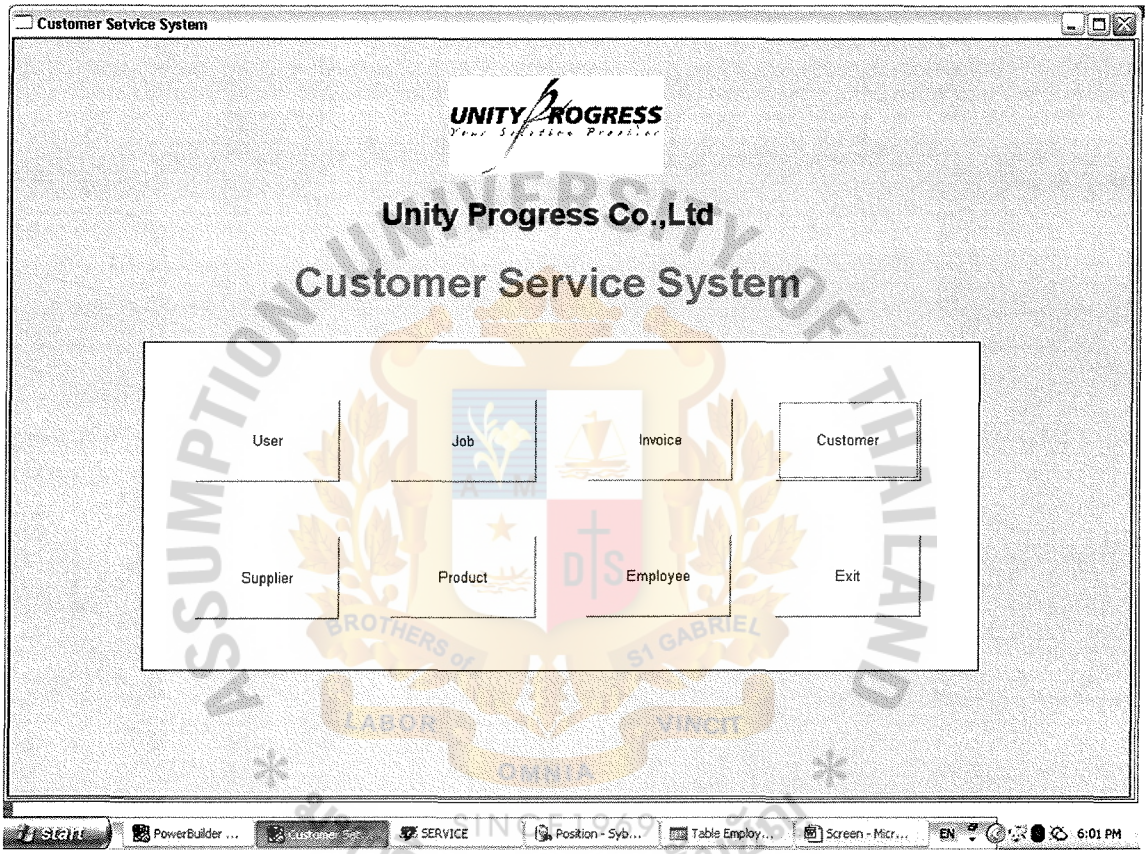

Figure H.1. Main Menu Screen of Customer Service System.

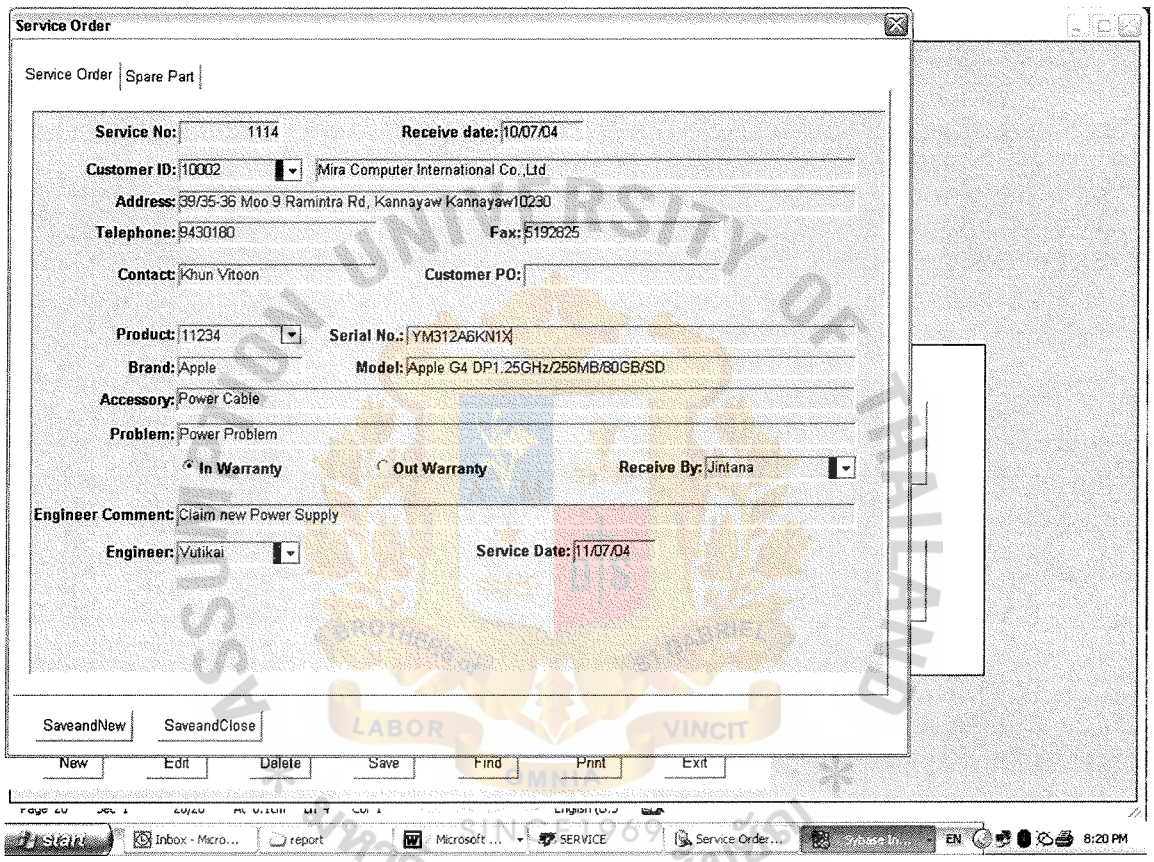

Figure H.2. Service Order Screen.

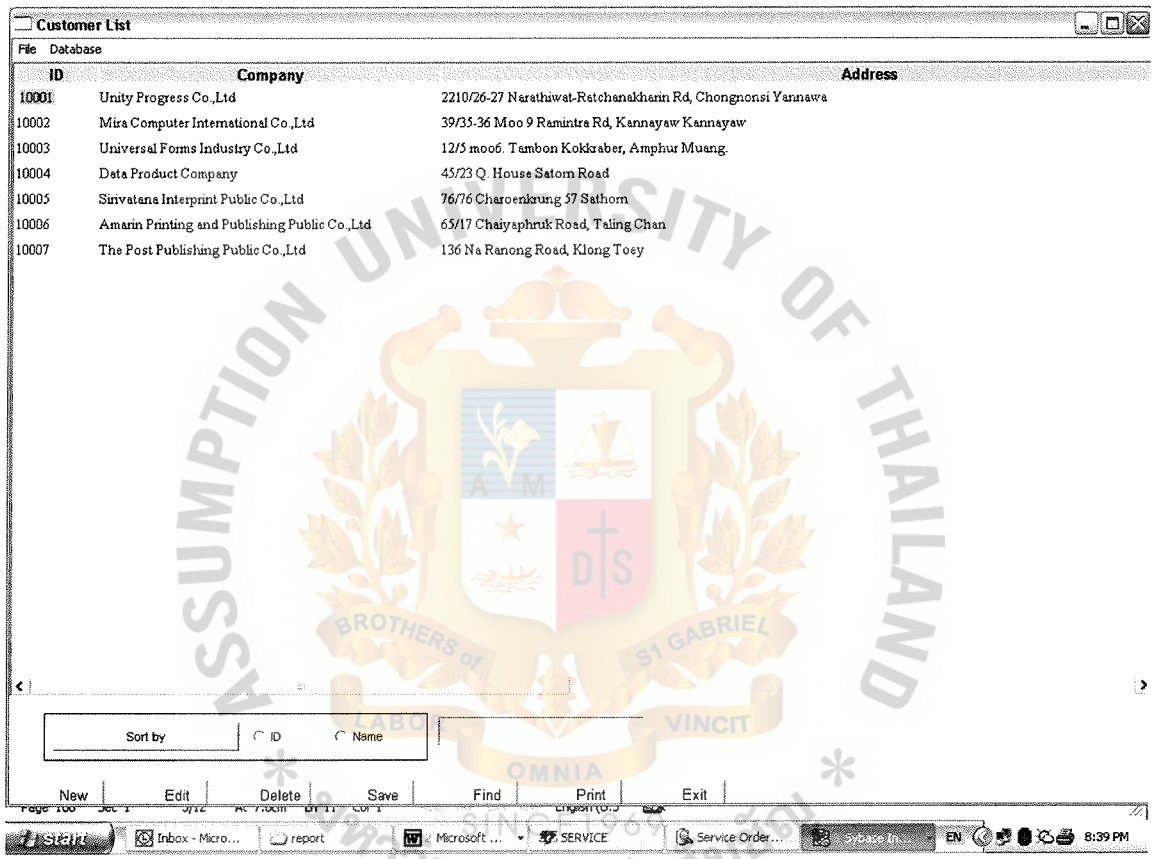

Figure H.3. Customer List Screen.

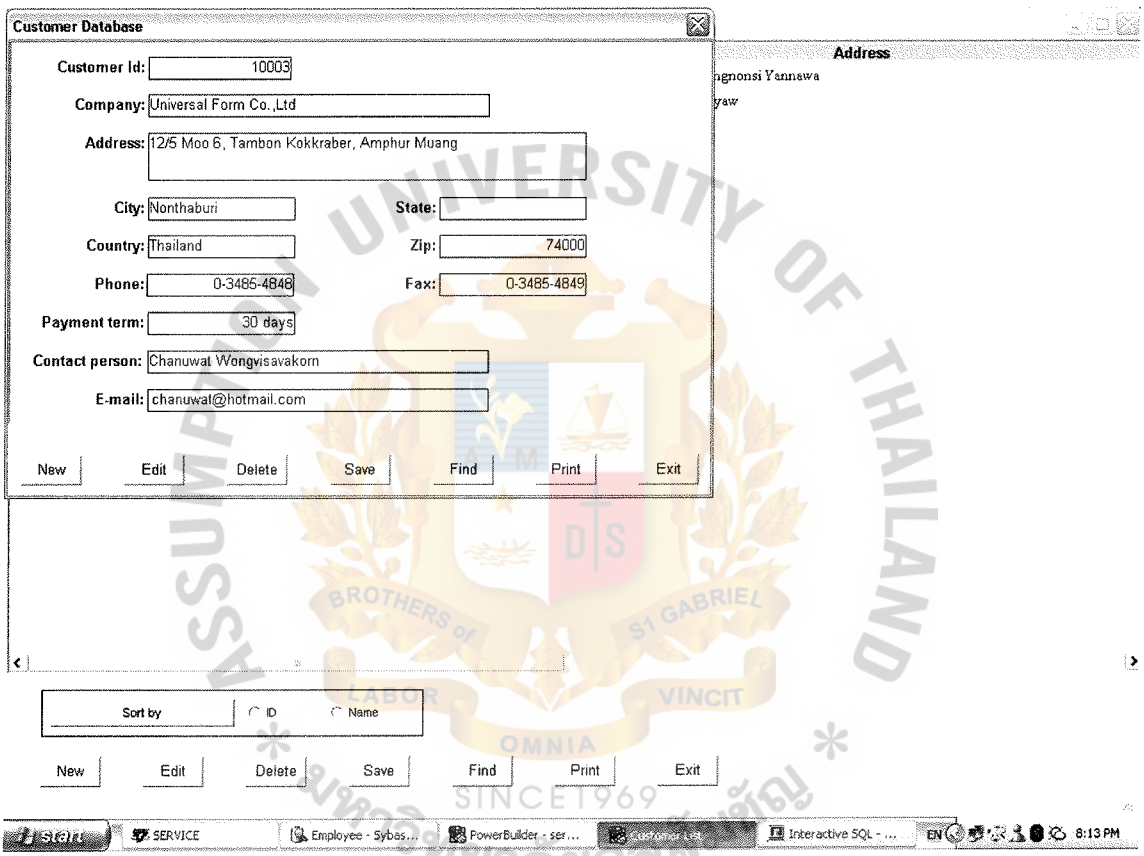

Figure H.4. Customer Database Screen.

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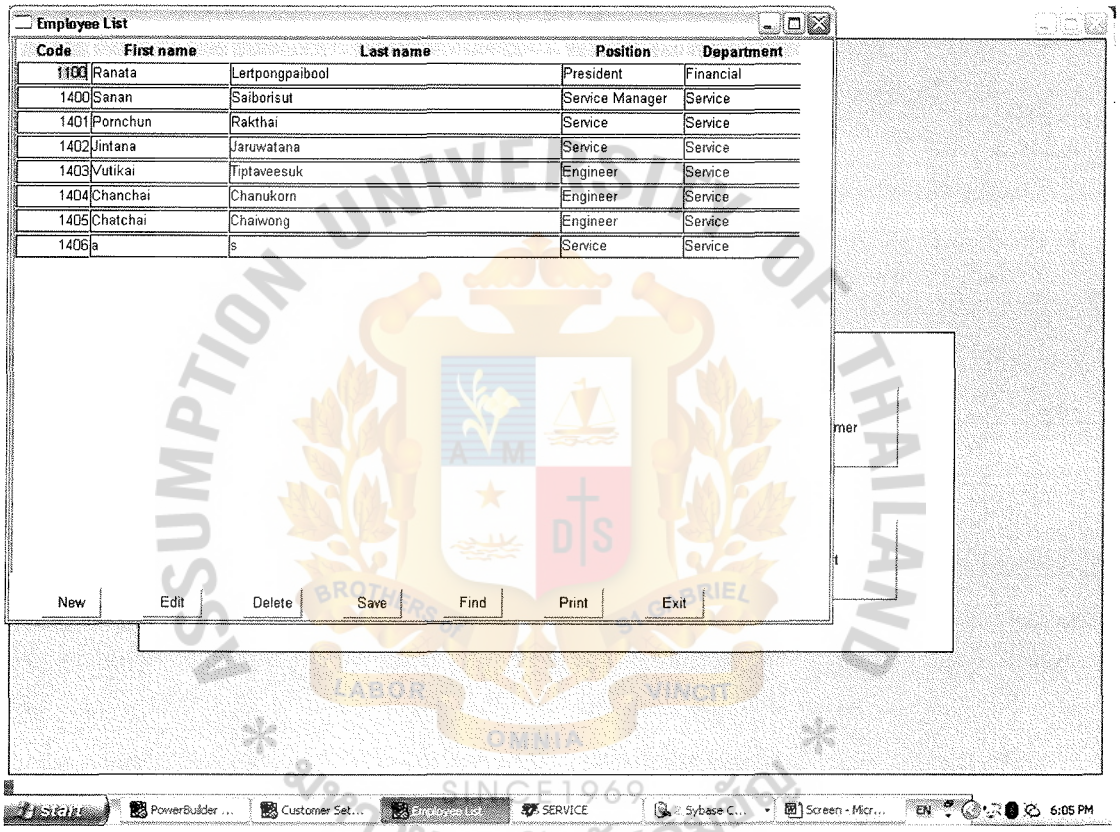

Figure H.5. Employee List Screen.

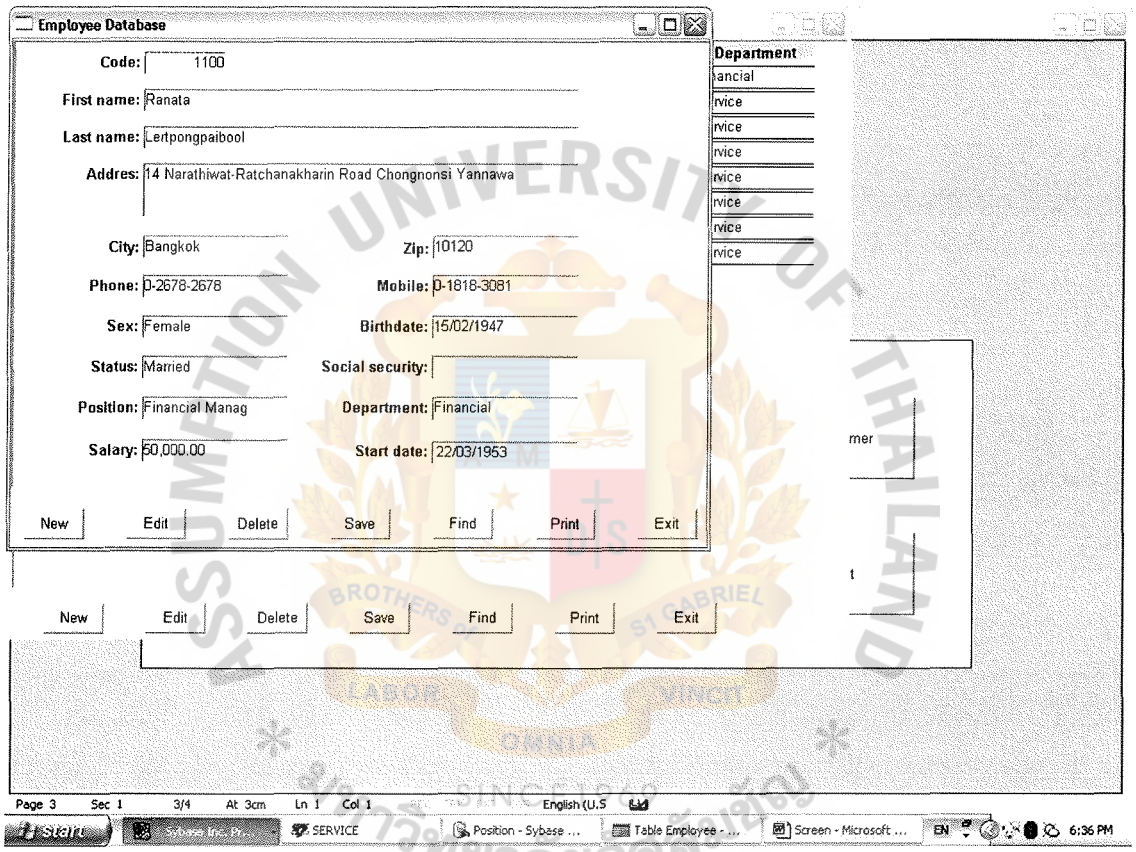

Figure H.6. Employee Database Screen.

APPENDIX I

OUTPUT REPORT DESIGN

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UNITY PROGRESS
Your Solution Provider

Unity Progress Co.,Ltd
2210/26-27 Narathiwat-Ratchanakharin Road
Chongnonsi Yannawa Bangkok 10120
Tel: 0-2678-2566-80 Fax: 0-2678-2560-1

Service Order

No: 12045
Date: 18/6/04

Customer: Sirivatana Interprint Public Co.,Ltd
Address: 76/76 Charoenkrung 57 Sathorn Bangkok 10120
Tel: 0-2675-5600 Fax: 0-2212-0086

Service Report

Contact Name: Khun Prayut PO No.:
Service Site: Sirivatana Interprint Public Co.,Ltd

Product: ZM234D/ACPP Serial No: YM312A6KN1X
Brand: Apple Model: Apple G4 DP1.25GHz/256MB/80GB/SD
Accessory: Power Cable
problem: Power Problem

○ In Warranty ● Out Warranty Receive by: Jintana

Engineer Comment: Change new Power Supply
Run Test: Pass
Engineer: Wattana Service Date: 19/6/04

Item	Description	Qty	Price per Unit	Total
1	ZM2345 Power Supply (1 year warranty)	1	7,000.00	7,000.00
2	Service Charge	1	1,500.00	1,500.00
			Sub Total	8,500.00
			VAT 7%	595.00
			Total Amount	9,095.00

หมายเหตุ: สินค้าที่หมดระยะเวลาประกัน ค่าบริการขั้นต่ำครั้งละ 1,000 บาท บริการนอกสถานที่ขั้นต่ำครั้งละ 1,500 บาท ค่าซ่อมต่ำกว่า 2,000 บาท ฝ่ายบริการของสงวนสิทธิ์ โดยไม่แจ้งราคาให้ทราบล่วงหน้า

Service
Date: / /

Customer
Date: / /

Figure I.1. Service Order Form.

Table I.1. Customer Information Report.

Customer Information Report 27-May-04

Code	Company	Address	Tel	Fax
1000	Mccann-Erickson Thailand	29-30th Floor, Bangkok City Tower, 179 South Sathorn Road, Bangkok10120	287-1000#125	287-3422
1001	Digital Offset Asia Pacific Co.,Ltd.	37/1 Soi Aramduang Satupadit Rd., Bangpongpang, Yannawa, Bangkok 10120	674-2528-30	212-9493
1002	Jaspal & Sons Co.,Ltd.	49 Moo 9, Soi Ruamjai, Bangna-Trad RD. (KM.19) Bangchalong, Bangplee, Samuthprakarn 10540, Thailand	312-6800	312-6825
1003	SC Matchbox	414 Shinawatra Tower 1,18th Floor,Phahon Yothin Road, Phayathai Bangkok 10400	299-5600	299-5664
1004	Thai British Security Printing	41/1 Soi Wat Suan Som, Poochao-Saming Prai Road, Samrongtai, Phrapradaen Samutprakarn 10130 Thailand.	754-2650	384-6996
1005	68 Studio Co.,Ltd.	2123-2125 New Petchburi Road, Bangkapi Huaykwang Bangkok 10310 Thailar	318-8241	318-8249
1006	71 Interscan	200/15 Nares Road Bangrak Bangkok 10500 Thailand	631-7171	631-7181
1007	Kampai Imaging Co.,Ltd.	68 Soi Saen Sabai 2, Rama IV Rd., Prakanong, Klogntoey, Bangkok 10110	661-3571-3	661-3570
1008	Chan Wanich Security Printing	Kongboonma Building 699 Silom Road, Silom, Bangrak Bangkok 10500 Tahilan	815-6969	815-5601
1009	DB Designs Co.,Ltd.	12/10 Soi Uckkhapat,Sukhumvit 49-4 Rd.,Wattana, Bangkok 10110	712-6506	712-6510
1010	Teleinfo Media Co.,Ltd.	4th Fl. 318 Phayathai Rd., Ratchathewi, Bangkok 10400	219-3939	219-3939#1610
1011	NESTLE (THAI) LTD.	500 Ploenchit Road Lumpini, Pathumwan, Bangkok 10330	657-8000	657-8328
1012	Patra Ceramics Group	1091/213-215 Soi Petchburi 33,New Petchburi Rd., Makasan, Rajthevee Bangkok 10400 Thailand	650-1144	650-1164
1012	Universal Forms Industry Co.,Ltd.	77/74 Sinsathorn tower,19th D Floor,Krungthonburi Road,Klongtonsai,Klongsan	440-0281-5	440-0083
1013	Sutin Supplies Ltd.Part.	184/2 Moo3 Soi Akarapol Songpapha Rd.Seegun, Donmuang, Bangkok 10210	928-8920-3	928-9149

Table I.2. Product Information Report.

Product Information Report 27-May-04

Code	Brand	Model	Catagories	Cost	Selling Price	Units in Stock	Units on Order
M9145TH/A/ACPP	Apple	G41.25GHz/256/80/combo/R9000PRO/os9	Computer	54,900	60,400	2	0
M9020TH/A/ACPP	Apple	G51.6GHz/256/80/SD/GF5200	Computer	72,900	80,200	0	5
M9393TH/A/ACPP	Apple	G5 DP1.8GHz/512/160/SD/GF5200/PCI-X	Computer	100,070	110,000	2	0
M9032TH/A/ACPP	Apple	G5 DP2.0GHz/512/160/SD/R9600PRO	Computer	119,500	131,000	7	0
M9168TH/A/ACPP	Apple	iMac 17" LCD G4 1.25G/256/80/SDR/Gefr FX5200	Computer	73,600	80,900	2	0
M9290TH/A/ACPP	Apple	iMac 20" FP G4 1.25G/256/80/SDR	Computer	90,200	99,200	0	0
M9164TH/A, SA/A	Apple	iBook 12.1/800G4/256/30G/Combo	Computer	45,900	50,500	0	3
M9388TH/A, SA/A	Apple	iBook 14.1/933G4/256/40G/Combo	Computer	54,500	60,000	4	0
M8981SA/A	Apple	PB 15"/1.25G/512/80/SD/APX/BT	Computer	104,240	112,600	5	0
M9110SA/A	Apple	PB 17"/1.33G/512/80/SD/APX/BT	Computer	120,110	130,500	3	0
M7649ZM/B	Apple	Display 17"	Monitor	26,500	29,200	5	20
M8893ZM/A	Apple	Display 20"	Monitor	50,900	55,900	2	0
M8537ZM/A	Apple	Display 23"	Monitor	80,500	88,500	0	2
SDM-HS53/WC UC7	Sony	LCD Monitor 15 inches - White	Monitor	13,750	15,990	15	10
SDM-HS73/WC UC7	Sony	LCD Monitor 17 inches - White	Monitor	17,650	20,990	12	0
SDM-HX93/SK UC7	Sony	LCD Monitor 19 inches - White	Monitor	33,635	39,990	6	0
SDM-S204/BK UC7	Sony	LCD Monitor 20 inches - Black	Monitor	46,250	54,990	0	0
1300N	HP	HP LaserJet 1300N	Printer	22,600	23,700	5	0
2300Dn	HP	HP Laser A4 2300DN	Printer	43,900	46,000	2	2

Table I.3. Service Report.

Service Report 27-May-04

Code	Date	Customer	Brand	Model	Serial No.	Status	FinishDate	Engineer
S00101	1/5/2004	SC Matchbox	Apple	G41.25GHz/256/80/Combo/R9000PRO/OS9	QT1003RS78	Finish	3/5/2004	Chatchai
S00102	1/5/2004	Kampai Imaging Co.,Ltd.	HP	HP Laser A4 2300N	S1267399	Finish	2/5/2004	Virot
S00103	2/5/2004	DB Disigns Co.,Ltd.	Apple	iMac 17" LCD G41.25GHz/256/80/SD/Gefr FX 520	RT0003U8923	Finish	4/5/2004	Banyat
S00104	3/5/2004	NESATLE (THAI) LTD.	Apple	G5 DP 2.0GHz/512/160/SD/R9600PRO	ED9384B8F93	Finish	7/5/2004	Chatchai
S00105	6/5/2004	SC Matchbox	Sony	LCD Monitor 19 inches - White	28.900.489	Finish	10/5/2004	Watana
S00106	7/5/2004	71 Interscan	Apple	PB 17"/1.33G/512/80/SD/APX/BT	WR2435Y56U	Finish	14/5/2004	Virot
S00107	7/5/2004	Chan Wanich Security Printing	Apple	iMac 20" FP G41.25GHz/256/80/SDR	RE394Y94T6	Finish	10/5/2004	Watana
S00108	7/5/2004	Chan Wanich Security Printing	Umax	Astra 4700	456HG67	Finish	8/5/2004	Viboon
S00109	8/5/2004	Universal Forms Industry Co.,Ltd.	Apple	PB 17"/1.33G/512/80/SD/APX/BT	SW5678JH989	Waiting Part		Virot
S00110	9/5/2004	Mccann-Erickson Thailand	Umax	PowerLook 2100	389045nM	Waiting Part		Viboon
S00111	9/5/2004	Amarin Publishing Co.,Ltd.	Epson	830 Photo Printer	356HN67	Finish	12/5/2004	Banyat
S00112	10/5/2004	Sirivatana Printing Co.,Ltd.	Apple	Display 20"	CV466FG567G	Waiting Part		Watana
S00113	11/5/2004	Bangkok Post Publishing	Apple	Display 17"	LG567HN799D	Finish	15/5/2004	Watana
S00114	11/5/2004	Patra Ceramics Group	Sony	LCD Monitor 15 inches - White	45673D335	Finish	13/5/2004	Chatchai
S00115	14/5/2004	Digital Offset Asia Pacific Co.,Ltd.	Apple	iBook 14.1/933G4/256/40G/Combo	GH467HN7894	Checking		Virot
S00116	14/5/2004	C. Image Co.,Ltd	Hiti	630PS Photo Printer	12403n2006	Checking		Viboon
S00117	14/5/2004	Amarin Publishing Co.,Ltd.	Umax	PowerLook 4000	455O109	Finish	15/5/2004	Chuchart
S00118	15/5/2004	71 Interscan	Apple	G5 DP 2.0GHz/512/160/SD/R9600PRO	ZX3456Y56B78	Checking		Watana

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