



Order Processing System for
Architectural Product Trading and Service Company

By

Mr. Songkiat Techangamvong

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

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

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Project Title Order Processing System for Architectural Product Trading and Service Company

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ABSTRACT

Nowadays, the development of business and technology are growing together. Business growth is pushed by technology progress. Technology development is inspired by business mechanism. Information Technology is applied in all kinds of business, especially the large scale business. Even small and medium size enterprises require a computerized system.

The project presents the analysis and design of Order Processing System for Architectural Product Trading and Service Company. The proposed system covers all basic functions, which are registration, quotation arrangement, sales order arrangement, service arrangement, update product and stock. The new system is designed to solve the problems that are found in the existing manual system and to satisfy the business requirements. The system is developed based on the client-server approach, which accesses the data on a real time basis. In terms of application, the web-based technology is chosen because of simple development and friendly to use. In order to decrease the expenditure, the proposed system chooses the open source software to be the development tool. The Graphic User Interface (GUI) technology allows monitoring and analyzing information via workstations. The cost analysis and cost comparison is determined by using the payback period method and break-even analysis is considered.

The proposed system is developed not only for increased system efficiency, but also to decrease the operation cost. This project provides the direction of performing business with an excellent support system as a computerized system.

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I. INTRODUCTION

1.1 Background of the Project

In the late 1990s, Thailand's economy was damaged from the effect of the world economic crisis. Many business organizations were dissolved. Some large companies decreased their business scale. Unemployment rate increased. Due to this severe economic pressure, small and medium size enterprises (SMEs) theory comes into existence. Thai government supported the SME entrepreneurs in terms of capital and knowledge. Half a decade later, the Thai economy revived. Most SMEs which were set up during the crisis period grew, and the number of SMEs increased.

Until recently, more than 80% of SMEs run their business in a traditional way. Most enterprises are not well organized and operation processes are in chaos. All business transactions are run on a manual basis. Business communication is made by physical ways such as telephone and fax. These are the reasons why SMEs always run their business with low performance, less productivity and long lead times. The unorganized business structure of SMEs cannot support rapid growth.

Vispack Co., Ltd. is a traditional SME which trades architectural products such as floor tiles, rubber tiles, carpets, and roofs for both architectural customers and end users. Its growth rate is high and tends to increase each year. However, the unorganized business structure and manual operation cannot keep up with such growth. So Vispack Co., Ltd. cannot expand its business to its full potential. The solution is to adjust its organization, and to develop a computerized system which supports systematic operation. The project aims to develop the computerized information system for Vispack trading and service company.

1.2 Objectives of the Project

The main objective of the project is to develop a computerized information system for Vispack Co., Ltd.

To develop the computerized information system, the company has to define the problems as well as user requirements. This project will be completed only when most of the problems are solved and the system meets the user requirements. The following are the objectives of the project:

- (1) To analyze and adjust operation processes and procedures of Vispack Co., Ltd. in order to increase business performance and productivity.
- (2) To design and develop a new computerized information system to support current business operation and further business expansion.
- (3) To decrease operation cost and time consumption to fulfill business transactions.
- (4) To provide a well designed information gathering system which can support required information for strategic planning.

1.3 Scope of the Project

The project focuses on entire sales and service process which is the main function in this business. It starts from receiving contacts from customer, then providing action and reaction along business transactions including delivery of product and required service are made. The system covers 5 processes, which are customer registration, quotation arrangement, sales order arrangement, service arrangement, and product and stock adjustment.

1.4 Deliverables

The deliverables of the project on information system are as follows:

- (1) Data Modeling (ER Diagram)
- (2) Process Modeling (Context Diagram, Data Flow Diagram)
- (3) System Specification (Hardware and software specification)
- (4) Cost Benefit Analysis (Payback Period, Net Present Value)
- (5) Input Design (Input Screen of proposed system)
- (6) Output Design (Report from proposed system)
- (7) Application software developed by using various tools
- (8) Report design which covers the following:
 - (a) Quotations
 - (b) Product Requisitions
 - (c) Product Delivery Orders
 - (d) Job Delivery Orders
 - (e) Invoices
 - (f) Customer Summary Reports
 - (g) Quotation Summary Reports
 - (h) Sales Summary Reports
 - (i) Service Summary Reports
 - (j) Sales Data Reports
 - (k) Service Data Reports
- (9) Structure Design (Structure Chart)

1.5 Project Plan

After the project proposal is approved by the management, the development team prepared the project plan, as shown in Figure 1.1. The project plan of Vispack Co., Ltd. composes of three phases, detailed as follows:

- (1) System Analysis Phase:
 - (a) Define the objective and scope of the project.
 - (b) Study the existing system (Context Diagram, Data Flow Diagram).
 - (c) Identify the existing system problems.
 - (d) Study and analyze the business requirements and priorities of a new improved system.
 - (e) Generate the proposed system in the form of Entity Relationship Diagrams, Data Flow Diagrams.
 - (f) Analyze cost and benefit of existing system and proposed system.
- (2) System Design Phase:
 - (a) Evaluation of alternative solutions and specifications of a computerized system.
 - (b) Study how the system will meet the requirements identified during system analysis.
 - (c) Provide a physical design of the proposed system.
 - (d) Describe the data to be input, calculated, or sorted.
 - (e) Identify reports and other outputs to be produced by the system.
 - (f) Respond to provide programmers with complete and clearly outlined specifications that state what the software should do.

(3) System Implementation phase

Implementation includes all those activities that take place to convert from the old system to the new system. Two main stages are classified for implementing the proposed system, which are construction stage and delivery stage.



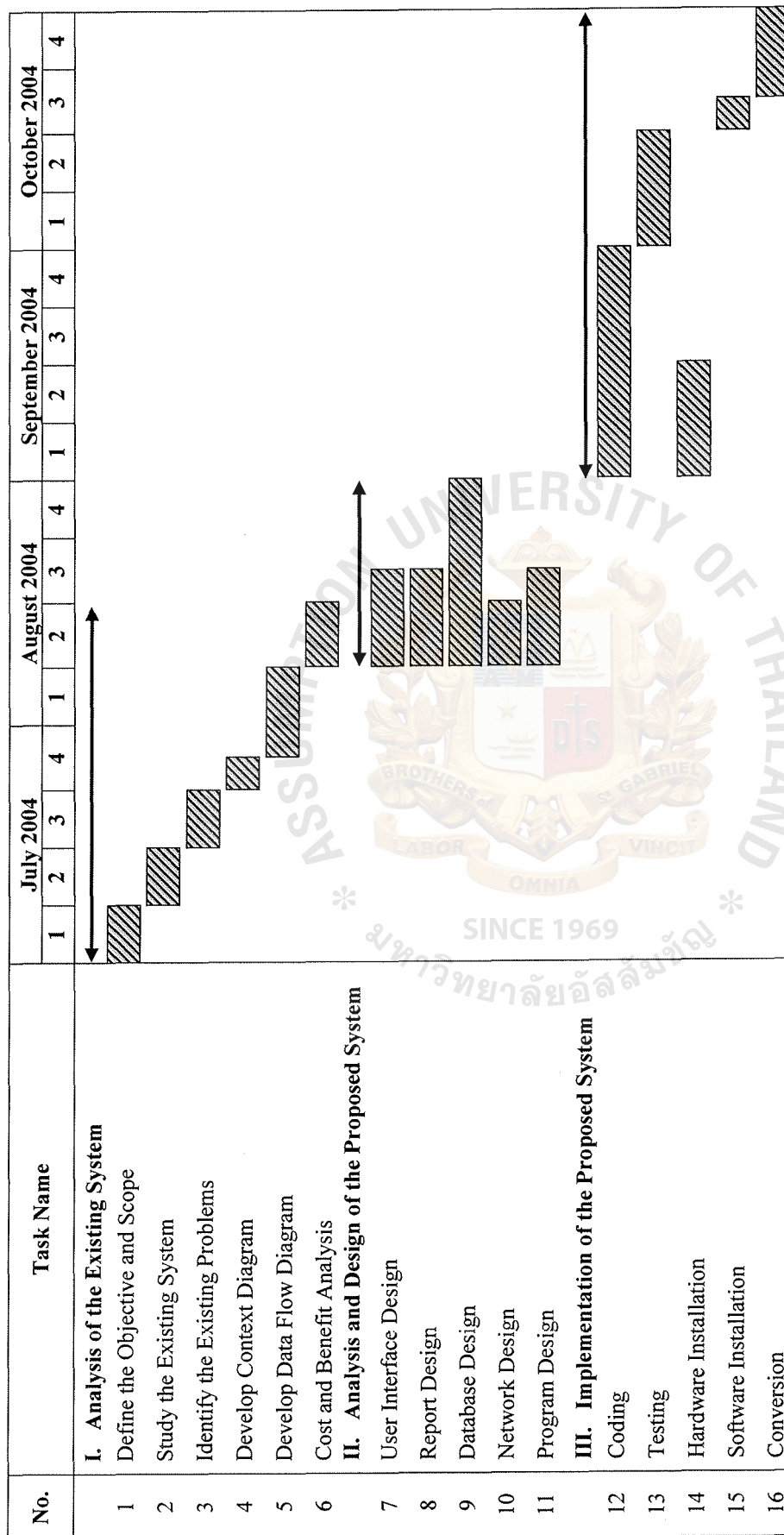


Figure 1.1. Project Plan.

II. THE EXISTING SYSTEM

2.1 Background of the Company

Vispack Co., Ltd. is a small business, which has been established since 1997. The company acts as the trader of architectural products such as floor tiles, rubber tiles, carpets, and roofs, etc. Some customers buy for reselling, while some customers buy for using. Installation service is also provided.

Due to the revival of Thai economy in 2002, Vispack Co., Ltd. expanded its business. Management team had to adjust the business structure to support rapid growth. The organization was arranged according to management requirements as shown in Figure 2.1. Vispack Co., Ltd. consists of 5 departments.

The first department of the organization chart is sales and marketing department. This department is responsible for sales functions, which are providing quotations and sales order processing. Sales and marketing department also manages all service cases. It gathers all business information and generate marketing plan for each situation.

The second department of the organization chart is service department. It reports to sales and marketing department. If the customer requires installation service, sales coordinator will generate service order pass to service department. Service staff will complete the job. Periodically, service staff sends the service status report to sales and marketing department.

The third department is purchasing and inventory department. This department concentrates on product procurement and acquisition from both domestic suppliers and international makers. Stock management is included in the functions of purchasing department as well.

The last two departments are finance and accounting department, and general administration department. For finance and accounting department, the activities include accounting activities and financial control. General administration department includes office management section and human resource section.

According to the project scope, Vispack information System concentrates on sales and marketing department, and service department.

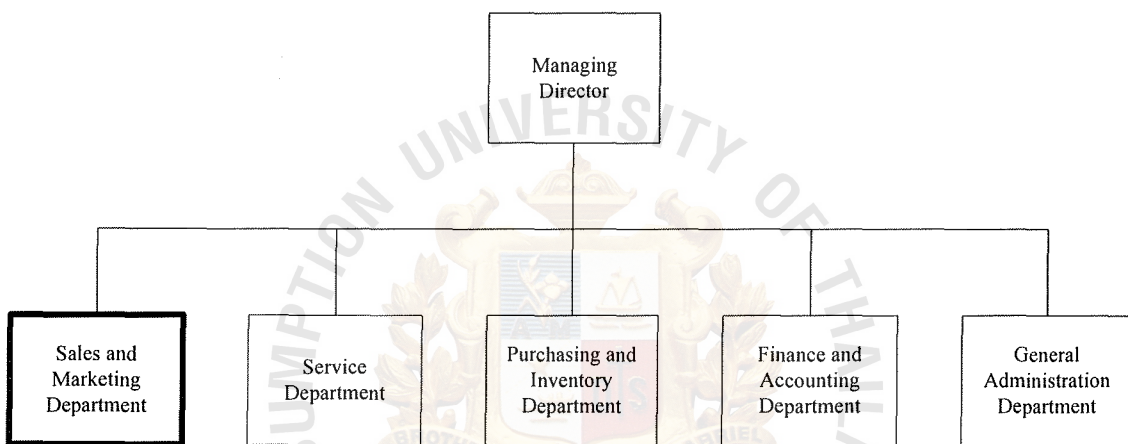


Figure 2.1: Organization Chart of Vispack Co., Ltd.

2.2 Existing Business Functions

As mentioned earlier, the existing system of Vispack Co., Ltd. is a manual system. Figure 2.2 and Figure 2.3 are the context diagram and data flow diagram that describe the existing system. The system is operated without well-organized data gathering. All processes are unorganized and in chaos.

In customer registration, the process starts when the new customer contacts the company, or when a salesperson approaches a new customer. The company profile is sent to the new customer. Sales coordinator records the customer profile manually in the MS Excel file.

In arranging quotation process, the customer sends the inquiry by phone call, facsimile or direct contact. If such inquiry requires service, the job details are sent to company. Inquiry is passed to sales coordinator in order to quote the price. Inventory of inquired product is checked from stock balance, and price is quoted according to price list. Service also calculated the price. Then quotation document is printed out and sent to customer by facsimile only.

In arranging sales order process, the customer will place an order according to the quoted price. Sales coordinator will send product requisition to inventory department. If such sales order is a trading case, product and invoice are prepared and delivered. If customer requires company service, product is sent with product delivery order. Then service order is sent to service department for further action.

The service order is sent to service department. After the ordered product has been delivered to customer site, service staffs install the product. The periodical status report is sent back to sales department. When the service is completed, the job inspection appointment is made to the customer. If the customer accept the job, job delivery order and invoice is sent to customer.

The inventory department always sends the information of new product lots. The stock balance is also updated to sales department. Sales coordinator accept the information and update information in product MS Excel file or stock MS Excel file according to the case.

Typically, management team requires monthly summary reports, which are customer summary report, sales summary report and service summary report. And the finance and accounting department also requires daily reports, which are sales data report and service data report.

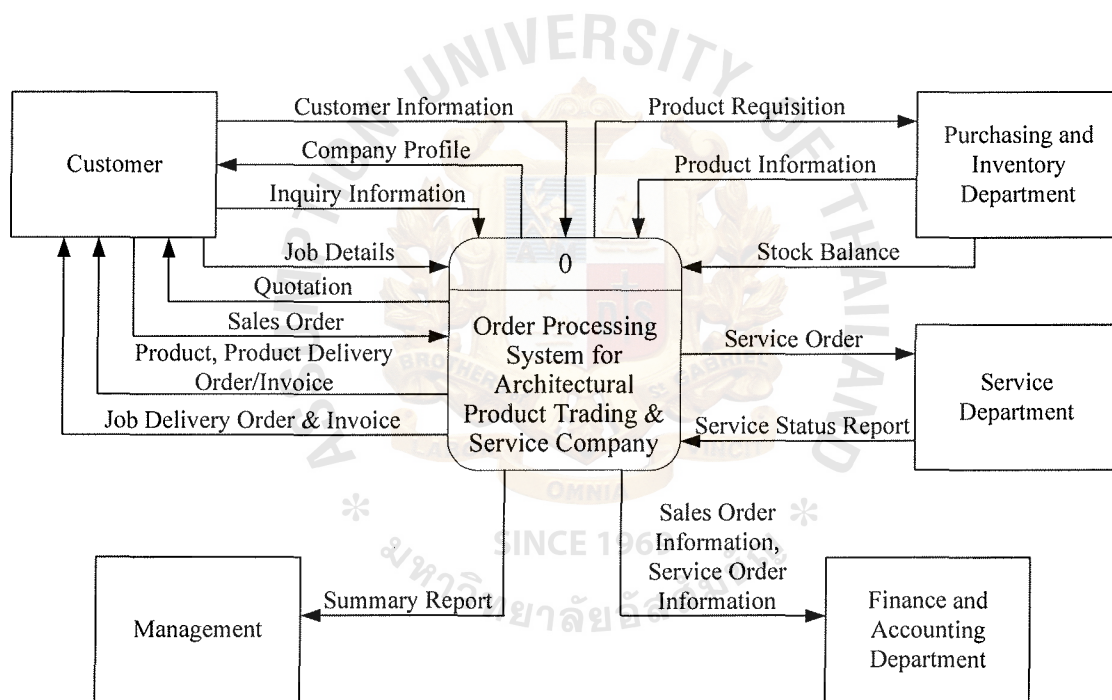


Figure 2.2. Context Diagram of Existing System.

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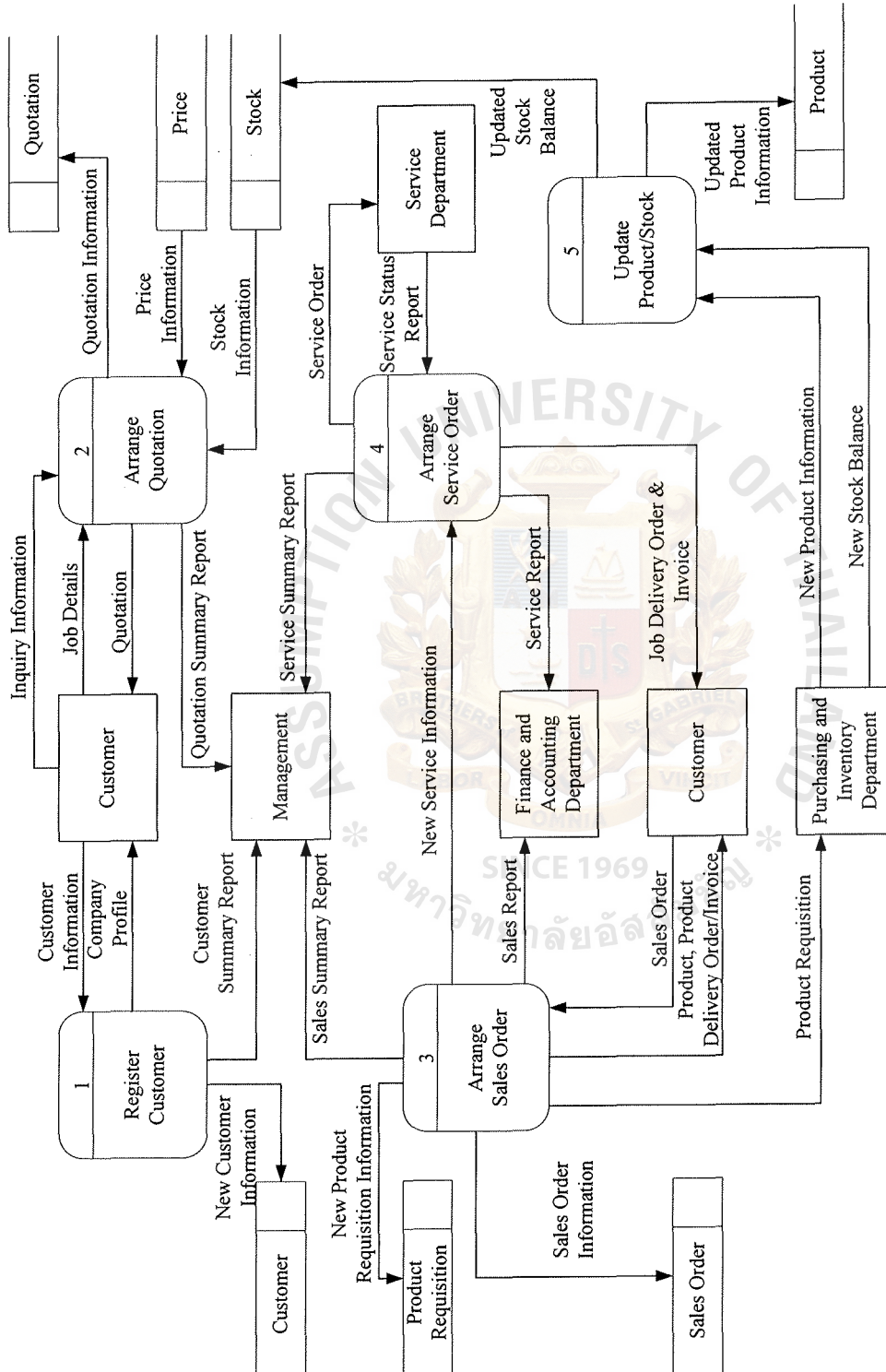


Figure 2.3. Data Flow Diagram of Existing System.

2.3 Existing Problems and Areas for Improvement

The existing Vispack Co., Ltd. information system operates manually. Some personal computers are used to provide documentation only. Due to the rapid growth of the company, the manual system cannot support overwhelming transactions. There are many problems such as duplication of work, lack of manpower utilization, inconsistency of information and reports. As a result, business is run with low productivity and high operating cost, and it cannot grow to its full potential.

Problem analysis was developed according to the Wetherbe's PIECES framework. The problem, opportunity, and directive statement are identified according to the checklist of Performance, Information, Economic, Control, Efficiency, and Service. Problems are analyzed and concluded as follows:

- (1) Manpower utilization and time consumption are not acceptable comparing to productivity. In the existing system, all processes are performed by humans. In order to complete each process, the manual system wastes more than 50% processing time.
- (2) Operation cost and opportunity cost are high. The paper-based operation consumes office supplies. The manual system cannot cover current numbers of sales transactions. The opportunity cost from losing sales transaction is increased.
- (3) Due to the lack of a database management, the data store of manual system is stored separately. Business information is inconsistent and redundant.
- (4) The company data store is incomplete. Strategic information such as sales information and customer information is incomplete and inconsistent.

- (5) Lack of data security and control causes information loss and error.

Moreover, the existing system cannot monitor process errors and illegal data access.

- (6) Due to future rapid growth, the existing system is impossible to support increasing business transactions.

From the defined problems, Table 2.1 describes urgency of solving, visibility of problem, annual benefits (if the problems are solved), priority of important problems and proposed solution. Table 2.2 describes causes and effects of problems, objectives of improvement and any constraints.



Table 2.1. Problem Statement Matrix.

Brief Statements of Problem, Opportunity, or Directive	Urgency	Visibility	Annual Benefit	Priority	Proposed Solution
1. The current manual system causes unutilized manpower, time consumption compared to productivity.	3 month	High	1,460,000	1	New system development
2. High operation cost and opportunity cost	6 month	High	377,800	2	New system development
3. Inconsistent information and redundant data stored between departments cause confusion and inconsistent operation.	6 month	Medium	Unknown	3	New system development with database management system
4. Incomplete strategic information occurs because of lack of unorganized data management.	9 month	Medium	Unknown	4	New system development with database management system
5. Lack of data security and control	12 month	Low	Unknown	4	New system development with security feature
6. Due to future rapid growth, the existing system is impossible to support increasing business transactions	ASAP	Low	Unknown	5	Future Plan

Table 2.2. Problem, Opportunities, Objectives, and Constraints Matrix.

Cause and Effect Analysis		System Improvement Objectives	
Problem or Opportunity	Cause and Effect	System Objective	System Constraint
(1) Manpower utilization and time consumption are not acceptable compared to productivity.	<p>(1) Manual system requires human actions in all steps of activities, and manual actions always consume amount of time.</p> <p>(2) Complicated company structure is an obstacle.</p>	<p>(1) Define and clarify business processes and procedures, and design the suitable steps of each process.</p> <p>(2) Promote the computerized actions instead of human actions in the possible processes.</p>	<p>(1) User training is seriously required.</p> <p>(2) High cost of development.</p>
(2) High operation cost and opportunity cost.	<p>(1) The operation cost increases because of waste of office supplies, and human error.</p> <p>(2) The sales transactions are increasing beyond office staffs' capacities. The opportunities cost occurs from lost sales transactions.</p>	<p>(1) Reduce paper work so that the office supplies are saved.</p> <p>(2) Provide keyless operation and promote computerized actions in possible processes.</p> <p>(3) Develop computerized system to support increasing sales transactions and business growth.</p>	<p>(1) User training is seriously required.</p>

Table 2.2. Problem, Opportunities, Objectives, and Constraints Matrix (Continued).

Cause and Effect Analysis		System Improvement Objectives	
Problem or Opportunity	Cause and Effect	System Objective	System Constraint
(3) Inconsistent information and redundant data stored between departments cause confusion and inconsistent operation.	(1) There is no Database Management System to arrange information gathering. (2) The existing network architecture cannot support information sharing.	(1) Develop the proposed system with the Database Management System. The DBMS should be based on relational database.	(1) Lack of knowledge in database management system. (2) Limited budget.
(4) Incomplete strategic information is occurred because of unorganized data management.	(1) There is no Database Management System to arrange information gathering. (2) The current system cannot provide the function of generating all necessary reports.	(1) Develop the proposed system with the application that supports report generating function.	(1) Lack of knowledge in database management system.

Table 2.2. Problem, Opportunities, Objectives, and Constraints Matrix (Continued).

Cause and Effect Analysis		System Improvement Objectives	
Problem or Opportunity	Cause and Effect	System Objective	System Constraint
(5) Lack of data security and control	<p>(1) The paper document allows any user to access and edit the information. Information loss and error always occur.</p> <p>(2) There is no security control in terms of user accessibility.</p>	(1) Develop the system security and control by determining accessibility restriction.	None
(6) Due to the future rapid growth, the existing system is impossible to support increasing business transaction	(1) Manual system cannot cover overwhelming paper works of increasing transactions.	(1) Analyze, design and develop the system with scalability so that it can support future growth.	(1) Limited budget.

III. THE PROPOSED SYSTEM

3.1 Requirement Analysis

The preliminary investigation and problem analysis of the existing system reveals many problems in terms of system performance, information, economics, efficiency, and system security. The new computerized information system is proposed to solve all stated problems. After all problems have been defined, user requirements have been analyzed. The requirement analysis has been held among all users from sales and marketing department, purchasing department, and inventory department. The business requirements have been divided into 2 categories; functional requirements and non-functional requirements.

Functional Requirements

- (1) The proposed system should provide the applications, which complete the main business functions presented below:
 - (a) Customer Registration
 - (b) Quotation Arrangement
 - (c) Sales Order Arrangement
 - (d) Service Order Arrangement
- (2) The proposed system should be able to complete minor functions in product information update and stock balance update.
- (3) The proposed system should generate reports periodically. The reports include the MIS reports to be presented to the management team, and data reports to involved departments.
- (4) The proposed system should support fast contact and response for internal users and customers.

Non-functional Requirement

- (1) The proposed system should be user friendly.
- (2) The proposed system should be able to produce the non-periodic reports for any decision making on demand.
- (3) The proposed system should encourage the paperless operation. Reports and documents should be presented to internal users in the form of display screen.
- (4) The proposed system should encourage the reducing of keyboard data entry in order to reduce human errors.
- (5) The proposed system should be stable and reliable.

The above mentioned functional and non-functional requirements are used as the base for system analysis and system design of this project.

3.2 System Analysis

After the scope of business requirements is defined, system analysis is prepared in order to provide the best solution for problem solving. System analysis is performed in 2 dimensions, Data Modeling and Process Modeling.

Data Modeling

Data Modeling is a technique for organizing and documenting a system's data. The complete data model is usually developed as a database. Typically, the data model is called an entity relationship diagram (ERD). In this project, System Architect CASE Tool is used to develop the diagrams. There are three levels of entity relationship diagrams: context data model, key-based data model, and fully attributed data model.

The context data model represents only the fundamental business entities and relationship between each entity. The context data model of Vispack information system consists of 8 entities, which have relationships with one another. The fundamental entity names are presented below:

- (1) Customer Entity
- (2) Product Entity
- (3) Price Entity
- (4) Quotation Entity
- (5) Sales Order Entity
- (6) Service Entity
- (7) Product Requisition Entity
- (8) Stock Entity

In key-based data model, the primary and foreign keys are added to each entity to present the unique characteristic of each entity and nonspecific relationships are resolved by introducing the associate entity. All relationships contribute foreign key

from their parent entities to child entities. Product and Customer entities have a single attribute primary key. Quotation, Sales Order, Price and Product Requisition entities have two attributes for identifying an instance of the entity. Stock and Service entities have three attributes for individual instance of the entity. All nonspecific relationships, or many-to-many relationship introduce the associate entities, which are Price Quote (associated between Price and Quotation) and Order Product (associated between Sales Order and Product).

Finally, the fully attributed data model identifies all attributes to be captured and stored in database and shows them on each entity. All attributes consist of primary key, foreign key and non-key attributes. The fully attributed data model requires the understanding of the data attributes for the system. For example, Quotation has Quotation ID and Customer ID as primary key; Quotation Date, Salesperson, and Quotation Status as non-key attributes, and Customer ID is also a foreign key attribute.

The complete entity relationship diagram of the proposed system is shown in Appendix A.

Process Modeling

Process modeling is a technique for organizing and documenting the structure and flow of data through a system's process and the logic, policies, and procedures to be implemented by system processes. Typically, the process model is called a data flow diagram (DFD).

To construct the process model, the context diagram is firstly drawn to establish the initial project scope, which defines how the developed system interacts with other systems and the business as a whole. Figure 3.1 illustrates the context diagram of the proposed system.

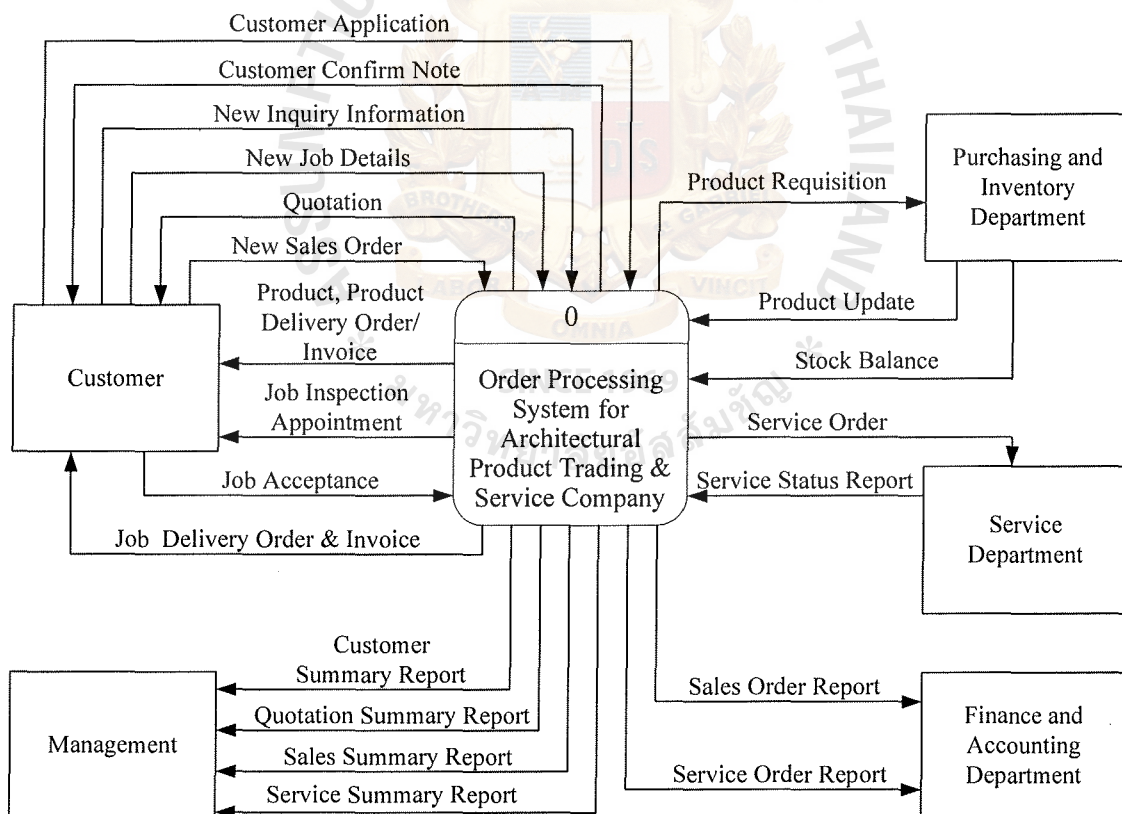


Figure 3.1. Context Diagram of Proposed System.

There are 5 external agents who contact the system.

- (1) Customer means a person who contacts the system in case of inquiry or order.
- (2) Service Department is an involved department which receives service orders and completes them. It has to report service status back to the system.
- (3) Purchasing and Inventory Department is an involved department which manages product availability and stock balance.
- (4) Management is a management team who needs MIS report for decision making.
- (5) Finance and Accounting Department is an involved department which requires sales data and purchase data.

From the context DFD, the system is further analyzed in functional decomposition diagram. The functional decomposition diagram shows the top-down structure of a system. This diagram serves as an outline for drawing the data flow diagram. The functional decomposition diagram of the proposed system is shown in Figure 3.2.

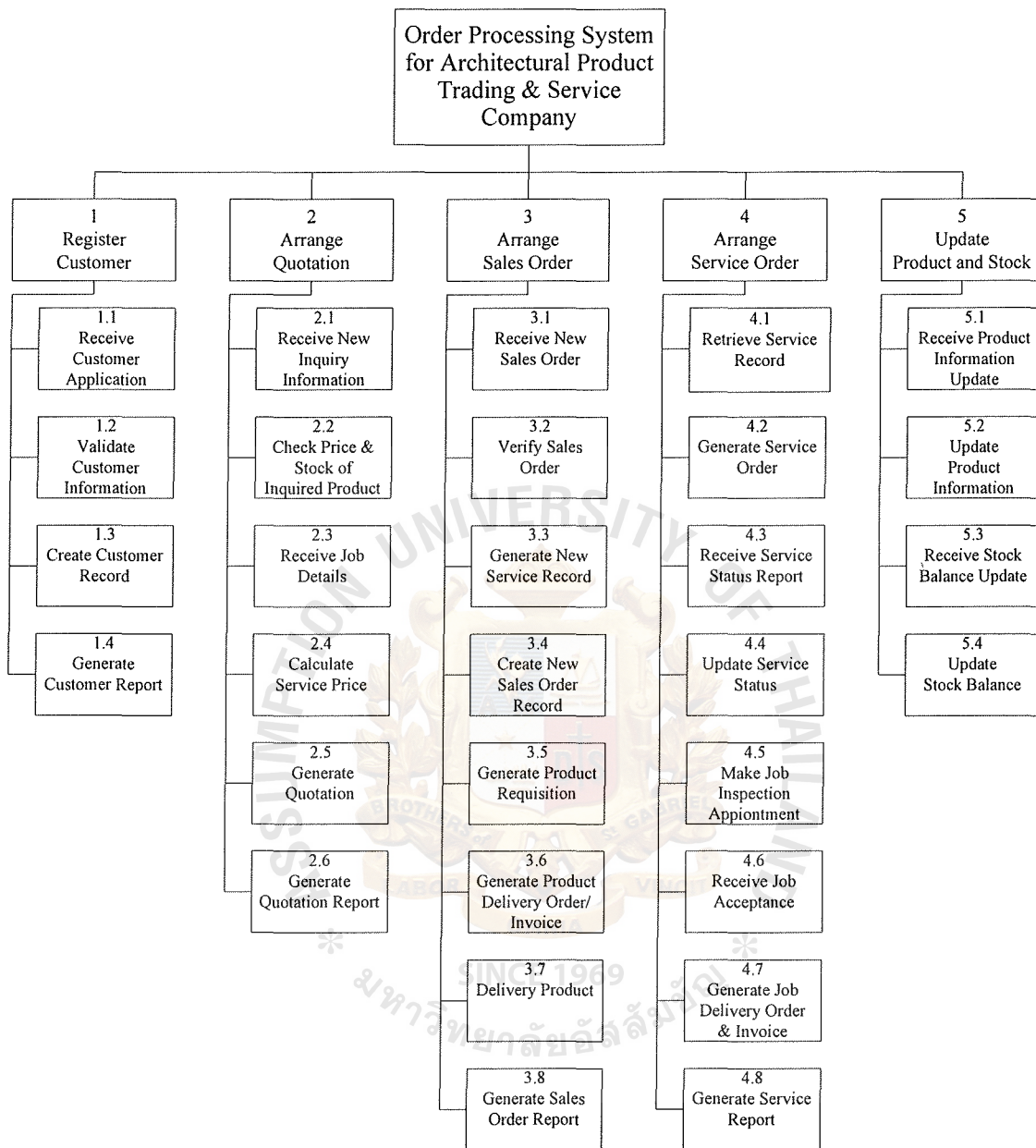


Figure 3.2. Functional Decomposition of Proposed System.

Vispack information system is composed of 5 processes, which are Customer Registration process, Quotation Arrangement process, Sales Order Arrangement process, Service Order Arrangement process and Product and Stock Update process. In order to complete each process, it can be further defined in detail.

A data flow diagram (DFD) can be drawn to depict the flow of data, which can describe the details of each process. A data flow diagram has many levels of details. The lower the level of data flow diagram, the more details of the processes within the system have. The details of each main process can be defined and described as follows:

(1) Register Customer

As the customer contact the system, they have to register their profile into the system. First, the system receives the application. The customer application is validated whether the input information is correct. The valid information is registered and recorded into the customer database. The confirmed notice is responded to customer. At the end of period, customer summary report is generated.

(2) Arrange Quotation

The process starts when the customer sends the inquiry information. The system gets product data, price data and stock data from product data stored and stock data stored to generate quotation. If the customer requires installation service, the system will receives job details. Service price is calculated. Then the system generates quotation to the customer. Finally, the quotation summary report is generated to management periodically.

(3) Arrange Sales Order

The system gets the sales order information from the customer. The sales order information is verified. If the customer requires installation service, the service requirement is recorded into service data stored, waiting for further process. The sales order information is recorded into sales order data stored. The system generates product requisition to purchasing and inventory department to prepare the shipment. In case of trading, product is delivered to customer with invoice. On the other hand, if the case is trading with service, product is delivered to customer with product delivery order. Then the installation service is proceeded in the next process. Finally, the system generates sales report and sales summary report to financial and accounting department and management.

(4) Arrange Service Order

In case that the customer required installation service, the system retrieves service record from service data stored. Then the service order is generated and sent to service department. Periodically, the service department generates service status report to the system. The status is updated to service data stored. When the service is completed, the system will issue job inspection appointment to customer. After customer inspects and accepts the job, the job acceptance is sent to the system. Then job delivery order and invoice are sent to customer. At the end of process, the system generates service report to financial and accounting department, and service summary report to management.

(5) Update Price and Stock Information

The purchasing and inventory department always send the new product information to the system. Normally, the new stock balance is updated to the system as well. When the system receives such information, the system will update product information and stock information into product data stored and stock data stored.

Figure 3.3 illustrates the Data Flow Diagram of Proposed System. The lower levels of Data Flow Diagram are shown in Appendix B.



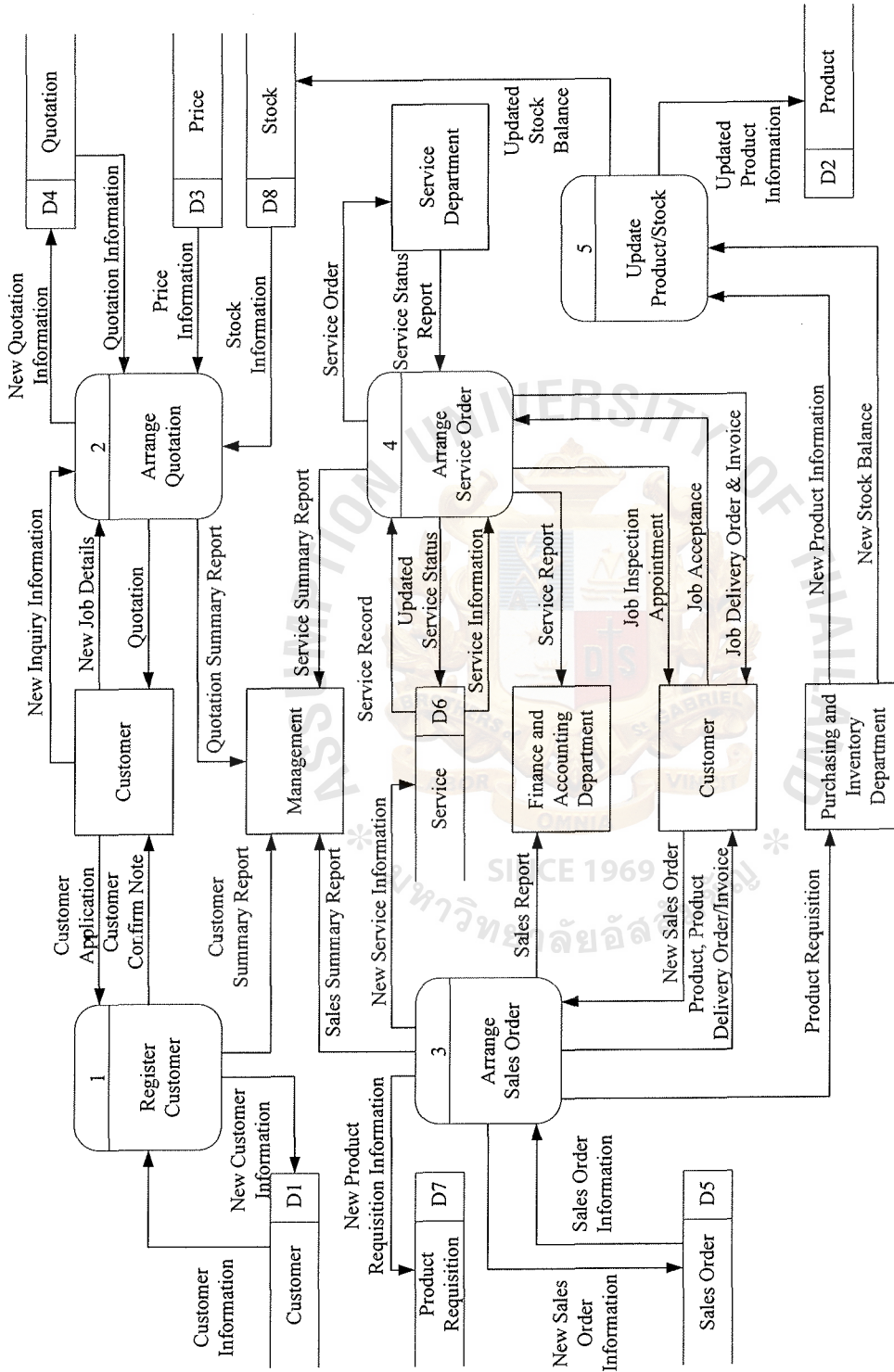


Figure 3.3. Data Flow Diagram of Proposed System.

3.3 Decision Analysis

The business requirement statements and the defined proposed system have been developed as a solution in decision analysis phase. In decision analysis phase, candidate solutions are identified and analyzed. This project identifies 3 candidate solutions. Then each candidate is analyzed in terms of technical feasibility, operational feasibility, economic feasibility, and schedule feasibility.

Candidate Solutions

After business requirements are established, candidate solutions can be identified from the ideas and opinions of the development team and user. Along with reviewing the system specification, three candidate solutions can be defined for the proposed system.

(1) Candidate 1: Database Server – MS Visual Studio.net & SQL server 2000

Database server is the most suitable architecture for data management. This solution provides multi-user environment. The relational database technology is applied in order to gain full efficiency in data management. MS Visual Studio.net and SQL server 2000 are used as development tool and database software respectively.

This candidate fully supports all business functions according to user requirements. Even though SQL server is complicated, it provides higher capacity in data management. MS Visual Studio.net and SQL server 2000 are compatible products. Moreover, they are Microsoft products which provide user friendly property.

(2) Candidate 2: Web-based Database Server – MS ASP.net & SQL server 2000

Database server provides efficient data management. Web-based application provides wide accessibility. MS ASP.net and SQL server 2000 are used as development tool and database software. This candidate allows the system the advantages of relational database technology and database management concept. It fully supports all user requirements. Due to the simple characteristic of web-based, it provides wide accessibility for both internal users and external customers. Moreover, web-based application can be implemented very quickly. Application development applies MS ASP.net, which is a familiar tool in programming. It requires only a web server software and web browser to develop and run the application. SQL server 2000 is a compatible product which provides stability and full technical support.

(3) Candidate 3: Web-based Database Server – PHP & MySQL

Professional Home Page and MySQL are used in this candidate to develop the web-based application. This candidate consumes the advantages of database server. It also provides wide accessibility by web-based application. Moreover, the development tools are less expensive. Apache web server is a powerful open source software for running the application. PHP is a suitable open software for application development. MySQL is an open source database for DBMS.

Table 3.1 illustrates the candidate system matrix of proposed system, which describes the characteristics of each candidate in more details. The columns of the matrix represent candidate solutions. The rows of the matrix represent characteristics that differentiate the candidates.

Table 3.1. Candidate Systems Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate3
<p>Portion of System Computerized</p> <p>Brief description of that portion of the system that would be computerized in this candidate.</p>	Fully supported all basic business functions for company's general system	Fully supported all basic functions in Order Processing System	Same as candidate 2
<p>Benefit</p> <p>Brief description of the business benefits that would be realized for this candidate.</p>	Powerful DBMS and application enable user performing their tasks more efficiently and effectively.	Powerful DBMS and web-based application enable user performing their tasks with quick and wide accessibility.	Powerful DBMS and web-based application enable user performing their tasks with quick and wide accessibility.
<p>Servers and Workstations</p> <p>A description of servers and workstations needed to support this candidate.</p>	Server: XEON 2.4 GHz Workstation: Pentium IV 2.4 GHz	Same as candidate 1	Same as candidate 1
<p>Software tools needed</p> <p>Software tools needed to design and build that candidate (e.g., database management system, emulators, operating systems, languages etc.) Not generally applicable if applications software packages are to be purchased</p>	<p>OS & DBMS</p> <ul style="list-style-type: none"> • Microsoft Windows 2000 Server • Microsoft Windows XP Professional • SQL Server 2000 <p>System Development Software</p> <ul style="list-style-type: none"> • Visual Studio.net <p>Internet Software</p> <ul style="list-style-type: none"> • Internet Explorer 6 <p>Document Preparation Software</p> <ul style="list-style-type: none"> • Microsoft Office 2002 • System Architect 2001 	<p>OS & DBMS</p> <ul style="list-style-type: none"> • Same as candidate 1 <p>System Development Software</p> <ul style="list-style-type: none"> • ASP.net <p>Internet Software</p> <ul style="list-style-type: none"> • Same as candidate 1 <p>Document Preparation Software</p> <ul style="list-style-type: none"> • Same as candidate 1 	<p>OS & DBMS</p> <ul style="list-style-type: none"> • Linux Red Hat 8.0 • Microsoft Windows XP Professional • MySQL 3.23.54 <p>System Development Software</p> <ul style="list-style-type: none"> • PHP 4.3.0 <p>Internet Software</p> <ul style="list-style-type: none"> • Same as candidate 1 <p>Document Preparation Software</p> <ul style="list-style-type: none"> • Same as candidate 1
<p>Application software</p> <p>A description of the software to be purchased, built, accessed, or some combination of three techniques.</p>	Customized Solution	Same as candidate 1	Same as candidate 1
<p>Method of data processing</p> <p>Generally some combination of: on-line, batch, deferred batch, remote batch, and real-time.</p>	Client Server	Client Server Web-Based	Client Server Web-Based

Table 3.1. Candidate Systems Matrix (Continued).

Characteristics	Candidate 1	Candidate 2	Candidate3
<p>Output devices and implications</p> <p>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).</p>	<p>Display: 15" Monitor</p> <p>Laser Printer: HP 1200 LaserJet</p> <p>Inkjet Printer: HP DeskJet 3550</p> <p>Dot-Matrix Printer: Epson LQ-300+</p>	Same as candidate 1	Same as candidate 1
<p>Input devices and implications</p> <p>A description of input methods to be used, input devices (e.g., Keyboard, mouse, etc.), special input requirements (e.g., new or revised forms from which data would be input), and input considerations (e.g., timing of actual inputs)</p>	<p>Keyboard</p> <p>Mouse</p> <p>Scanner HP 3570 C</p>	Same as candidate 1	Same as candidate 1
<p>Storage devices and implications</p> <p>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.</p>	<p>MS SQL Server DBMS with 20 GB storage capacity</p>	Same as candidate 1	Same as candidate 1

Feasibility Analysis

(1) Operational feasibility

It is a measure of how well the solution will work in the organization.

It is also a measure of how people feel about the system/project. All candidates fully support the current business process but candidate 2 and candidate 3 have higher feasibility than candidate 1 because they can fulfill all requirements and are suitable for Order Processing System.

(2) Technical feasibility

It is a measure of practicality of a specific technical solution and availability of technical resources and expertise. All three candidates require same technical skill in database design. They are simple in application development as well. MS Visual Studio.net, which is development tool of candidate 1, is very simple and familiar for programmers. Candidate 2 and candidate 3, which are web-based application use web server and web browser in application development. Candidate 2 uses MS ASP.net and Internet Information System 5.0 which are familiar tools for programmers. Candidate 3 uses PHP and Apache server which require more technical skill.

(3) Economic feasibility

It is a measure of the cost-effectiveness of a project or solution. Candidate 2 consumes the highest expenditure. The license fee of development software for DBMS and application is high. The network cost is also expensive. The cost of candidate 1 is also high because of license fee on development software. Candidate 3 is the cheapest solution.

In terms of effectiveness, candidate 2 and candidate 3 provide higher effective rate than candidate 1.

(4) Schedule feasibility

It is a measure of how reasonable the project timetable is. Candidate 1 spends the longest time in database and application development and implementation. Candidates 2 and 3 take equal time in development and implementation. Web-based characteristics support fast development and implementation.

The feasibility assessment is provided for each candidate solution. The score is recorded directly in the cell for each candidate's feasibility criteria assessment and assigned to each feasibility criteria for each candidate, and multiplied by the weight. The weight is distributed from the total 100% to all four feasibility criteria according to their degree of importance. Operational Feasibility, Technical Feasibility and Economic Feasibility is granted 30% equally. The management team concentrates on Operational Feasibility. Due to the limited knowledge of technology, the development team concentrates on Technical Feasibility. Economic Feasibility is concentrated because of limited budget. The rest 10% is granted to Schedule Feasibility because the existing system is still running. There is enough time to develop the system. The weighted scores of each feasibility criteria are summed up for each candidate to rank the candidate solution of the proposed system. Candidate 3 has the highest total score, and ranks the best solution for the proposed system.

Table 3.2 shows the feasibility analysis matrix for each candidate. In addition, the details of Economic Feasibility by cost-benefit calculations are shown in Appendix C, which are all Estimated Cost of Candidate tables, Payback Period 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 support all basic business function of Order Processing System Score: 90	Fully support all basic business function and business requirement of Order Processing System Score: 100	Same as candidate 2 Score: 100
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 to the technical expertise needed to develop, operate, and maintain the candidate system.	30%	Visual Studio.net is a great developing software that programmers can use to develop program by using familiar language. Easy to use. Score: 85	ASP.net is great a development tool for web application. Familiar technology provides easy development. Maintenance is easy because server will compile source code automatically. It provides easy access through internet explorer. Score: 90	PHP is a popular web development tool. It is open source program. PHP is easy in maintenance because server will compile source code automatically. Application provides easy access through internet explorer. Score: 90
Economic Feasibility Cost to develop: Payback period (discounted): Net present value: Detailed calculations:	30%	Approximately 1,186,800 baht Approximately 1 year 6 months Approximately 2,896,008.42 baht See Appendix C Score: 90	Approximately 1,453,300.00 baht Approximately 2 years 3 months Approximately 1,802,436.03 baht See Appendix C Score: 70	Approximately 1,211,300.00 baht Approximately 1 year 9 months Approximately 2,044,436.03 baht See Appendix C Score: 90
Schedule Feasibility An assessment of how long the solution will take to design and implement.	10%	Approximately 10 Months Score: 65	Approximately 6 months Score: 90	Approximately 6 months Score: 90
Ranking:	100%	86	87	93

3.4 System Design

After completing the feasibility analysis, the proposed system, which is chosen, is passed to system design phase. The system design phase starts at the application architecture design, structure design, process specification, database design and system interface design. Well-designed specifications are used in system construction and implementation.

System Architecture

Business requirement statements mention that the proposed system should support both internal users and external users. External users include customers, prospective customers and suppliers. In order to fulfill the business requirements, the proposed system is designed as web-based application and database server.

The web-based application is based on World Wide Web architecture so that it can support wide accessibility. The web-based application consists of two components, which are web server and web browser. The Order Processing System has to support heavy access from internal users, so the proposed system includes web server development.

The system architecture describes details of data architecture, interface architecture, process architecture and network architecture.

(1) Data Architecture

The proposed system manages data by using database management system or DBMS. Centralized data system is applied. Physical data are kept in the centralized database server. Multi-users interact database server via terminals. In term of database design, relational database concept is applied so that the system consumes full advantages of database server. Data are stored in tabular form, in which each file contains data in rows

(records) and columns (fields). All tables have relationship to each other. The proposed system chooses MS SQL server as the software for DBMS. SQL is used for creating table and view, insert record, delete records, update and read.

(2) Process Architecture

Software Development Environment (SDE) for the proposed system consists of programming language with built-in SQL connectivity, which is Professional Home Page (PHP 4.3.0). It provides Rapid Application Development (RAD) for building Graphical User Interface, automatic code generation with associated system events, various database connectivity and interoperability, report writing tools, and more. Finally, programming language has to support web-based application development.

(3) Interface Architecture

The proposed system will store all user interface and business logic on clients. On-line processing is used, so that users can do transactions or inquire for some information from the system. In addition, input devices and output devices are identified as follows:

(a) Input Devices

Computer mouse and keyboard are major input devices of the proposed system because they are simple and currently available. Scanner is an optional input device for the system.

(b) Output Devices

PC Monitor and printers are output devices of the proposed system. The client will use Graphical User Interface (GUI) technology to increase the learning curve of users.

(4) Network Architecture

At present, the existing network infrastructure of the system is Local Area Network (LAN) with Ethernet star topology. For the proposed system, all network resources and database are shared among clients through LAN.

Structure Design

To facilitate the development of the computerized system, structure design technique is used to break up the program into a hierarchy of modules that results in a program that is easier to implement and maintain.

Data Flow Diagram (DFD) from requirement analysis section is used as input of structure design. The logical DFD, which depicts the business requirement of the proposed system, is converted to program DFD, which illustrates the technical aspects of the proposed system. The output of structure design is partitioned data flow diagram and structure chart, which is illustrated in Appendix D.

Process Specification

The purpose of a process specification is to define what the system does to transform inputs into outputs. It provides the details of system processes in table format, which is easier to look at all related input, output, and relevant process than in a diagram. All specified tables, which are the processes from the logical data flow diagram, are shown in Appendix E.

Data Dictionary

To support system design, data dictionary provides a list of terms and definitions for all data items and data stores within the developed system. The data dictionary for both entity relationship diagram and data flow diagram is shown in Appendix F.

Database Design

Referring to the data model (ERD) in the previous section, it requires some additional processes called data analysis to convert the designed logical data model into implemented database. In data analysis, a normalization technique is used to transform all data in ERD into applicable database. The result of database design is database structure in table format, which is shown in Appendix G.

Input Design

During requirement analysis, inputs are modeled as data flows that consist of data attributes and connect external entities to process, process to data store and process to process. System output can be easily identified from the data flow that is sent from external entity. The selected attributes are reviewed to define the proper caption or label that identifies these attributes on the input screen. Input controls ensure that the data input to the computer is correct and that the system is protected against accidental and intentional errors and abuse, including deception.

After identifying system inputs and review logical requirement, the input screens of proposed system are designed to accept the information for generating report, and storage into data store. The input screens of the proposed system are in Appendix H.

Output Design

Outputs are the most visible component of a working information system and present information to system user. Information from the data flow diagram is required in the output design. System output can be easily identified from the data flow that is sent to external entity. More details are obtained from interviewing system user.

Outputs can be classified according to their distribution inside or outside the organization and the people who read or use them. The details of each class are different. The examples of the report design are in Appendix I.

3.5 Hardware and Software Requirements

The current order processing system is manual. The existing hardware consists of three stand alone personal computers. Any server is not developed in this system. In terms of software, the operating system software and application software are illegal software. In order to implement the proposed system, new hardware equipments and software programs should be acquired.

The hardware equipments consist of two servers which run the services as Web Server and Database Server. The proposed system requires operating system software and software for web server and software for database management. The hardware and software specification for server are shown in Table 3.3, Table 3.4 and Table 3.5.

Table 3.3. Hardware Specifications of the Database Server.

Hardware	Specification
CPU	Intel ® XEON™ Processor 2.4 GHz
Cache Memory	512 KB L2 cache
Primary Memory	512 MB DDR SDRAM Memory or higher
Hard Drive	36 GB Ultra 320 SCSI Hard Drive
Backup Drive	CD-RW 52x24x52
Floppy Drive	1.44MB/Boot
Display	15" CRT Color Monitor
Input Device	PS/2 Keyboard 104 keys, PS/2 Mouse

Table 3.4. Hardware Specifications of the Web Server.

Hardware	Specification
CPU	Intel ® XEON™ Processor 2.4 GHz
Cache Memory	512 KB L2 cache
Primary Memory	512 MB DDR SDRAM Memory or higher
Hard Drive	36 GB Ultra 320 SCSI Hard Drive
CD-ROM Drive	24X IDE
Floppy Drive	1.44MB/Boot

Table 3.5. Software Specifications of the Server.

Software	Specification
Operating System x 2 units	Red Hat Linux 8.0
DBMS	MySQL 3.23.54
Web Server	Apache 1.3.27

According to the proposed system, the workstation requires a web browser (such as MS Internet Explorer), to run the developed program, and some application programs (such as word processing and spreadsheet), to perform general functions. The workstation should have hardware specification that support Microsoft Windows XP Professional and Microsoft Office 2002 as general standard. The hardware and software specification for each workstation are shown in Table 3.6 and Table 3.7.

Table 3.6. Hardware Specifications for the Workstations.

Hardware	Specification
CPU	Intel® Pentium® 4 Processor 2.4 GHz
Cache Memory	512KB ON-DIE L2
Primary Memory	256MB DDR SDRAM Memory
Hard Drive	40GB with 7200 rpm
CD-ROM	48X Max
Floppy Drive	1.44MB 3.5"
Display	15" CRT Color Monitor
Input Device	PS/2 Keyboard 104 keys, PS/2 Mouse

Table 3.7. Software Specifications for the Workstations.

Software	Specification
Operating System	Microsoft Window XP Professional
Web Browser	Microsoft Internet Explorer 6.0
Application Software	Microsoft Office 2002

Table 3.8. Other Hardware Specifications.

Hardware	Specification
Printer	Laser Printer: HP 1200n LaserJet Dot-Matrix Printer: Epson LQ-300+ Inkjet Printer: HP DeskJet 3550
Scanner	HP ScanJet 3570C
UPS	For Server: 1500 VA For Workstation: 550 VA

Table 3.9. Network Peripheral Specifications.

Network Peripheral	Specification
Network topology	Star topology
Switching Hub	Switching Hub 12 ports 10/100 Mbps
LAN Card	10/100 Mbps
Wiring and cable	UTP 4 pair CAT 5
Leased Line	256 Kbps Leased Line

Table 3.10. Software Specifications for the development.

Software	Specification
System Development Software	PHP 4.3.0
Document Preparation Software	Microsoft Office 2002 System Architect 2001

The system proposes web-based application with World Wide Web technology. The user can access application and information via common interface. Web-based application can be easily developed with a widely used development tool. Due to the developed software, workstations do not have to be installed because they can be accessed by using web browser software to execute the developed application stored on the server. The network architecture of the proposed system is shown in Figure 3.4.

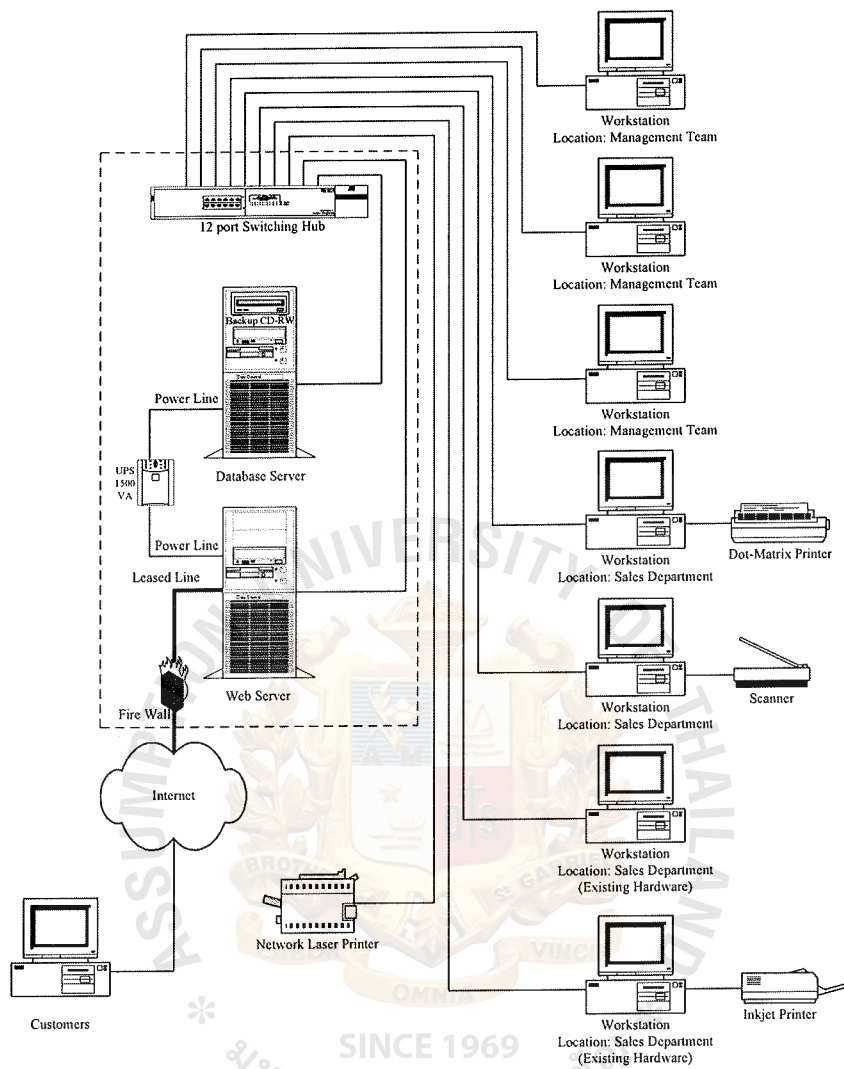


Figure 3.4. Network Configuration of the Proposed System.

3.6 Security and Controls

According to business requirements, the proposed system has to provide security and control policy. Minimum security standards must be applied to every computerized system to prevent unauthorized access and alteration to the system.

(1) Identification

The system must have a unique User ID and Administrator ID. The procedure to control the creating of User ID must be set up to ensure proper verification over system users. User responsibility to the system must be specified in advance before granting authorized level to each user. Users are divided into two groups, which are internal user and external user. Internal User ID, which is shared among company staff, has the authority to access business functional operation. External User ID for customers and suppliers is granted the right to view information only. Administrator ID must be carefully assigned to the responsible person for managing all User ID of the system. System log is required to keep track of all changes made to the system.

(2) Authentication

The password system is required to authenticate the assigned User. The characteristics of good password feature are specification of a range of password ID, locks User ID when incorrect password is entered and non-displaying of password on system screen. The user should keep password secret for protecting unauthorized persons from using their password to enter the system and making unauthorized information change to the system.

(3) Authorization

The security policy has determined 3 levels of authorized users, which are administrator, internal user and external user. Assignment of the authorized level of user must be attentive to limit the area of accessing the system because of sensitivity of data and software. Authorized level is changed or deleted when the user changes responsibility or resigns.

(4) Auditing

The system must have audit trail to investigate the system in case of unauthorized access and alteration to the system. The audit trail may be in form of a system log to monitor the changes to the system and access violation. This log has to be reviewed by the assigned person on a consistent basis.

(5) Production Environment

When developing the new application program, the system must ensure that it is separated from the development area and the production area. In production area, the developed program is not modified without authorization.

(6) Backup and Recovery

The system is necessary to have backup and recovery because the system information may be damaged from unauthorized user, software virus, or even hardware problem. Backup may be done on daily, weekly or monthly basis depending on backup schedule and importance of information. Recovery process must be cleared to ensure that all relevant persons know how to restore information from backup media into production and do not damage useful information.

3.7 Cost/Benefit Analysis

In decision analysis phase, all candidates are discussed and compared in terms of feasibility. One dimension of the feasibility analysis is economic feasibility. Economic feasibility measures the cost effectiveness of the project, and it has been defined as a cost-benefit analysis. The cost and benefit of existing system and proposed system are compared. Cost is classified into fixed cost and variable cost. Fixed cost is the certain expenditure that occurs in a fixed rate, and variable cost is the uncertain expenditure that occurs in proportion to some usage factor. Benefit is classified as tangible and intangible. Tangible benefit is measurable such as cost saving, and sales increasing, whereas intangible benefit is unpredictable such as the opportunity cost.

Therefore, the cost of both systems are clarified and calculated as shown in the following tables and figures. And benefits of the new system are presented in terms of tangible and intangible. Finally, the cost and benefit information is analyzed in terms of break-even analysis and payback period in order to present the effectiveness of the proposed system.

(1) Cost of the existing system

The existing system is operated manually so that the fixed cost is only office equipment cost and the variable cost or the annual operating cost, includes salary cost and office supplies & miscellaneous expenses. The office equipment that the company uses in the operation consists of two personal computers, two electrical typewriters and five electrical calculators. In terms of human resources, the existing system requires a manager, four supervisors for making basic decision, ten staffs for operation and documentation. In the manual system, office supplies and

miscellaneous cost is high. The details of the existing system cost are summarized in Table 3.11 and Table 3.12 presents five years accumulated existing system cost.

Table 3.11. Cost of Existing System, in Baht.

Cost Items	Years				
	1	2	3	4	5
Fixed Cost					
Personal Computer 2 unit @ 15,000	30,000.00	-	-	-	-
Typewriter 2 unit @ 8,000	16,000.00	-	-	-	-
Calculator 5 units @ 2,000	10,000.00	-	-	-	-
Total Fixed Cost	116,000.00	-	-	-	-
Operating Cost					
Salary Cost:					
Manager 1 units @ 35,000	420,000.00	462,000.00	508,200.00	559,020.00	614,922.00
Supervisor 4 units @ 20,000	960,000.00	1,056,000.00	1,161,600.00	1,277,760.00	1,405,536.00
Staff 10 units @ 10,000	1,200,000.00	1,320,000.00	1,452,000.00	1,597,200.00	1,756,920.00
Total Annual Salary Cost	2,580,000.00	2,838,000.00	3,121,800.00	3,433,980.00	3,777,378.00
Office Supplies & Miscellaneous Cost					
Stationary Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Paper Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Utility Per Annual	12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Miscellaneous Per Annual	8,000.00	8,800.00	9,680.00	10,648.00	11,712.80
Total Annual Office Supplies & Miscellaneous Cost	45,000.00	49,500.00	54,450.00	59,895.00	65,884.50
Total Annual Operating Cost	2,625,000.00	2,887,500.00	3,176,250.00	3,493,875.00	3,843,262.50
Total Existing System Cost	2,741,000.00	2,887,500.00	3,176,250.00	3,493,875.00	3,843,262.50

Table 3.12. Five Years Accumulated Manual System Cost, in Baht.

Year	Total Existing System Cost	Accumulated Cost
1	2,741,000.00	2,741,000.00
2	2,887,500.00	5,628,500.00
3	3,176,250.00	8,804,750.00
4	3,493,875.00	12,298,625.00
5	3,843,262.50	16,141,887.50
Total	16,141,887.50	

(2) Cost of proposed system

The proposed system cost is also classified into fixed cost and annual operating cost. The fixed cost includes hardware cost, software cost, network cost, people-ware cost, maintenance cost and implementation cost. The annual operating cost has the same cost category as in the existing system cost which are salary cost, office supplies & miscellaneous expenses and system operation cost. For the proposed system, hardware cost consists of servers cost, workstations cost, and other hardware equipments cost. Software cost comprises of software cost of servers and workstations. Network cost includes network equipment cost. People-ware cost is cost in hiring people for developing the system, which includes system analysts, programmers and network specialist. Maintenance cost is the cost of maintenance of both software and hardware. Implementation cost includes training cost and set up cost. The new system reduces the number of staff and officers and rotates the existing employees to do other works. The number of manager is the same. Due to the computerized system, paperwork is reduced, so paper usage decreases and other office supplies and miscellaneous cost also decrease. The details of the proposed system cost are summarized in Table 3.13 and Table 3.14 presents five years accumulated computerized system cost.

Table 3.13. Estimated Cost of Proposed System, in Baht.

Cost Items		Years				
		1	2	3	4	5
Fixed Cost						
Hardware Cost:						
Server	2 units @ 132,000/5	52,800.00	52,800.00	52,800.00	52,800.00	52,800.00
Workstation	5 units @ 27,500/5	27,500.00	27,500.00	27,500.00	27,500.00	27,500.00
Laser Printer	1 unit @ 25,500/5	5,100.00	5,100.00	5,100.00	5,100.00	5,100.00
Dot-Matrix Printer	1 unit @ 9,000/5	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00
Inkjet Printer	1 unit @ 2,000/5	400.00	400.00	400.00	400.00	400.00
Scanner	1 unit @ 5,300/5	1,060.00	1,060.00	1,060.00	1,060.00	1,060.00
UPS - Server	1 unit @ 10,000/5	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
UPS - Workstation	5 unit @ 2,000/5	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Network Cost:						
Wiring Cost	10 units @ 900/5	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00
Switching Hub	1 unit @ 10,000/5	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Router	1 unit @ 40,500/5	8,100.00	8,100.00	8,100.00	8,100.00	8,100.00
Total Hardware Cost		104,560.00	104,560.00	104,560.00	104,560.00	104,560.00
Maintenance Cost						
Software Maintenance		-	4,000.00	4,400.00	4,840.00	5,324.00
Hardware Maintenance		-	8,000.00	8,800.00	9,680.00	10,648.00
Total Maintenance Cost		-	12,000.00	13,200.00	14,520.00	15,972.00
Software Cost:						
Server Software Cost		-	-	-	-	-
Workstation Software Cost		17,000.00	17,000.00	17,000.00	17,000.00	17,000.00
Total Software Cost		17,000.00	17,000.00	17,000.00	17,000.00	17,000.00
People-Ware Cost:						
System Analyst	2 units @ 96,000	192,000.00	-	-	-	-
Programmer	2 units @ 48,000	96,000.00	-	-	-	-
Network Specialist	1 unit @ 20,000	20,000.00	-	-	-	-
Total People-Ware Cost		308,000.00	-	-	-	-
Implementation Cost:						
Training Cost		235,000.00	-	-	-	-
Installation Cost		60,000.00	-	-	-	-
Total Implementation Cost		295,000.00	-	-	-	-
Total Fixed Cost		724,560.00	133,560.00	133,560.00	133,560.00	133,560.00
Operating Cost						
Salary Cost:						
Manager	3 units @ 35,000	420,000.00	462,000.00	508,200.00	559,020.00	614,922.00
Supervisor Staff	3 units @ 20,000	720,000.00	792,000.00	871,200.00	958,320.00	1,054,152.00
Officer Staff	6 units @ 10,000	720,000.00	792,000.00	871,200.00	958,320.00	1,054,152.00
Computer Officer	1 units @ 6,000	180,000.00	198,000.00	217,800.00	239,580.00	263,538.00
Total Annual Salary Cost		2,040,000.00	2,244,000.00	2,468,400.00	2,715,240.00	2,986,764.00
System Operating Cost		192,000.00	211,200.00	232,320.00	255,552.00	281,107.20
Office Supplies & Miscellaneous Cost						
Stationary	Per Annual	9,000.00	9,900.00	10,890.00	11,979.00	13,176.90
Paper	Per Annual	4,000.00	4,400.00	4,840.00	5,324.00	5,856.40
Utility	Per Annual	8,400.00	9,240.00	10,164.00	11,180.40	12,298.44
Miscellaneous	Per Annual	4,200.00	4,620.00	5,082.00	5,590.20	6,149.22
Total Annual Office Supplies & Miscellaneous Cost		25,600.00	28,160.00	30,976.00	34,073.60	37,480.96
Maintenance Cost		12,000.00	13,200.00	14,520.00	15,972.00	17,569.20
Total Annual Operating Cost		2,257,600.00	2,483,360.00	2,728,696.00	3,004,865.60	3,305,352.16
Total Proposed System Cost		2,994,160.00	2,630,120.00	2,876,776.00	3,154,397.60	3,456,481.36

Table 3.14. Five Years Accumulated Computerized Cost, in Baht.

Year	Total Proposed System Cost	Accumulated Cost
1	2,994,160.00	2,994,160.00
2	2,630,120.00	5,624,280.00
3	2,876,776.00	8,501,056.00
4	3,154,397.60	11,655,453.60
5	3,456,481.36	15,111,934.96
Total	15,111,934.96	

(3) Comparison of system cost

After both the existing system cost and proposed system cost are identified, a comparison table is constructed to disclose the cost saving after implementing the proposed system. The figures of the comparison of the system cost are summarized in Table 3.15.

Table 3.15. Comparison of the Accumulated Manual Cost and Accumulated Proposed Cost, in Baht.

Year	Accumulated Existing System Cost	Accumulated Proposed System Cost
1	2,741,000.00	2,994,160.00
2	5,628,500.00	5,624,280.00
3	8,804,750.00	8,501,056.00
4	12,298,625.00	11,655,453.60
5	16,141,887.50	15,111,934.96

(4) Benefit Analysis

The benefits of the proposed system can be classified into tangible and intangible benefits. The tangible benefit might be measured in terms of unit of cost saving or profit. The intangible benefit is benefit that is difficult to qualify. The details of both types of benefits can be summarized as follows:

Tangible Benefits

The tangible benefit of the proposed system is grouped into four main categories as follows:

Cost Saving:

The proposed system introduces a new way in handling paperwork. The number of staff and officers is fewer in operating the system. The demand for paper and stationary is reduced because information is stored in electronic form. Mailing channel is not necessary for the new system; therefore, no mailing expense is incurred.

Opportunity Cost Saving:

The proposed system provides systematic sales order arrangement and service arrangement. So opportunity cost from losing customer and delay in operations can be reduced.

Operation System Improvement:

According to the new system, work of employees is reduced and that enables them to find new customers, new image of the company or a new channel such as web which might persuade new customers to subscribe.

Operation Time Improvement:

Due to the computerized system, the system decreases the employees' work and that can be calculated as reducing of one clerk.

Table 3.16. Tangible Benefit of Proposed System, in Baht.

Benefit Items		Price	
<u>Operation Cost Saving:</u>			
Salary Cost:			
1	Supervisor (20,000 baht per month)	240,000.00	
4	Staffs (10,000 baht per month)	480,000.00	
Office Supplies Cost:			
	Stationery	6,000.00	
	Paper	6,000.00	
	Utility	3,600.00	
	Miscellaneous	3,800.00	
	Total Office Supplies Cost	19,400.00	
Miscellaneous Expenses:			
	Mailing Expense (500 baht per month)	6,000.00	
Total Cost Saving			745,400.00
<u>Opportunity Cost Saving:</u>			
	Transaction Lost from Service Delay	500,000.00	
	Delay Operation	160,000.00	
Total Opportunity Cost Saving			660,000.00
<u>Operation System Improvement:</u>			
15	New Customer		1,500,000.00
<u>Operation Time Improvement</u>			
1	Staff (10,000 baht per month)		120,000.00
Total Tangible Benefit:			3,025,400.00

Intangible Benefits

The intangible benefits of the proposed system are customer satisfaction, better decision making, improved employee effectiveness, and a better company image.

(5) Break-even Analysis

Break-even Analysis shows the point where the cumulative cost of the existing system is equal to the cumulative cost of the proposed system.

The break-even point of the proposed system is depicted in Figure 3.5.

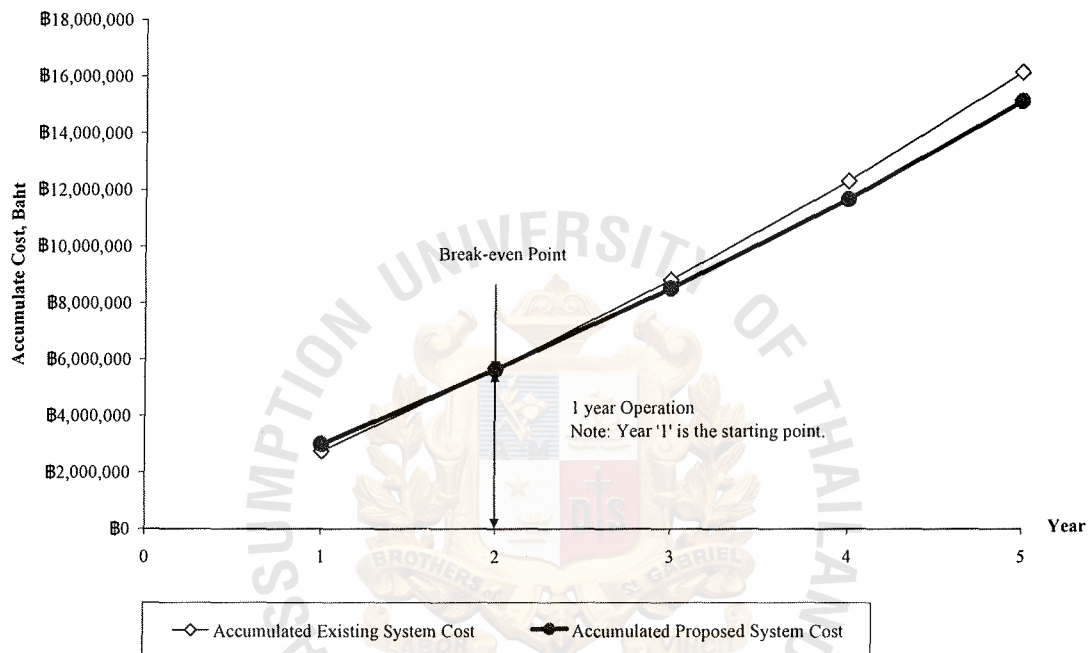


Figure 3.5. Break-even Analysis.

(6) Payback Period

Payback analysis technique is a simple and popular method of determining when an investment will pay for itself. Because system development costs are incurred long before benefits begin to accrue, it will take some time for the benefits to overtake the cost. Payback analysis determines how much time will lapse before growing benefits overtake growing and continuing cost. Figure 3.6 shows the payback period of the proposed system that is calculated to evaluate the candidate solution (See

the full details in Table C.3 in Appendix C). The result of payback period is 1 year and 9 months, which is less than the predefined maximum desired payback period (2 years). Thus, this project is acceptable for implementation with the return on investment to recover the initial investment within 2 years.

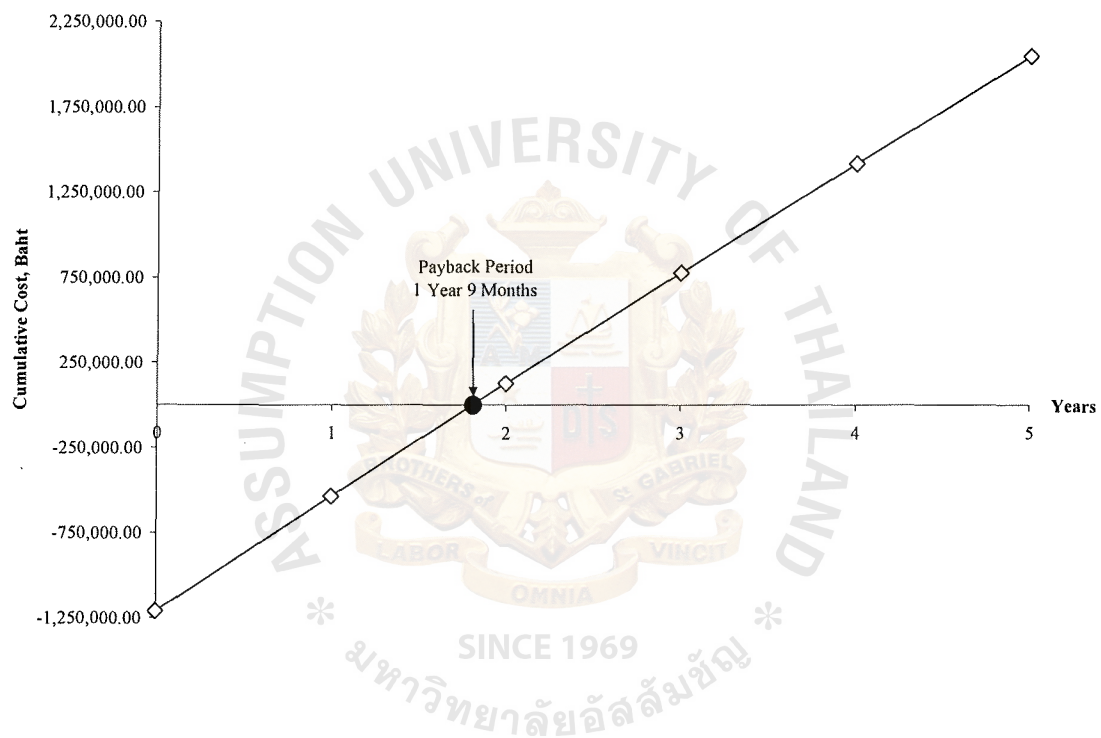


Figure 3.6. Payback Period Analysis of the Proposed System.

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

The proposed system has been analyzed and designed as mentioned in the previous chapter. The proposed system is developed and ready to be implemented in the current operation. The process of system implementation can be classified into many types which are presented briefly as follows:

(1) Hardware and Software Acquisition and Installation

The proposed system can be developed with some existing hardware. The existing personal computers are applied as part of the workstations. Servers, workstations and network equipments are acquired to complete the infrastructure. Software is acquired as open source, except the operating system of workstation. Hardware and software installation has to be performed with good planning, because it may affect current operations.

(2) Personnel Training

Training is divided into two parts, which are advanced training for system administrator, and basic training for system users. The advanced training includes system configuration, active directory management and database administration. The basic training includes application functions and how to use it.

(3) Site and Data Preparation

The site is prepared to implement the new system. Infrastructure is developed including LAN cabling, network configuration, servers and workstations installation. Then the users prepare the data in order to input into the database of the new system.

(4) System Testing

Testing is conducted to ensure that the proposed system is working properly. Unit testing, System Testing, and Integration Testing are done to fulfill this objective.

(5) Conversion Plan

The conversion plan has to be prepared to serve as a guideline for the entire conversion process. The conversion can be performed as Abrupt cut-over, Parallel conversion, Location conversion, or Staged conversion.

4.2 Stages of Project Implementation

The overall processes of project implementation can be categorized into two main stages, which are detailed as follows:

(1) Construction Stage

The purpose of the construction stage is to develop and test a functional system to ensure that the new system is able to fulfill the business and design requirements and to implement the interfaces between the existing system and the proposed system. The activities of this stage are concluded as follows:

- (a) Network infrastructure of the proposed system is installed and tested.
- (b) Databases are developed according to the design. Data is created in the database. The database system is tested.
- (c) The web-based application is developed according to defined process specification and structure design. User interface and output report is developed. Then testing is performed.

(2) Delivery Stage

The delivery stage is prepared to transit to the new system smoothly.

This stage covers system testing, conversion preparing, and converting.

The activities are concluded as follows:

- (a) Network is configured for the new system.
- (b) Databases and application are installed and tested.
- (c) Training and documentation are provided individually for the new system user and system administrator.
- (d) Conversion plan is prepared as parallel conversion in order to ensure the system is smooth.

4.3 Conversion

Conversion from the current system to the new one is done in parallel with the current operation. In system conversion, technical problems and unexpected problems can occur. The current system is run as a backup system until the new system can operate smoothly.

4.4 System Acceptance Testing

System acceptance test is the final system test performed by users using real data. Verification test is run by using simulated data. Then validation test is run in order to ensure smooth system performance. Finally, audit test is run to ensure that all errors in application are eliminated.

4.5 Training and Documentation

Before the new system is implemented completely, training and documentation must be prepared for the system users. The document proved which to be useful in developing the new system must be collected. User manual is created to cover all system functions. The benefits of training are reviewed for system users'

understanding and the training session should be in-group to encourage group-learning possibilities.

4.6 System Maintenance

When the proposed system is implemented into operation, maintenance of the system is done essentially. Generally, this activity includes maintenance and improvement of the system and program. The purpose of program maintenance is to solve any possible program errors that occur after the system is implemented. The system analyst and programmer must coordinate for solving the program bugs and advise the users to fix the system problems by themselves.

When the new system operates, the system needs to be evaluated for performance and efficiency at some period of time. Appraisal is used as a standard in deciding to improve the system. Evaluation and improvement should be done at least once in three months to guarantee that the system still works efficiently.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This project is proposed to be the new computerized system to support the business operation of Order Processing System for Architectural Product Trading and Service Company. As the existing system is a manual system, business operation is performed with low productivity, and time consumption. It cannot support rapid business growth. The proposed system provides the solution to solve defined problems with fast response and more efficiency.

In terms of cost and benefit analysis, the proposed system shows that system development and operation consume less expenditure than in the existing system. Some costs such as salary cost and opportunity cost are reduced and eliminated. The cost comparison shows that the proposed system cost during first is higher than the cost of existing system because of some development cost of the new system in the first year. In the long-term period, cost of the proposed system drops and becomes less than that of the existing system.

In term of business operation, the proposed system provides the benefit of manpower utilization. Referring to the tangible benefit in Table 3.15, the proposed system saves 1 company supervisor and 4 company staffs. Moreover, the business expansion leads the increasing business transactions. The proposed system can support rest 6 staffs of company to fulfill the increasing business transactions.

The proposed system provides not only cost saving and manpower utilization, but also time saving as shown in the Table 5.1.

Table 5.1. Degree of Achievement of Proposed System.

Process	Existing System	Proposed System
Register Customer Process	20 mins.	2 mins.
Arrange Quotation Process	30 mins.	3 mins.
Arrange Sales Order Process	30 mins.	2 mins.
Arrange Service Process	3 hrs.	10 mins.
Update Product & Stock Information	10 mins.	5 mins.

(1) Register Customer Process

The Register Customer Process of the existing system spends 20 minutes because of manual operation. As soon as new customer contacts the system, the staff gathers the customer information and validates it by checking with data file. The valid user information is recorded to the file by keying. The proposed system provides computerized process with less time consumption and information security.

(2) Arrange Quotation Process

The existing system consumes 30 minutes to complete one quotation manually. The proposed system provides computerized processes including, price quoting, stock checking, service price calculating and quotation generating. It consumes only 3 minutes to complete one quotation. Moreover, all quotations are kept as strategic information with security policy.

(3) Arrange Sales Order Process

The existing system consumes 30 minutes to arrange one sales order. Paper-based processes are replaced by computerized processes, which include receiving orders through web-based application, order verifying,

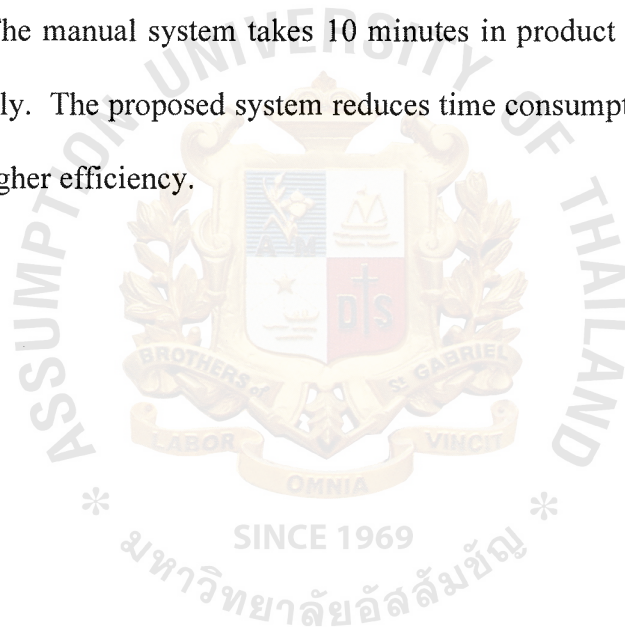
and order recording. All sales orders are kept as strategic information and input of other process with security policy.

(4) Arrange Service Process

The existing system consumes 3 hrs to arrange one service. Time is spent in inter-department process. Paper-based processes are replaced by computerized processes. All sales orders are kept as strategic information and input of other process with security policy.

(5) Update Product and Stock Process

The manual system takes 10 minutes in product and stock adjusting manually. The proposed system reduces time consumption to be 5 minutes with higher efficiency.



5.2 Recommendations

The proposed system offers solutions for all basic business functions for increasing performance and productivity, and decreasing cost and time consumption. However, the system should be further developed as per the following recommendations:

- (1) The proposed system covers only sales and marketing department. It has to contact service department, purchasing and inventory department, and finance and accounting department. The system should be further developed to connect with service system, purchasing and inventory management system, and finance and accounting system. The further developed system should cover the business transactions and information flow from sales and marketing department to mentioned departments.
- (2) Referring to customer relationship management (CRM) concept, existing customer is as precious as new customer. To maintain existing customer requires good customer support system. As the proposed system offers the web-based application to support sales and service transaction, the structure of proposed web-based application can be further developed to support customer relationship management function. However, the CRM's development means the big change in organization and operation. It requires more investment and internal cooperation.



APPENDIX A
ENTITY RELATIONSHIP DIAGRAM

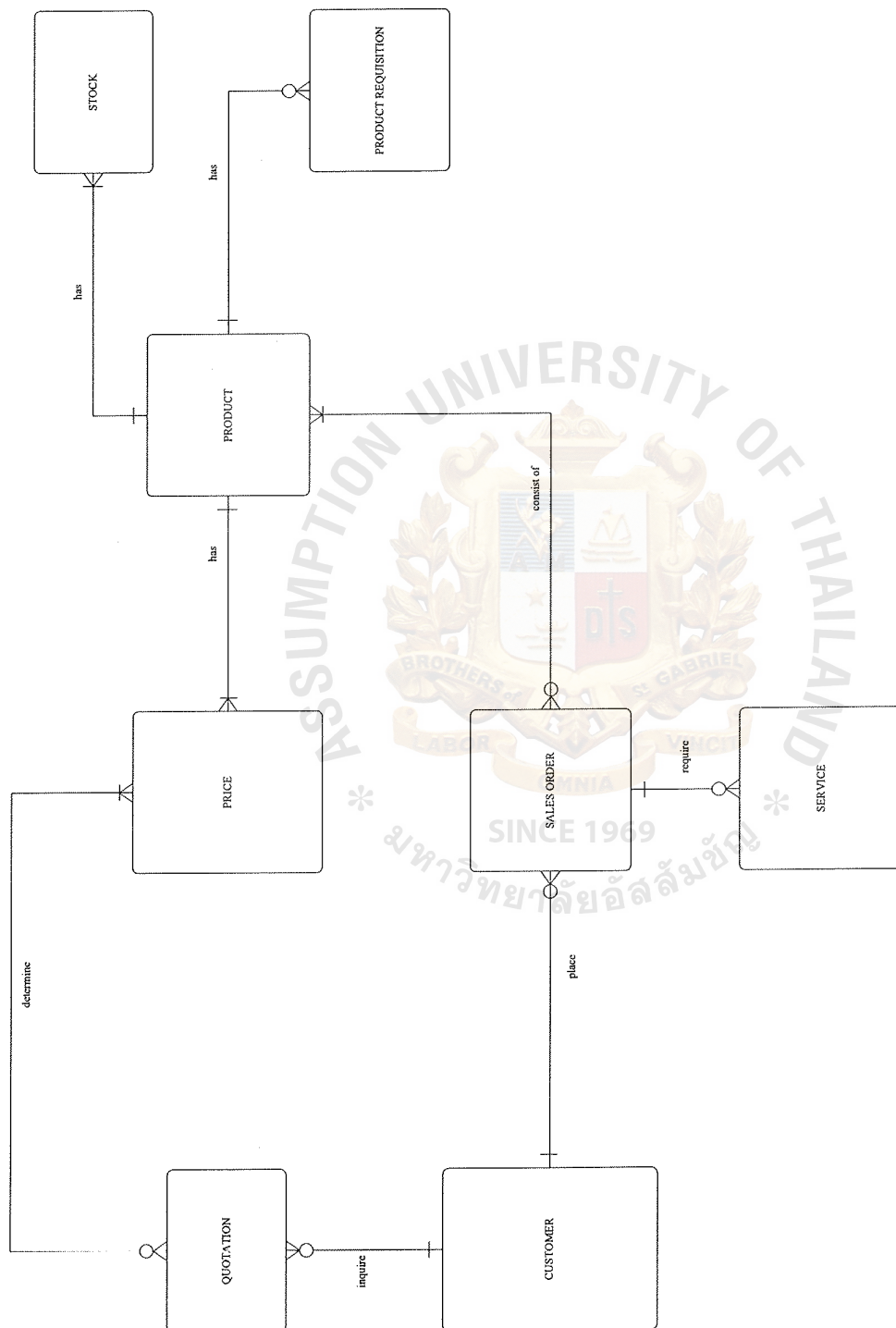


Figure A.1. Context Data Model of the Proposed System.

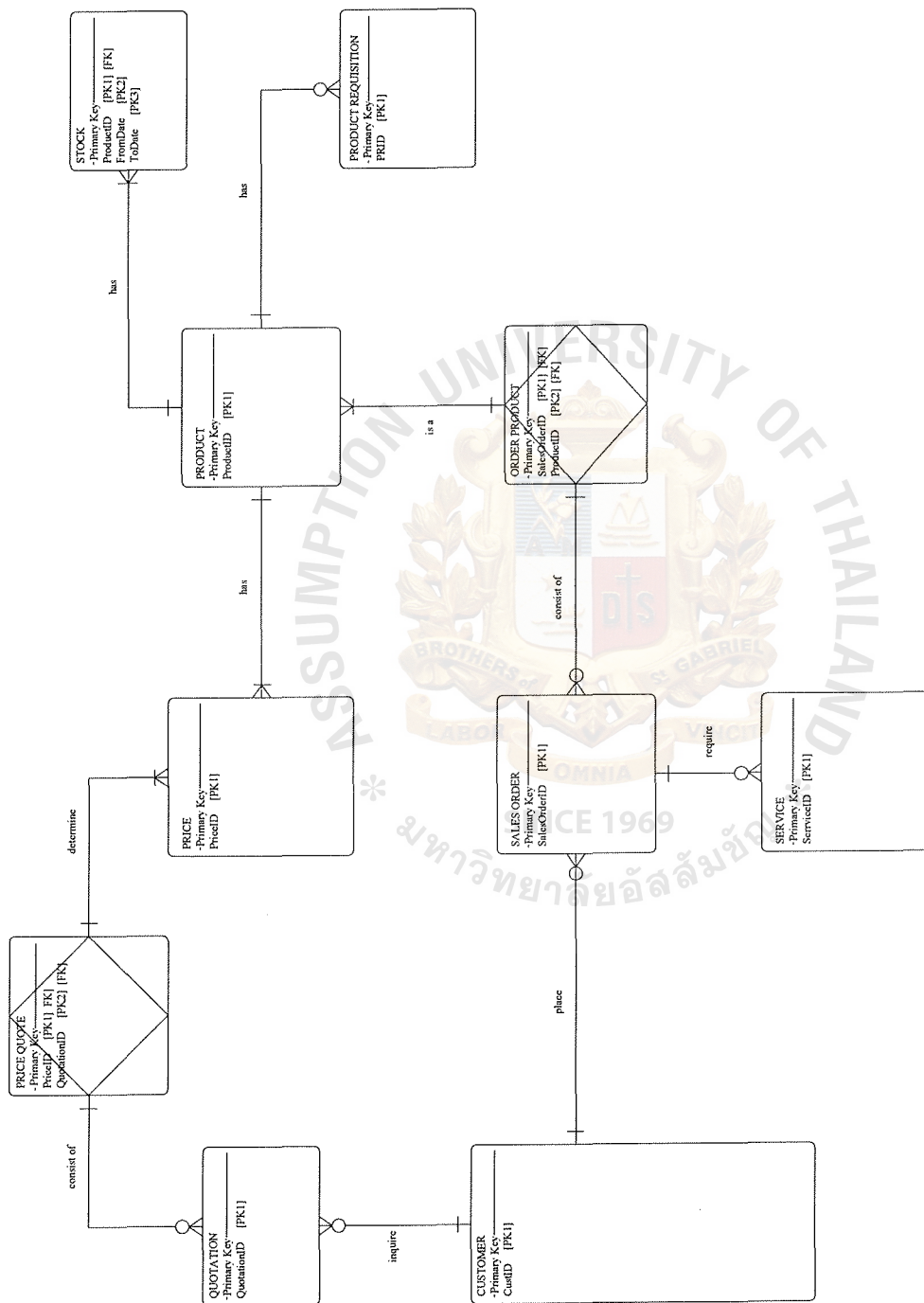


Figure A.2. Key-based Data Model of the Proposed System.

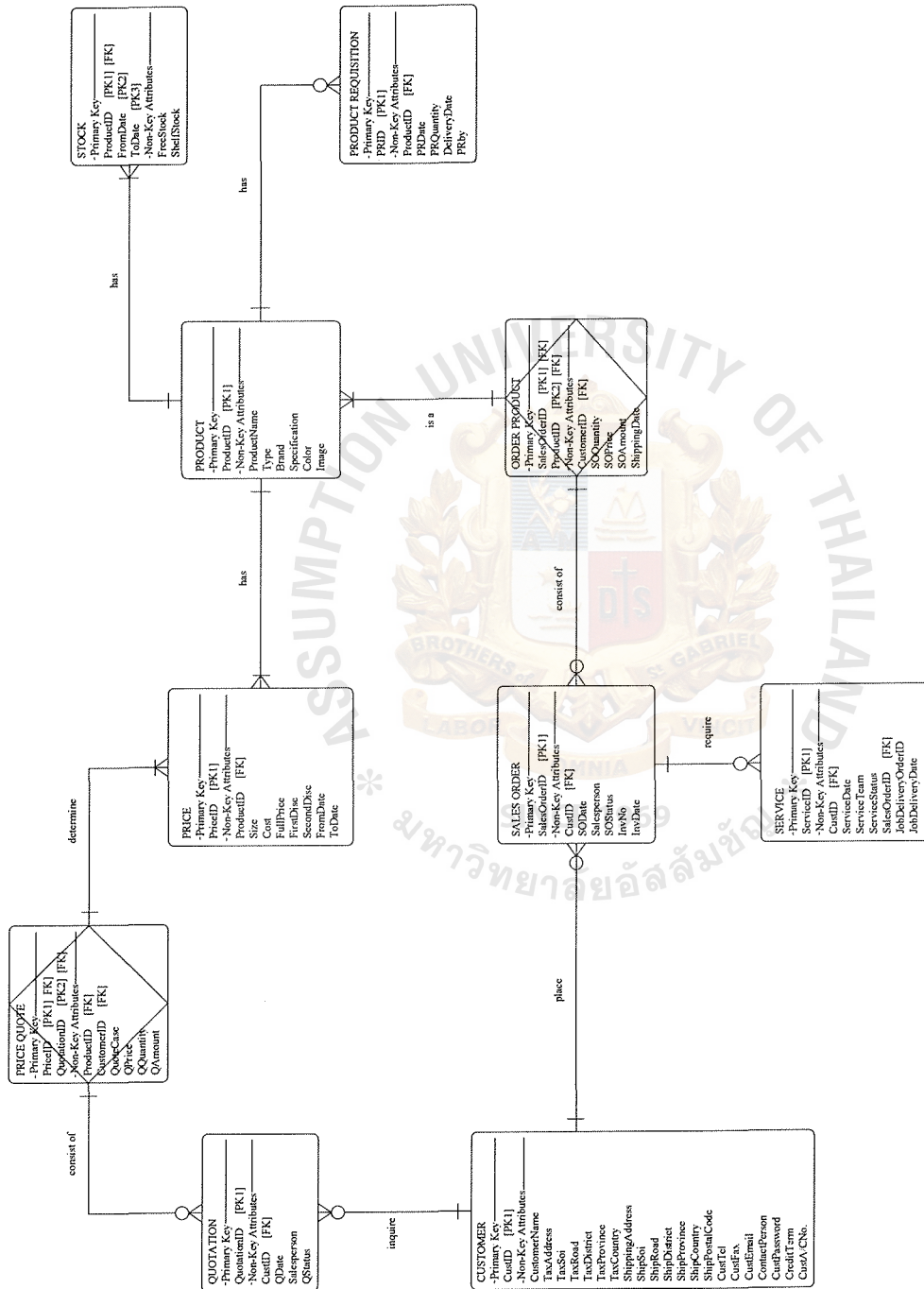


Figure A.3. Fully Attributes Data Model of the Proposed System.



APPENDIX B
DATA FLOW DIAGRAM

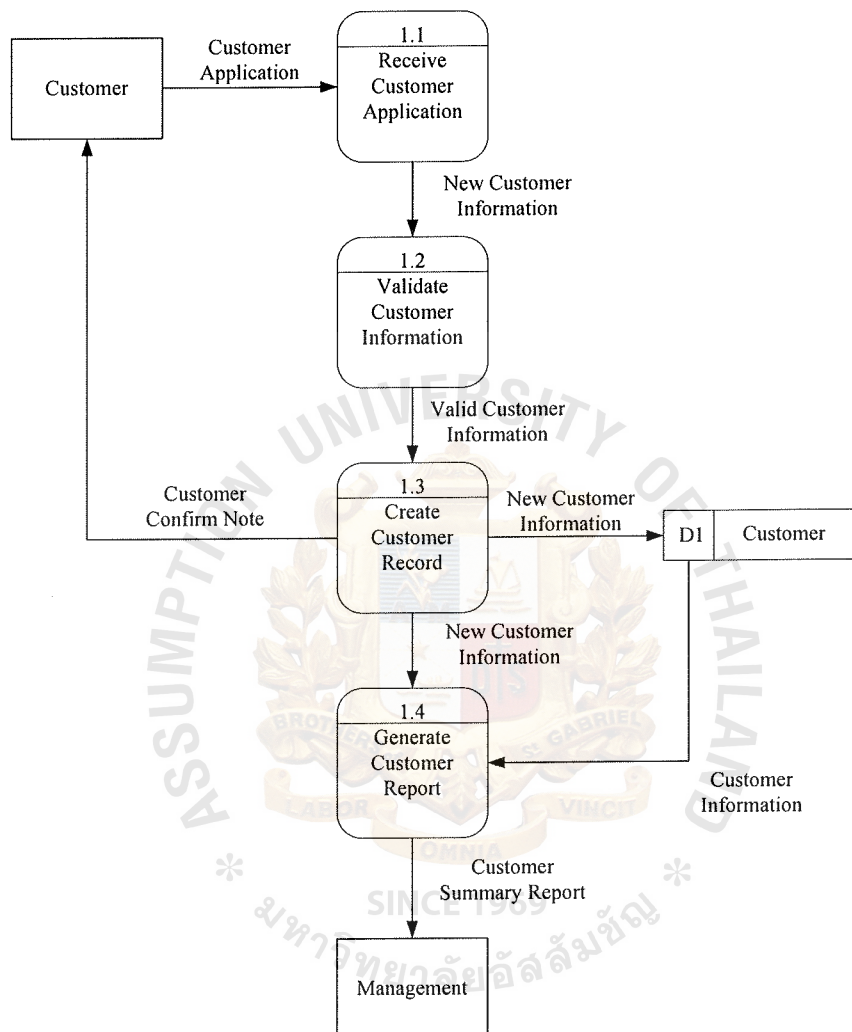


Figure B.1. Data Flow Diagram for Register Customer Process.

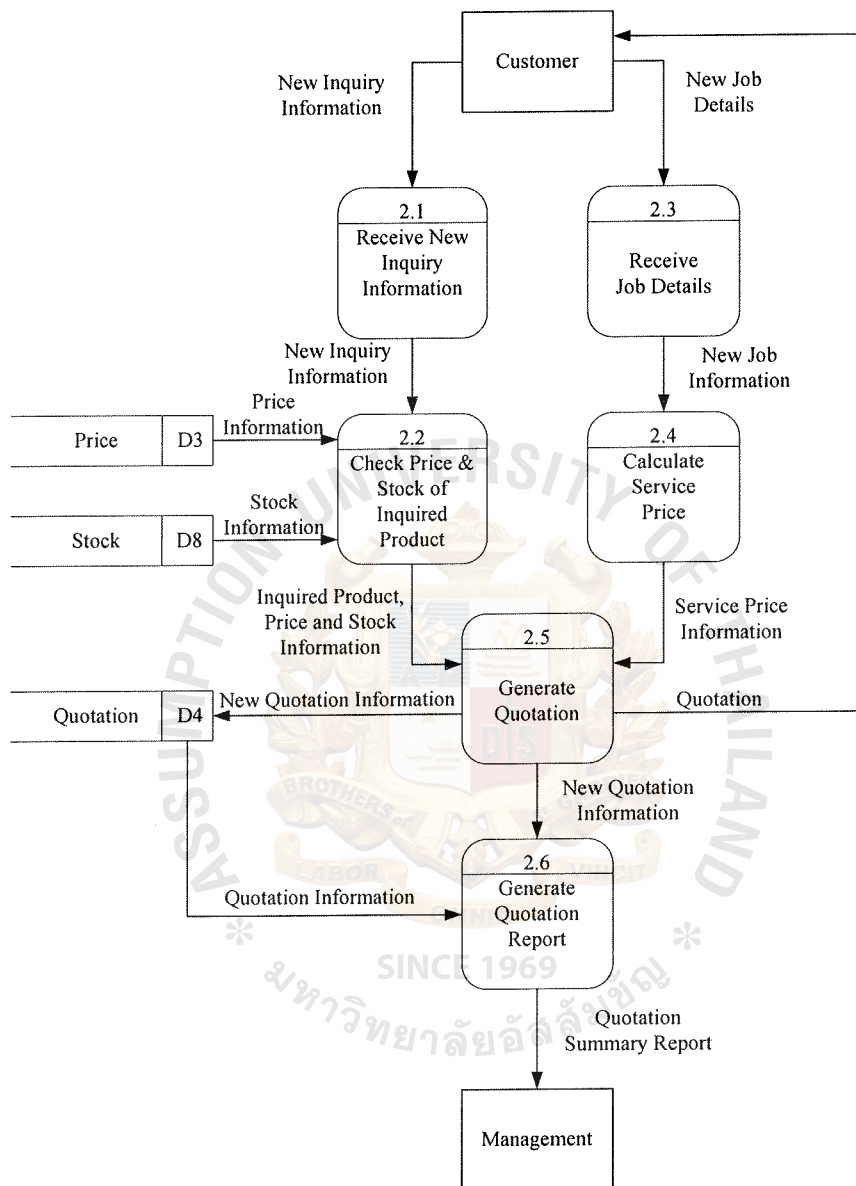


Figure B.2. Data Flow Diagram for Arrange Quotation Process.

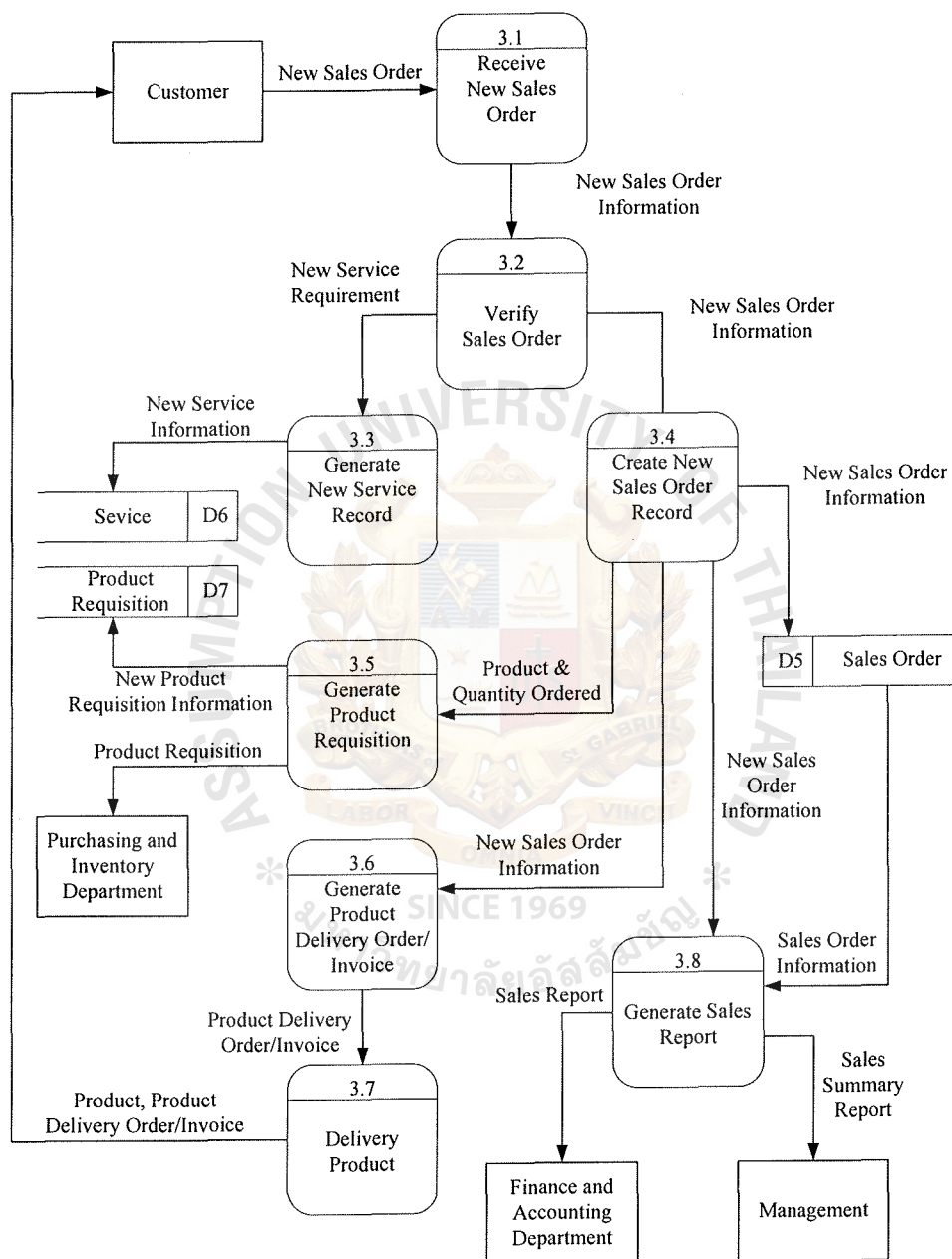


Figure B.3. Data Flow Diagram for Arrange Sales Order Process.

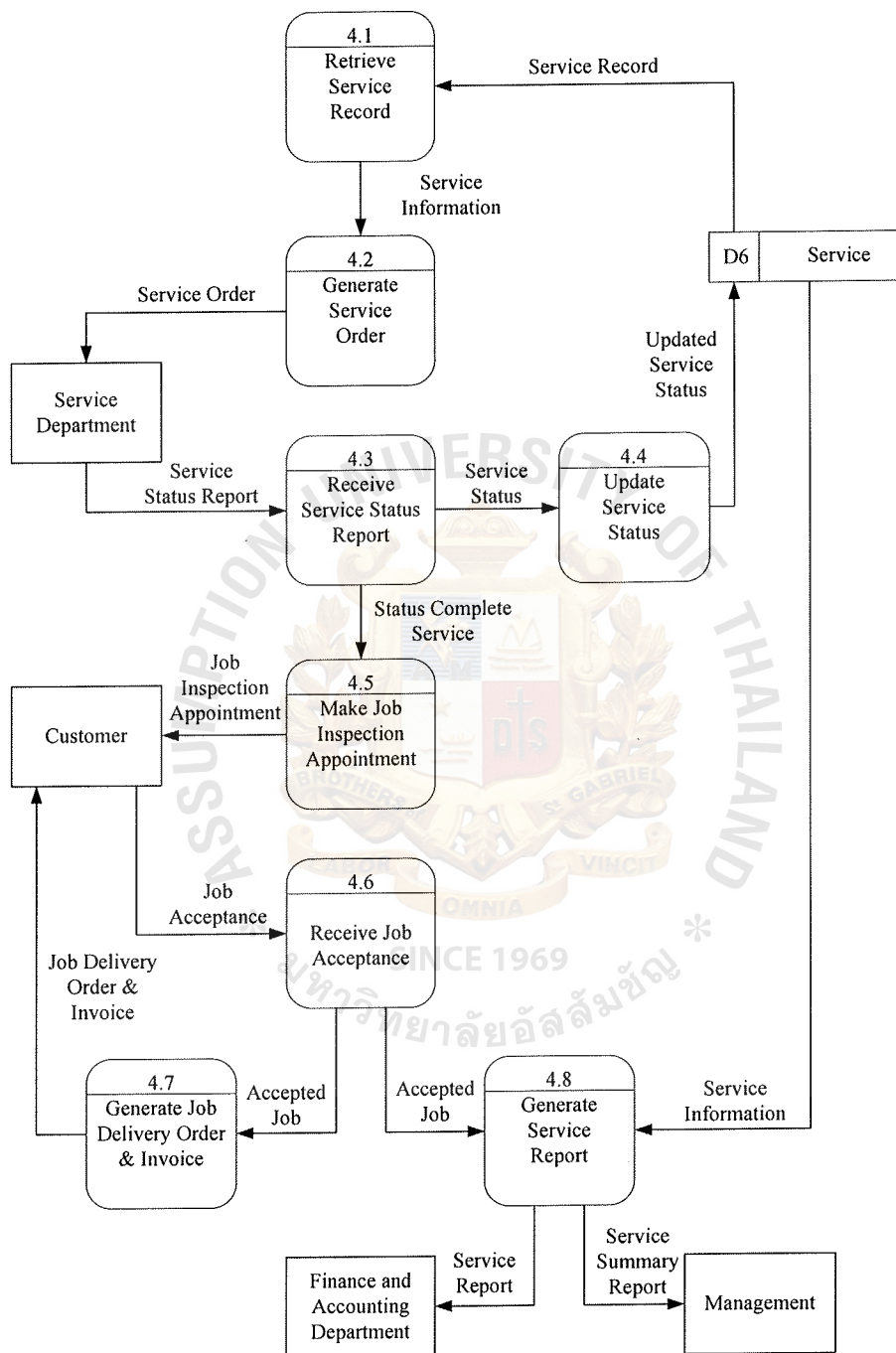


Figure B.4. Data Flow Diagram for Arrange Service Process.

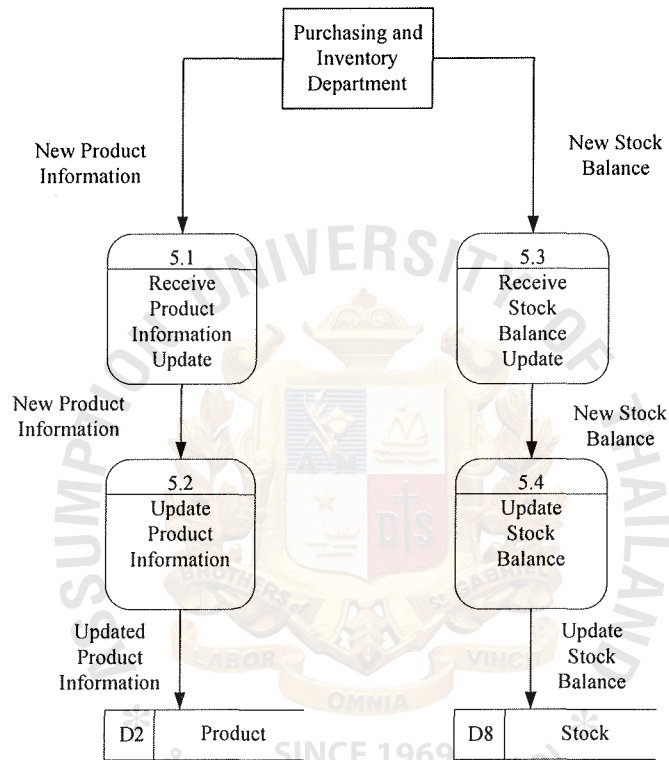


Figure B.5. Data Flow Diagram for Update Product and Stock Process.



APPENDIX C
FEASIBILITY ANALYSIS

Table C.1. Estimated Cost of Candidate 1, in Baht.

Cost Items		Price	
Development Cost			
Personal:			
2	System Analysts (6 months, 2 units @16,000 baht/month)	192,000.00	
1	Programmer (4 months, 1 unit @12,000 baht/month)	48,000.00	
1	Network Specialist (1 month, 1 unit @ 20,000 baht/month)	20,000.00	
	Total Personal Cost		260,000.00
Implementation:			
	Training Cost	235,000.00	
	Installation Cost	60,000.00	
	Total Implementation Cost		295,000.00
Hardware:			
1	Server (1 unit @ 132,000 baht)	132,000.00	
5	Workstation (5 units @ 27,500 baht)	137,500.00	
	Other Devices	62,300.00	
	Total Hardware Cost		331,800.00
Software:			
1	Operating System for Server (1 unit @ 46,000 baht)	46,000.00	
1	DBMS (1 unit @ 100,000.00 baht)	100,000.00	
1	Development Software (1 unit @ 50,000 baht)	50,000.00	
5	Operating System for Workstation (5 units @ 17,000 baht)	85,000.00	
	Total Software Cost		281,000.00
Network:			
10	Point Wiring Cost (10 unit @ 900 baht)	9,000.00	
1	24 Ports Switching Hub (1 unit @ 10,000 baht)	10,000.00	
	Total Network Cost		19,000.00
Total Development Cost			1,186,800.00
Project Annual Operating Costs:			
Personal:			
1	Managers (1 units @ 35,000 baht)	420,000.00	
3	Supervisor Staffs (3 units @ 20,000 baht)	720,000.00	
6	Staffs (6 units @ 10,000 baht)	720,000.00	
1	Computer Staff (1 unit @ 15,000 baht)	180,000.00	
	Total Personal Cost		2,040,000.00
System Operating Cost:			
	Lease Line	Per Annual	-
	Internet	Per Annual	-
	Total System Operating Cost		-
Office Supplies @ Miscellaneous:			
	Stationary	Per Annual	9,000.00
	Paper	Per Annual	4,000.00
	Utility	Per Annual	8,400.00
	Miscellaneous	Per Annual	4,200.00
	Total Office Supplies & Miscellaneous Cost		25,600.00
Maintenance:			
	Software Maintenance	4,000.00	
	Hardware Maintenance	8,000.00	
	Total Maintenance Cost		12,000.00
Total Project Annual Operating Cost			2,077,600.00
Total Project Annual Cost			3,264,400.00

Table C.2. Estimated Cost of Candidate 2, in Baht.

Cost Items		Price	
Development Cost			
Personal:			
2	System Analysts (6 months, 2 units @16,000 baht/month)	192,000.00	
2	Programmers (4 months, 2 units @12,000 baht/month)	96,000.00	
1	Network Specialist (1 month, 1 unit @ 20,000 baht/month)	20,000.00	
	Total Personal Cost		308,000.00
Implementation:			
	Training Cost	235,000.00	
	Installation Cost	60,000.00	
	Total Implementation Cost		295,000.00
Hardware:			
2	Server (2 units @ 132,000 baht)	264,000.00	
5	Workstation (5 units @ 27,500 baht)	137,500.00	
	Other Devices	62,300.00	
	Total Hardware Cost		463,800.00
Software:			
2	Operating System for Server (1 unit @ 46,000 baht)	92,000.00	
1	DBMS (1 unit @ 100,000.00 baht)	100,000.00	
1	Development Software (1 unit @ 50,000 baht)	50,000.00	
5	Operating System for Workstation (5 units @ 17,000 baht)	85,000.00	
	Total Software Cost		327,000.00
Network:			
10	Point Wiring Cost (10 unit @ 900 baht)	9,000.00	
1	- 24 Ports Switching Hub (1 unit @ 10,000 baht)	10,000.00	
1	Router (1 unit @ 10,000 baht)	40,500.00	
	Total Network Cost		59,500.00
Total Development Cost			1,453,300.00
Project Annual Operating Costs:			
Personal:			
1	Managers (1 units @ 35,000 baht)	420,000.00	
3	Supervisor Staffs (3 units @ 20,000 baht)	720,000.00	
6	Staffs (6 units @ 10,000 baht)	720,000.00	
1	Computer Staff (1 unit @ 15,000 baht)	180,000.00	
	Total Personal Cost		2,040,000.00
System Operating Cost:			
	Lease Line & Internet	Per Annual	192,000.00
	Total System Operating Cost		192,000.00
Office Supplies @ Miscellaneous:			
	Stationary	Per Annual	9,000.00
	Paper	Per Annual	4,000.00
	Utility	Per Annual	8,400.00
	Miscellaneous	Per Annual	4,200.00
	Total Office Supplies & Miscellaneous Cost		25,600.00
Maintenance:			
	Software Maintenance	4,000.00	
	Hardware Maintenance	8,000.00	
	Total Maintenance Cost		12,000.00
Total Project Annual Operating Cost			2,269,600.00
Total Project Annual Cost			3,722,900.00

Table C.3. Estimated Cost of Candidate 3, in Baht.

Cost Items		Price	
<u>Development Cost</u>			
Personal:			
2	System Analysts (6 months, 2 units @16,000 baht/month)	192,000.00	308,000.00
2	Programmers (4 months, 2 units @12,000 baht/month)	96,000.00	
1	Network Specialist (1 month, 1 unit @ 20,000 baht/month)	20,000.00	
Total Personal Cost			
Implementation:			
	Training Cost	235,000.00	295,000.00
	Installation Cost	60,000.00	
Total Implementation Cost			
Hardware:			
2	Server (2 units @ 132,000 baht)	264,000.00	463,800.00
5	Workstation (5 units @ 27,500 baht)	137,500.00	
	Other Devices	62,300.00	
Total Hardware Cost			
Software:			
2	Operating System for Server	-	85,000.00
1	DBMS	-	
1	Development Software	-	
5	Operating System for Workstation	85,000.00	
Total Software Cost			
Network:			
10	Point Wiring Cost (10 unit @ 900 baht)	9,000.00	59,500.00
1	- 24 Ports Switching Hub (1 unit @ 10,000 baht)	10,000.00	
1	Router (1 unit @ 10,000 baht)	40,500.00	
Total Network Cost			
Total Development Cost			1,211,300.00
<u>Project Annual Operating Costs:</u>			
Personal:			
1	Managers (1 units @ 35,000 baht)	420,000.00	2,040,000.00
3	Supervisor Staffs (3 units @ 20,000 baht)	720,000.00	
6	Staffs (6 units @ 10,000 baht)	720,000.00	
1	Computer Staff (1 unit @ 15,000 baht)	180,000.00	
Total Personal Cost			
System Operating Cost:			
	Lease Line & Internet	Per Annual 192,000.00	192,000.00
Total System Operating Cost			
Office Supplies @ Miscellaneous:			
	Stationary	Per Annual 9,000.00	25,600.00
	Paper	Per Annual 4,000.00	
	Utility	Per Annual 8,400.00	
	Miscellaneous	Per Annual 4,200.00	
Total Office Supplies & Miscellaneous Cost			
Maintenance:			
	Software Maintenance	4,000.00	12,000.00
	Hardware Maintenance	8,000.00	
Total Maintenance Cost			
Total Project Annual Operating Cost			2,269,600.00
Total Project Annual Cost			3,480,900.00

Table C.4. Payback Period for Candidate 1, in Baht.

Cash Flow Description	Years					
	0	1	2	3	4	5
Development cost	-1,186,800.00					
Operation & maintenance cost		-2,077,600.00	-2,285,360.00	-2,513,896.00	-2,765,285.60	-3,041,814.16
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted cost	-1,186,800.00	-1,855,000.00	-1,821,875.00	-1,789,341.52	-1,757,388.99	-1,726,007.04
Cumulative Time-adjusted cost	-1,186,800.00	-3,041,800.00	-4,863,675.00	-6,653,016.52	-8,410,405.51	-10,136,412.55
Benefits from new system	0.00	3,025,400.00	3,327,940.00	3,660,734.00	4,026,807.40	4,429,488.14
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted benefit	0.00	2,701,250.00	2,653,013.39	2,605,638.15	2,559,108.90	2,513,410.53
Cumulative Time-adjusted benefit	0.00	2,701,250.00	5,354,263.39	7,959,901.55	10,519,010.45	13,032,420.98
Cumulative Lifetime Time-adjusted cost + benefit	-1,186,800.00	-340,550.00	490,588.39	1,306,885.03	2,108,604.94	2,896,008.42

Table C.5. Payback Period for Candidate 2, in Baht.

Cash Flow Description	Years					
	0	1	2	3	4	5
Development cost	-1,453,300.00					
Operation & maintenance cost		-2,269,600.00	-2,496,560.00	-2,746,216.00	-3,020,837.60	-3,322,921.36
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted cost	-1,453,300.00	-2,026,428.57	-1,990,242.35	-1,954,702.31	-1,919,796.91	-1,885,514.82
Cumulative Time-adjusted cost	-1,453,300.00	-3,479,728.57	-5,469,970.92	-7,424,673.22	-9,344,470.13	-11,229,984.95
Benefits from new system	0.00	3,025,400.00	3,327,940.00	3,660,734.00	4,026,807.40	4,429,488.14
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted benefit	0.00	2,701,250.00	2,653,013.39	2,605,638.15	2,559,108.90	2,513,410.53
Cumulative Time-adjusted benefit	0.00	2,701,250.00	5,354,263.39	7,959,901.55	10,519,010.45	13,032,420.98
Cumulative Lifetime Time-adjusted cost + benefit	-1,453,300.00	-778,478.57	-115,707.53	535,228.32	1,174,540.32	1,802,436.03

Table C.6. Payback Period for Candidate 3, in Baht.

Cash Flow Description	Years					
	0	1	2	3	4	5
Development cost	-1,211,300.00					
Operation & maintenance cost		-2,269,600.00	-2,496,560.00	-2,746,216.00	-3,020,837.60	-3,322,921.36
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted cost	-1,211,300.00	-2,026,428.57	-1,990,242.35	-1,954,702.31	-1,919,796.91	-1,885,514.82
Cumulative Time-adjusted cost	-1,211,300.00	-3,237,728.57	-5,227,970.92	-7,182,673.22	-9,102,470.13	-10,987,984.95
Benefits from new system	0.00	3,025,400.00	3,327,940.00	3,660,734.00	4,026,807.40	4,429,488.14
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted benefit	0.00	2,701,250.00	2,653,013.39	2,605,638.15	2,559,108.90	2,513,410.53
Cumulative Time-adjusted benefit	0.00	2,701,250.00	5,354,263.39	7,959,901.55	10,519,010.45	13,032,420.98
Cumulative Lifetime Time-adjusted cost + benefit	-1,211,300.00	-536,478.57	126,292.47	777,228.32	1,416,540.32	2,044,436.03

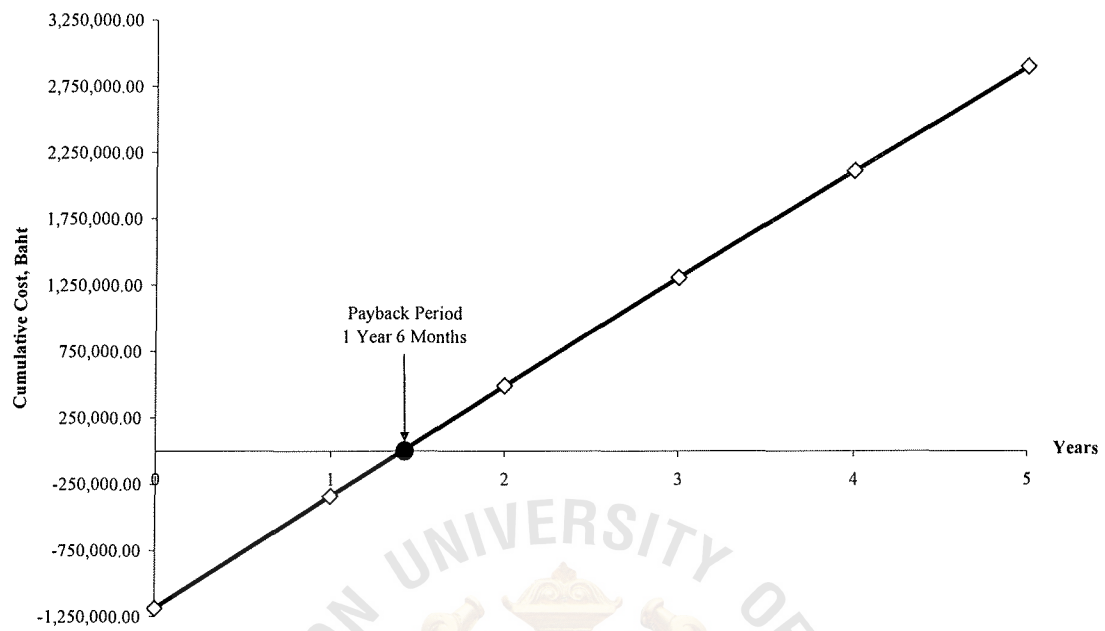


Figure C.1. Payback Period for Candidate 1.

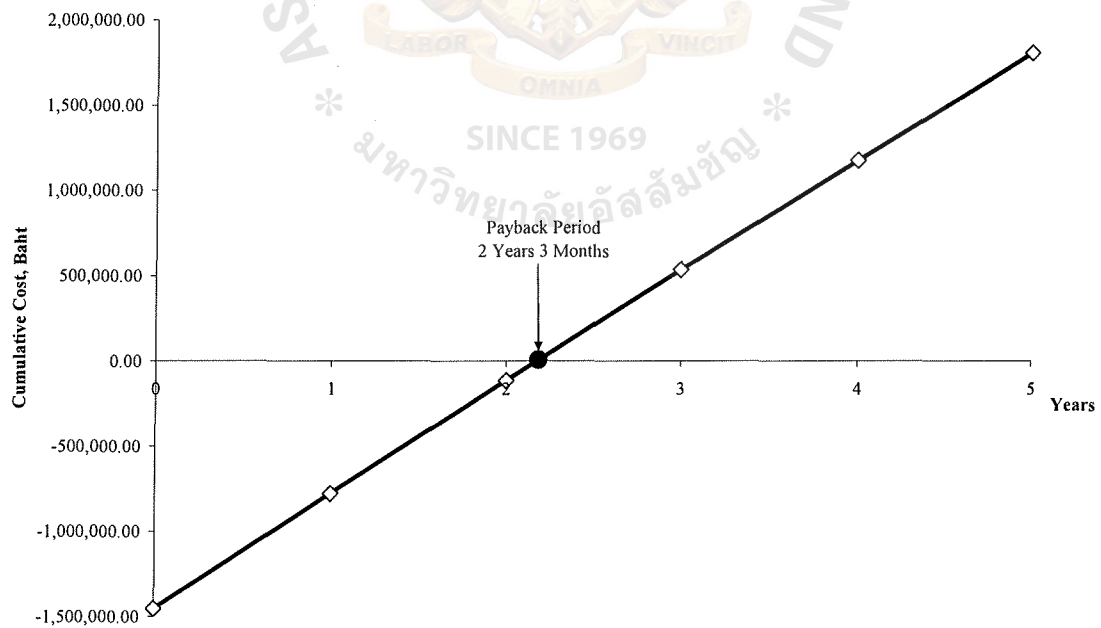


Figure C.2. Payback Period for Candidate 2.

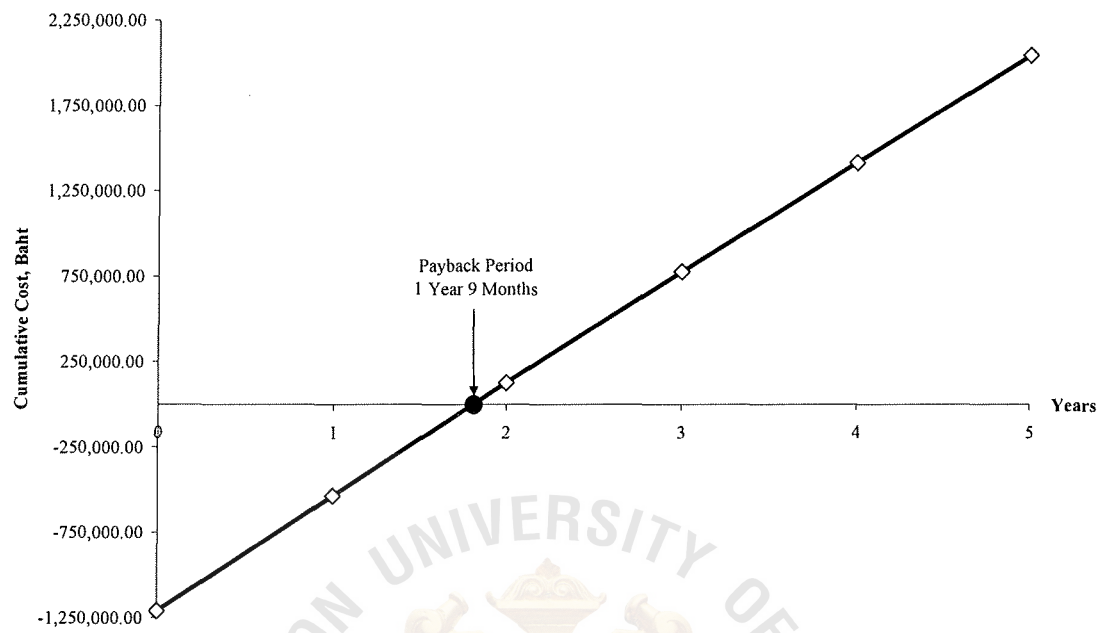


Figure C.3. Payback Period for Candidate 3.

Table C.7. Net Present Value for Candidate 1, in Baht.

Cash Flow Description	Years					
	0	1	2	3	4	5
Development cost	-1,186,800.00					
Operation & maintenance cost		-2,077,600.00	-2,285,360.00	-2,513,896.00	-2,765,285.60	-3,041,814.16
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted cost	-1,186,800.00	-1,855,000.00	-1,821,875.00	-1,789,341.52	-1,757,388.99	-1,726,007.04
Cumulative Time-adjusted cost						-10,136,412.55
Benefits from new system	0.00	3,025,400.00	3,327,940.00	3,660,734.00	4,026,807.40	4,429,488.14
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted benefit	0.00	2,701,250.00	2,653,013.39	2,605,638.15	2,559,108.90	2,513,410.53
Cumulative Time-adjusted benefit						13,032,420.98
Cumulative Lifetime Time-adjusted cost + benefit						2,896,008.42

Table C.8. Net Present Value for Candidate 2, in Baht.

Cash Flow Description	Years					
	0	1	2	3	4	5
Development cost	-1,453,300.00					
Operation & maintenance cost		-2,269,600.00	-2,496,560.00	-2,746,216.00	-3,020,837.60	-3,322,921.36
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted cost	-1,453,300.00	-2,026,428.57	-1,990,242.35	-1,954,702.31	-1,919,796.91	-1,885,514.82
Cumulative Time-adjusted cost						-11,229,984.95
Benefits from new system	0.00	3,025,400.00	3,327,940.00	3,660,734.00	4,026,807.40	4,429,488.14
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted benefit	0.00	2,701,250.00	2,653,013.39	2,605,638.15	2,559,108.90	2,513,410.53
Cumulative Time-adjusted benefit						13,032,420.98
Cumulative Lifetime Time-adjusted cost + benefit						1,802,436.03

Table C.9. Net Present Value for Candidate 3, in Baht.

Cash Flow Description	Years					
	0	1	2	3	4	5
Development cost	-1,211,300.00					
Operation & maintenance cost		2,269,600.00	-2,496,560.00	-2,746,216.00	-3,020,837.60	-3,322,921.36
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted cost	-1,211,300.00	-2,026,428.57	-1,990,242.35	-1,954,702.31	-1,919,796.91	-1,885,514.82
Cumulative Time-adjusted cost						-10,987,984.95
Benefits from new system	0.00	3,025,400.00	3,327,940.00	3,660,734.00	4,026,807.40	4,429,488.14
Discount factor for 12%	1.000	0.893	0.797	0.712	0.636	0.567
Timed-adjusted benefit	0.00	2,701,250.00	2,653,013.39	2,605,638.15	2,559,108.90	2,513,410.53
Cumulative Time-adjusted benefit						13,032,420.98
Cumulative Lifetime Time-adjusted cost + benefit						2,044,436.03



APPENDIX D
STRUCTURE DESIGN

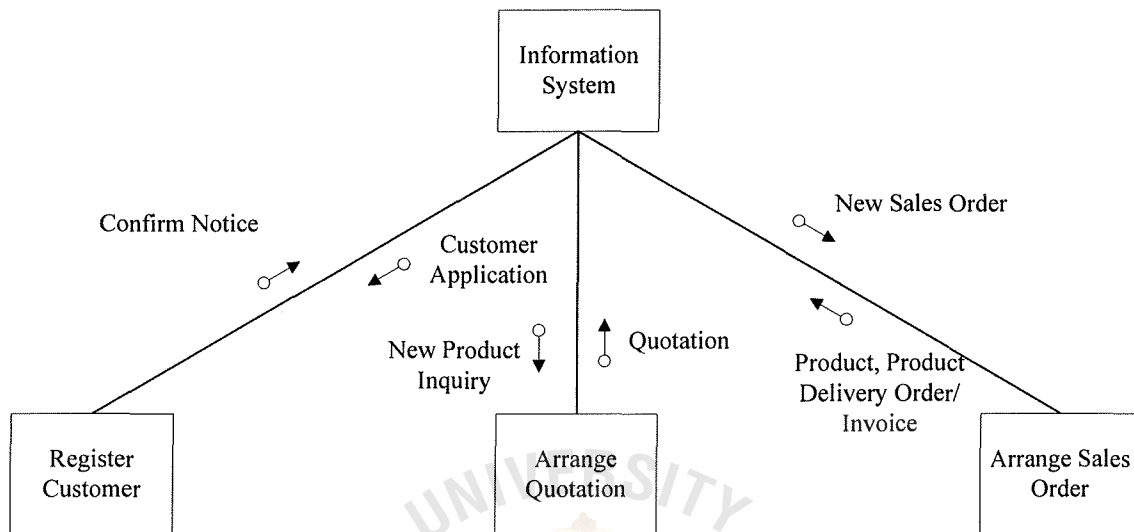


Figure D.1. Structure Chart of Information System – Part 1.

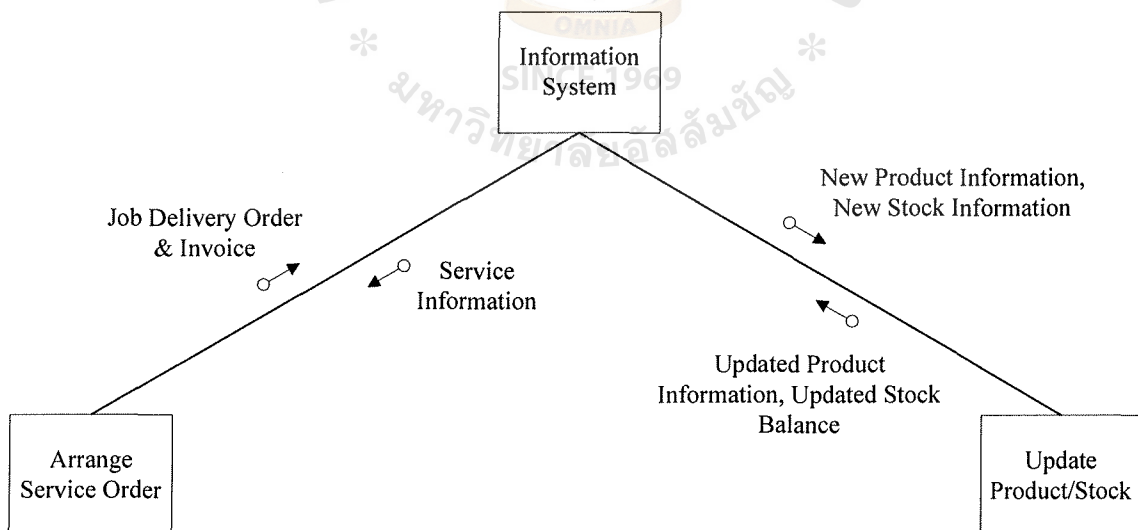


Figure D.2. Structure Chart of Information System – Part 2.

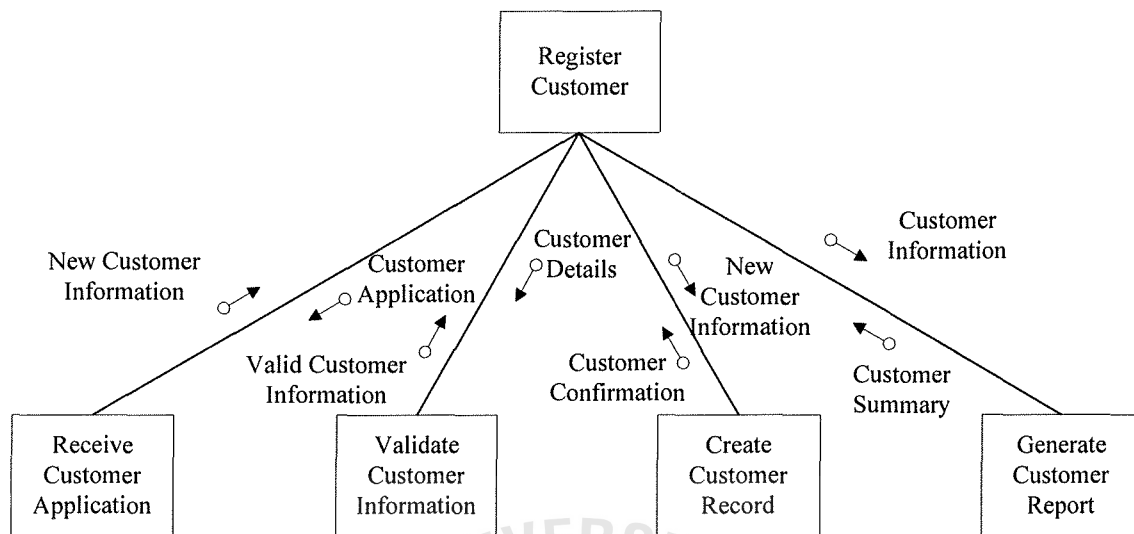


Figure D.3. Structure Chart of Register Customer Process.

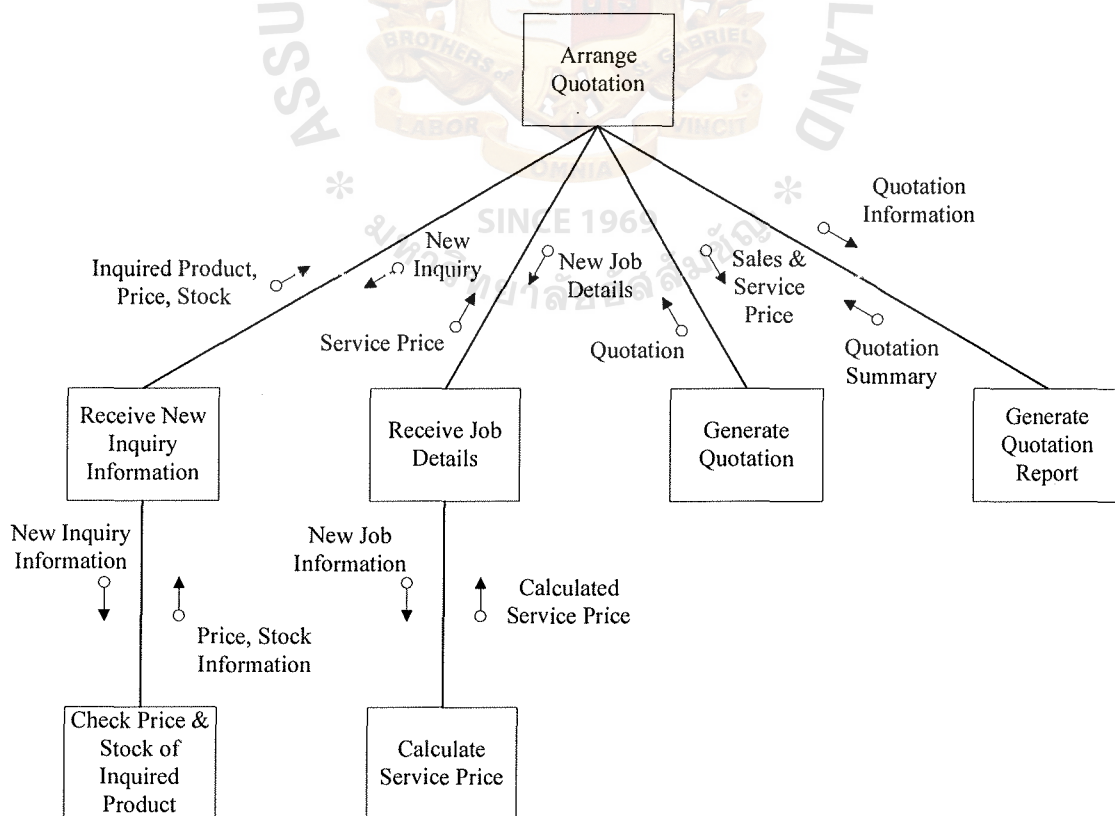


Figure D.4. Structure Chart of Arrange Quotation Process.

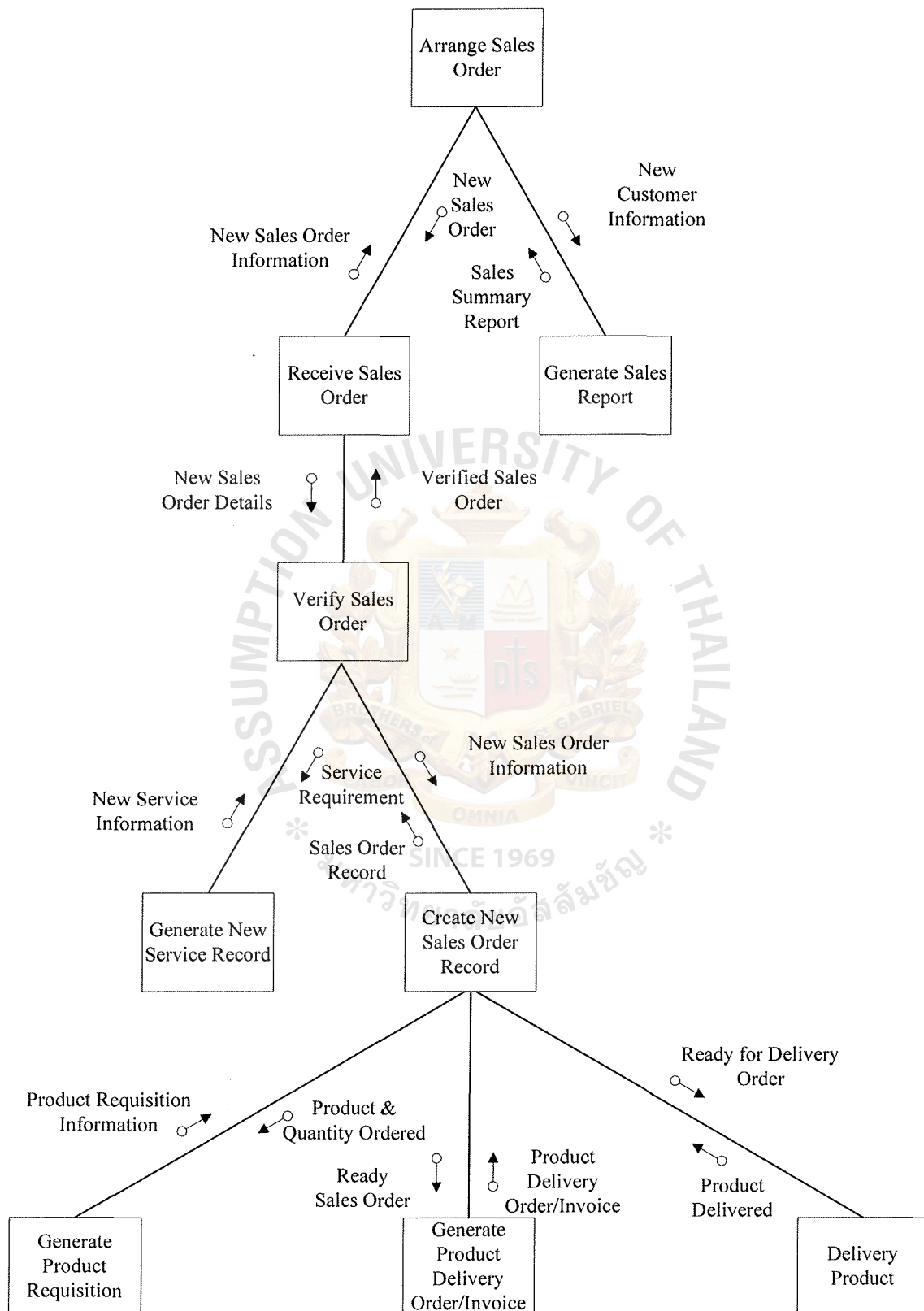


Figure D.5. Structure Chart of Arrange Sales Order Process.

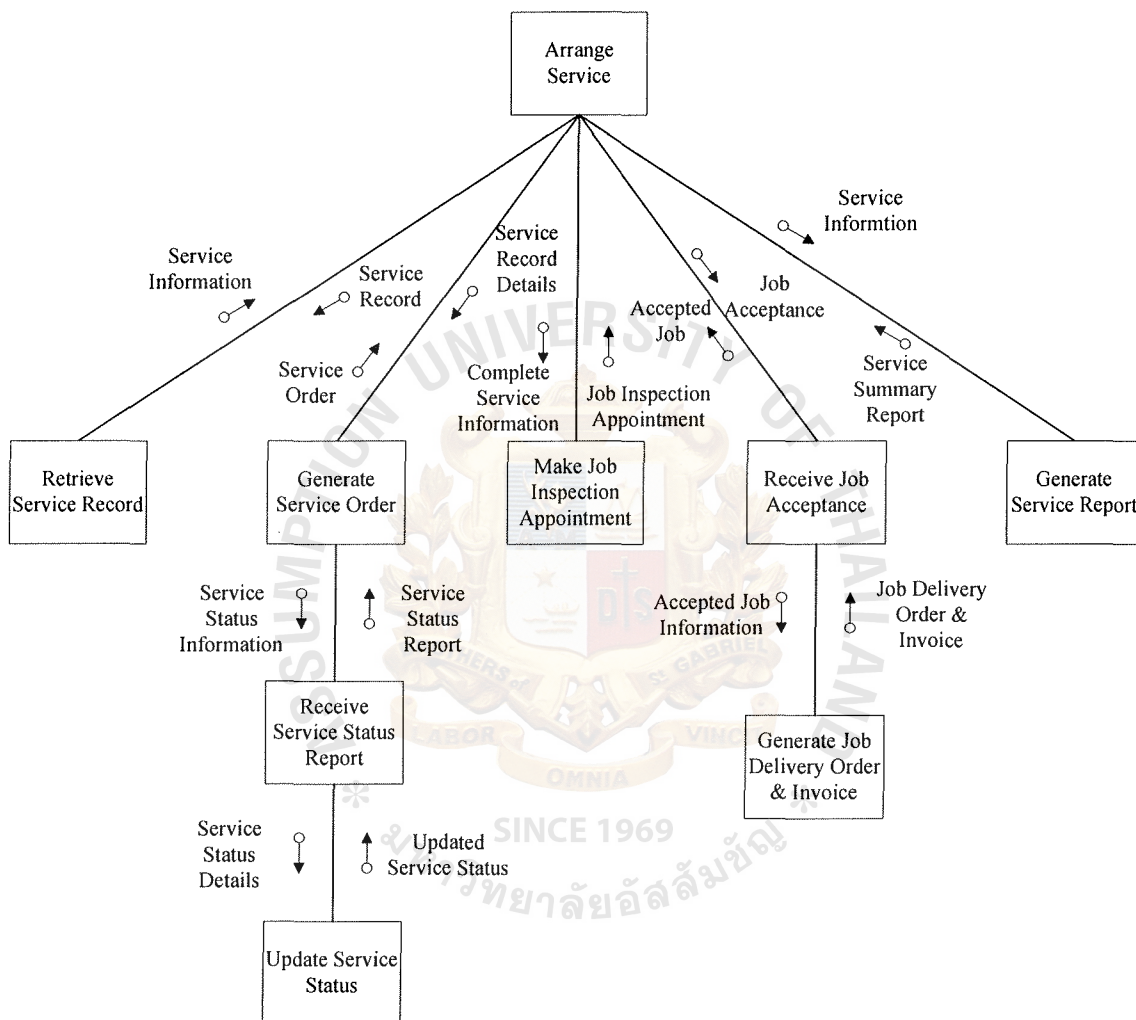


Figure D.6. Structure Chart of Arrange Service Process.

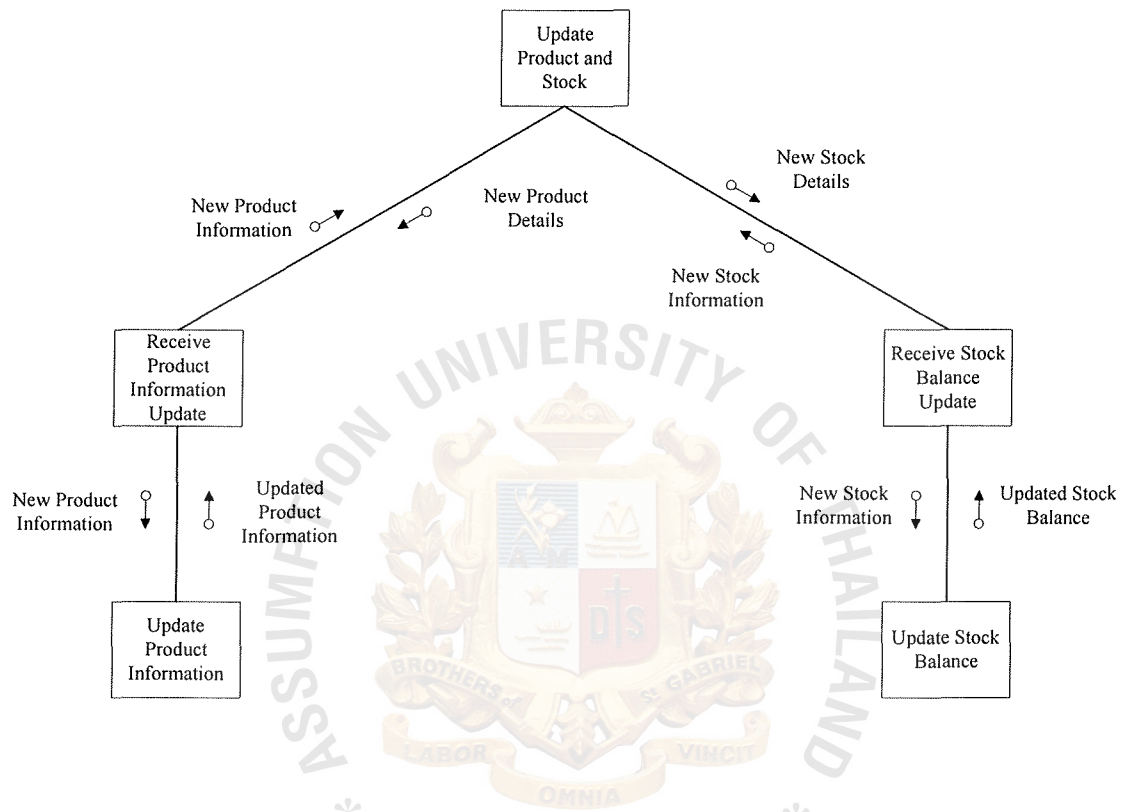


Figure D.7. Structure Chart of Update Product and Stock Process.



APPENDIX E
PROCESS SPECIFICATION

Table E.1. Process Specification of Process 1.0 Register Customer.

Items	Description
Process name:	Activity 1.0 – Register Customer
Data In:	(1) Application (from Customer)
Data Out:	(1) New Customer Information (to Customer Data Store) (2) New Customer ID (to Customer Data Store) (3) Confirm Notice (to New Customer) (4) Customer Summary Report (to Management)
Process:	(1) Receive Application (2) Validate Customer Application with Customer Information from Customer Data Store (3) Create Customer record into Customer Data Store (4) Sent the confirm notice to New Customer (5) Generate Customer Report to Management
Attachment:	(1) Customer (2) Customer Data Store (3) Management

Table E.2. Process Specification of Process 1.1 Receive & Classify Application.

Items	Description
Process name:	Activity 1.1 – Receive Customer Application
Data In:	(1) Application (from Customer)
Data Out:	(1) New Customer Information
Process:	(1) Receive Application from Customer (2) Send Customer Application (New Customer Information) to Validate Application Process
Attachment:	(1) Customer (2) Validate Customer Information Process

Table E.3. Process Specification of Process 1.2 Validate Customer/Supplier Information.

Items	Description
Process name:	Activity 1.2 – Validate Customer Information
Data In:	(1) Customer Application (from Receive & Classify Application Process) (2) Customer Information (from Customer Data Store/Supplier Data Store)
Data Out:	(1) Valid Customer Information
Process:	(1) Receive Customer Application with New Customer Information from Receive Customer Application Process (2) Validate the correctness of the information (3) If Information is valid, send Valid New Customer Information to Create Customer Record Process
Attachment:	(1) Receive Customer Application Process (2) Create Customer Record Process

Table E.4. Process Specification of Process 1.3 Create Customer Record.

Items	Description
Process name:	Activity 1.3 – Create Customer Record
Data In:	(1) Valid New Customer Information (from Validate Customer Information)
Data Out:	(1) Confirm Notice (to New Customer) (2) New Customer Information (to Customer Data Store)
Process:	(1) Receive Valid New Customer Information from Validate Customer Information Process (2) Create New Customer ID in Customer Data Store (3) Insert Customer Information into Customer Data Store (4) Send the Confirm Note to Customer
Attachment:	(1) Validate Customer Information Process (2) Customer Data Store (3) Customer

Table E.5. Process Specification of Process 1.4 Generate Customer Report.

Items	Description
Process name:	Activity 2.1 – Generate Customer Report
Data In:	(1) New Customer Information (from Create Customer Record Process) (2) Customer Information (from Customer Data Store)
Data Out:	(1) Customer Summary Report (to Management)
Process:	(1) Receive New Customer Information from Create Customer Record Process (2) Retrieve Customer Information from Customer Data Store (3) Generate Customer Summary Report (4) Send Customer Summary Report to Management
Attachment:	(1) Create Customer Record Process (2) Customer Data Store (3) Management

Table E.6. Process Specification of Process 2.0 Arrange Quotation Process.

Items	Description
Process name:	Activity 2.0 – Arrange Quotation
Data In:	(1) New Inquiry Information (from Customer) (2) New Job Details (from Customer) (3) Price Information (from Price Data Store) (4) Stock Information (from Stock Data Store) (5) Quotation Information (from Quotation Data Store)
Data Out:	(1) New Quotation Information (to Quotation Data Store) (2) Quotation (to Customer) (3) Quotation Summary Report (to Management)
Process:	(1) Receive New Inquiry Information from Customer (2) Check Price Information and Stock Information from Price Data Store and Stock Data Store (3) If Customer require installation service, receive New Job Details from Customer (4) Calculate Service Price (5) Generate Quotation and record New Quotation Information to Quotation Data Store (6) Send Quotation for Customer (7) Generate Quotation Report and send to Management
Attachment:	(1) Customer (2) Price Data Store (3) Stock Data Store (4) Quotation Data Store (5) Management

Table E.7. Process Specification of Process 2.1 Receive New Inquiry Information.

Items	Description
Process name:	Activity 2.1 – Receive New Inquiry Information
Data In:	(1) New Inquiry Information (from Customer)
Data Out:	(1) New Inquiry Information (to Check Price & Stock of Inquired Product Process)
Process:	(1) Receive New Inquiry Information from Customer (2) Send New Inquiry Information to Check Price & Stock of Inquired Product Process
Attachment:	(1) Customer (2) Check Price & Stock of Inquired Product Process

Table E.8. Process Specification of Process 2.2 Check Price & Stock of Inquired Product.

Items	Description
Process name:	Activity 2.2 – Check Price and Stock of Inquired Product
Data In:	(1) New Inquiry Information (from Receive New Inquiry Information Process) (2) Price Information (from Price Data Store) (3) Stock Information (from Stock Data Store)
Data Out:	(1) Inquired Product, Price and Stock Information (to Generate Quotation Process)
Process:	(1) Receive New Inquiry Information from Receive New Inquiry Information Process (2) Check Price Information from Price Data Store (3) Check Stock Information from Stock Data Store (4) Gather Product Information, Price Information and Stock Information, then send to Generate Quotation Process
Attachment:	(1) Receive New Inquiry Information Process (2) Price Data Store (3) Stock Data Store (4) Generate Quotation Process

Table E.9. Process Specification of Process 2.3 Receive Job Details.

Items	Description
Process name:	Activity 2.3 – Receive Job Details
Data In:	(1) New Job Details (from Customer)
Data Out:	(1) New Job Information (to Calculate Service Price Process)
Process:	(1) If the Customer require installation service, receive New Job Details from Customer (2) Check New Job Information (3) Send New Job Information to Calculate Service Price Process
Attachment:	(1) Receive Job Details Process (2) Generate Quotation Process

Table E.10. Process Specification of Process 2.4 Calculate Service Price.

Items	Description
Process name:	Activity 2.4 – Calculate Service Price
Data In:	(1) New Job Information (from Receive Job Details Process)
Data Out:	(1) Service Price Information (to Generate Quotation Process)
Process:	(1) Receive New Job Information from Receive Details Process (2) Calculate the Service Price according to size and type of job (3) Send Service Price Information to Generate Quotation Process
Attachment:	(1) Receive Job Details Process (2) Generate Quotation Process

Table E.11. Process Specification of Process 2.5 Generate Quotation.

Items	Description
Process name:	Activity 2.5 – Generate Quotation
Data In:	(1) Inquired Product, Price and Stock Information (from Check Price and Stock of Inquired Product Process) (2) Service Price Information (from Calculate Service Price Process)
Data Out:	(1) New Quotation Information (to Quotation Data Store) (2) Quotation (to Customer) (3) New Quotation Information (to Generate Quotation Report Process)
Process:	(1) Get Inquired Product, Price and Stock Information from Check Price and Stock of Inquired Product Process (2) In case that the customer requires installation service, get Service Price Information from Calculate Service Price Process (3) Generate Quotation and send to Customer (4) Record Quotation Information into Quotation Data Store (5) Send New Quotation Information to Generate Quotation Report Process
Attachment:	(1) Check Price and Stock of Inquired Product Process (2) Calculate Service Price Process (3) Quotation Data Store

Table E.12. Process Specification of Process 2.6 Generate Quotation Report.

Items	Description
Process name:	Activity 2.6 – Generate Quotation Report
Data In:	(1) New Quotation Information (from Generate Quotation Process) (2) Quotation Information (from Quotation Data Store)
Data Out:	(1) Quotation Summary Report (to Management)
Process:	(1) Receive New Quotation Information from Generate Quotation Process (2) Retrieve Quotation Information from Quotation Data Store (3) Generate Quotation Summary Report (4) Send Quotation Summary Report to Management
Attachment:	(1) Generate Quotation Process (2) Quotation Data Store (3) Management

Table E.13. Process Specification of Process 3.0.

Items	Description
Process name:	Activity 3.0 – Arrange Sales Order Process
Data In:	<ol style="list-style-type: none"> (1) New Sales Order (from Customer) (2) Sales Order Information (from Sales Order Data Store)
Data Out:	<ol style="list-style-type: none"> (1) New Service Information (to Service Data Store) (2) New Sales Order Information (to Sales Order Data Store) (3) New Product Requisition Information (to Product Requisition Data Store) (4) Product Requisition (to Purchasing and Inventory Department) (5) Product, Product Delivery Order/Invoice (to Customer) (6) Sales Report (to Finance & Accounting Department) (7) Sales Summary Report (to Management)
Process:	<ol style="list-style-type: none"> (1) Receive New Sales Order from Customer (2) Verify New Sales Order Information to be Service part and Sales Order part (3) For Service part, Create New Service Record in Service Data Store waiting for further process (4) For Sales Order part, Create New Sale Order Information in Sales Order Data Store (5) Generate Product Requisition and send to Purchasing and Inventory Department (6) Create New Product Requisition Record in Product Requisition Data Store (7) In case of Sales Order only, send product with invoice (8) Incase of Sales Order with Service, send product with Product Delivery Order (9) Generate Sale Report to Finance and Accounting Department and generate Sales Summary Report to Management
Attachment:	<ol style="list-style-type: none"> (1) Customer (2) Service Data Store (3) Product Requisition Data Store (4) Sales Order Data Store (5) Purchasing and Inventory Department (6) Finance and Accounting Department (7) Management

Table E.14. Process Specification of Process 3.1 Receive New Sales Order.

Items	Description
Process name:	Activity 3.1 – Receive New Sales Order Information
Data In:	(1) New Sales Order (from Customer)
Data Out:	(1) New Sales Order Information (to Verify Sales Order Process)
Process:	(1) Receive New Sales Order from Customer (2) Send New Sales Order Information to Verify Sales Order Process
Attachment:	(1) Customer (2) Verify Sales Order Process

Table E.15. Process Specification of Process 3.2 Verify Sales Order.

Items	Description
Process name:	Activity 3.2 – Verify Sales Order Information
Data In:	(1) New Sales Order Information (from Receive New Sales Order Process)
Data Out:	(1) New Sales Service Requirement (to Generate New Service Record) (2) New Sales Order Information (to Create New Sales Order Record)
Process:	(1) Receive New Sales Order Information from Receive New Sales Order Process (2) Verify Sales Order to be Sale Order Only case and Sales Order With Service Case (3) Send New Service Requirement to Generate New Service Record Process (4) Send New Sales Order Information to Create New Sales Order Record Process
Attachment:	(1) Receive New Sales Order Process (2) Create New Sales Order Record Process (3) Generate New Service Record Process

Table E.16. Process Specification of Process 3.3 Generate New Service Record.

Items	Description
Process name:	Activity 3.3 – Generate New Service Record
Data In:	(1) New Service Requirement (from Verify Sales Order Process)
Data Out:	(1) New Service Information (to Service Data Store)
Process:	(1) Receive New Service Requirement from Verify Sales Order Process (2) Create New Service ID in Service Data Store (3) Record New Service Information into Service Data Store
Attachment:	(1) Verify Sales Order Process (2) Service Data Store

Table E.17. Process Specification of Process 3.4 Create New Sales Order Record.

Items	Description
Process name:	Activity 3.4 – Create New Sales Order Record
Data In:	(1) New Sales Order Information (from Verify Sales Order Process)
Data Out:	(1) New Sales Order Information (to Sales Order Data Store, Generate Product Delivery Order/Invoice Process, Generate Sales Report Process) (2) Product and Quantity Order (to Generate Product Requisition Process)
Process:	(1) Receive New Sales Order Information from Verify Sales Order Process (2) Create New Sales Order ID to Sales Order Data Store (3) Insert New Sales Order Information to Sales Order Data Store (4) Send Product & Quantity Ordered to Generate Product Requisition Process (5) Send New Sales Order Information to Generate Product Delivery Order/Invoice Process, and Generate Sales Report Process
Attachment:	(1) Verify Sales Order Process (2) Sales Order Data Store (3) Generate Product Requisition Process (4) Generate Product Delivery Order/Invoice Process (5) Generate Sales Report Process

Table E.18. Process Specification of Process 3.5 Generate Product Requisition.

Items	Description
Process name:	Activity 3.5 – Generate Product Requisition
Data In:	(1) Product and Quantity Ordered (from Create New Sales Order Record Process)
Data Out:	(1) New Product Requisition Information (to Product Requisition Data Store) (2) Product Requisition (to Purchasing and Inventory Department)
Process:	(1) Receive Product and Quantity Ordered from Create New Sales Order Record Process (2) Create Product Requisition ID into Product Requisition Data Store (3) Insert Product Requisition Information into Product Requisition Data Store (4) Send Product Requisition to Purchasing and Inventory Department
Attachment:	(1) Create New Sales Order Record Process (2) Product Requisition Data Store (3) Purchasing and Inventory Department

Table E.19. Process Specification of Process 3.6 Generate Produce Delivery Order/Invoice.

Items	Description
Process name:	Activity 3.6 – Generate Produce Delivery Order/Invoice
Data In:	(1) New Sales Order Information (from Create New Sales Order Record Process)
Data Out:	(1) Product Delivery Order/Invoice (to Delivery Product Process)
Process:	(1) Receive New Sales Order Information from Create New Sales Order Record Process (2) In case of Sales Order Only, Generate Product Delivery Order (3) Incase of Sales Order With Service, Generate Invoice
Attachment:	(1) Create New Sales Order Record Process (2) Delivery Product Process

Table E.20. Process Specification of Process 3.7 Delivery Product.

Items	Description
Process name:	Activity 3.7 – Delivery Product
Data In:	(1) Product Delivery Order/Invoice (from Generate Product Delivery Order/Invoice Process)
Data Out:	(1) Product, Product Delivery Order/Invoice (to Customer)
Process:	(1) Receive Product Delivery Order or Invoice from Generate Product Delivery Order/Invoice Process (2) At delivery date, send Product with Product Delivery Order or Invoice according to the case to Customer
Attachment:	(1) Generate Product Delivery Order/Invoice Process (2) Customer

Table E.21. Process Specification of Process 3.8 Generate Sales Report.

Items	Description
Process name:	Activity 3.8 - Generate Sales Report
Data In:	(1) New Sales Order Information (from Create New Sales Order Record Process) (2) Sales Order Information (from Sales Order Information Process)
Data Out:	(1) Sales Report (to Finance and Accounting Department) (2) Sales Summary Report (to Management)
Process:	(1) Receive New Sales Order Information from Create New Sales Order Record Process (2) Retrieve Sales Order Information from Sales Order Data Store (3) Generate Sales Report to Finance and Accounting Department (4) Generate Sales Summary Report to Management
Attachment:	(1) Create New Sales Order Record Process (2) Sales Order Data Store (3) Finance and Accounting Department (4) Management

Table E.22. Process Specification of Process 4.0 Arrange Service.

Items	Description
Process name:	Activity 4.0 – Arrange Service
Data In:	(1) Service Record (from Service Data Store) (2) Job Acceptance (from Customer) (3) Service Status Report (from Service Department) (4) Service Information (from Service Data Store)
Data Out:	(1) Service Order (to Service Department) (2) Job Inspection Appointment (to Customer) (3) Job Delivery Order and Invoice (to Customer) (4) Service Report (to Finance and Accounting Department) (5) Service Summary Report (to Management)
Process:	(1) Retrieve Service Record from Service Data Store (2) Generate Service Order to Service Department (3) Receive periodically Service Status Report from Service Department (4) Update Service Status into Service Data Store (5) After Service complete, Job Inspection Appointment is sent to Customer (6) If Customer accept the job, receive Job Acceptance from Customer (7) Generate Job Delivery Order and Invoice to Customer (8) Generate Service Report to Finance and Accounting Department and generate Service Summary Report to Management
Attachment:	(1) Customer (2) Service Department (3) Service Data Store (4) Finance and Inventory Department

Table E.23. Process Specification of Process 4.1 Retrieve Service Record.

Items	Description
Process name:	Activity 4.1 – Retrieve Service Record
Data In:	(1) Service Record (from Service Data Store)
Data Out:	(1) Service Information (to Generate Service Order Process)
Process:	(1) Retrieve Service Record form Service Data Store (2) Send Service Information to Generate Service Order Process
Attachment:	(1) Service Data Store (2) Generate Service Order Process

Table E.24. Process Specification of Process 4.2 Generate Service Order

Items	Description
Process name:	Activity 4.2 – Generate Service Order
Data In:	(1) Service Information (from Retrieve Service Record)
Data Out:	(1) Service Order (to Service Department)
Process:	(1) Receive Service Information from Retrieve Service Record Process (2) Generate Service Order and Send to Service Department
Attachment:	(1) Retrieve Service Record Process (2) Service Department

Table E.25. Process Specification of Process 4.3 Receive Service Status Report.

Items	Description
Process name:	Activity 4.3 – Receive Service Status Report
Data In:	(1) Service Status Report (from Service Department)
Data Out:	(1) Service Status (to Update Service Status Process)
Process:	(1) Receive Service Status Report from Service Department periodically (2) Send Service Status to Update Service Status report (3) If the Service Status is complete, send Status Complete Service to Make Job Inspection Appointment Process
Attachment:	(1) Service Department (2) Update Service Status (3) Make Job Inspection Appointment

Table E.26. Process Specification of Process 4.4 Update Service Status .

Items	Description
Process name:	Activity 4.4 – Update Service Status
Data In:	(1) Service Status (from Receive Service Status Report Process)
Data Out:	(1) Updated Service Status (to Service Data Store)
Process:	(1) Receive Service Status from Receive Service Status Report Process (2) Update Service Status into Service Data Store
Attachment:	(1) Receive Service Status Report Process (2) Service Data Store

Table E.27. Process Specification of Process 4.5 Make Job Inspection Appointment.

Items	Description
Process name:	Activity 4.5 – Make Job Inspection Appointment
Data In:	(1) Status Complete Service (from Receive Service Status Report Process)
Data Out:	(1) Job Inspection Appointment (to Customer)
Process:	(1) Receive Status Complete Service from Receive Status Report Process (2) Make Job Inspection Appointment with Customer (3) Send Job Inspection Appointment to Customer
Attachment:	(1) Receive Service Status Report Process (2) Customer

Table E.28. Process Specification of Process 4.6 Receive Job Acceptance.

Items	Description
Process name:	Activity 4.6 – Receive Job Acceptance
Data In:	(1) Job Acceptance (from Customer)
Data Out:	(1) Accepted Job (to Generate Job Delivery Order and Invoice)
Process:	(1) If Customer accept the job, receive Job Acceptance from Customer (2) Send the Accepted Job to Generate Job Delivery Order and Invoice Process
Attachment:	(1) Customer (2) Generate Job Delivery Order and Invoice Process

Table E.29. Process Specification of Process 4.7 Generate Job Delivery Order and Invoice.

Items	Description
Process name:	Activity 4.7 – Generate Job Delivery Order and Invoice
Data In:	(1) Accepted Job (from Receive Job Acceptance Process)
Data Out:	(1) Job Delivery Order and Invoice (to Customer)
Process:	(1) Receive Accepted Job from Receive Job Acceptance Process (2) Generate Job Delivery Order and Invoice (3) Send Job Delivery Order and Invoice to Customer
Attachment:	(1) Receive Job Acceptance Process (2) Customer

Table E.30. Process Specification of Process 4.8 Generate Service Report.

Items	Description
Process name:	Activity 4.8 – Generate Service Report
Data In:	(1) Accepted Job (from Receive Job Acceptance Process) (2) Service Information (from Service Data Store)
Data Out:	(1) Service Report (to Finance and Accounting Department) (2) Service Summary Report (to Management)
Process:	(1) Receive Accepted Job from Receive Job Acceptance Process (2) Retrieve Service Information from Service Data Store (3) Generate Service Report to Finance and Accounting Department (4) Generate Service Summary Report to Management
Attachment:	(1) Receive Job Acceptance (2) Service (3) Finance and Accounting Department (4) Management

Table E.31. Process Specification of Process 5.0 Update Product and Stock

Items	Description
Process name:	Activity 5.0 – Update Product and Stock
Data In:	(1) New Product Information (from Purchasing and Inventory Department) (2) New Stock Balance (from Purchasing and Inventory Department)
Data Out:	(1) Updated Product Information (to Product Data Store) (2) Updated Stock Balance (to Stock Data Store)
Process:	(1) Receive New Product Information from Purchasing and Inventory Department (2) Update Product Information into Product Data Store (3) Receive New Stock Balance from Purchasing and Inventory Department (4) Update Stock Balance into Stock Data Store
Attachment:	(1) Purchasing and Inventory Department (2) Product Data Store (3) Stock Data Store

Table E.32. Process Specification of Process 5.1 Receive Product Information Update.

Items	Description
Process name:	Activity 5.1 – Receive Product Information Update.
Data In:	(1) New Product Information (from Purchasing and Inventory Department)
Data Out:	(1) New Product Information (to Update Product Information Process)
Process:	(1) Receive New Product Information from Purchasing and Inventory Department (2) Send New Product Information to Update Product Information Process
Attachment:	(1) Purchasing and Inventory Department (2) Update Product Information Process

Table E.33. Process Specification of Process 5.2 Update Product Information.

Items	Description
Process name:	Activity 5.2 – Update Product Information
Data In:	(1) New Product Information (from Receive Product Information Update Process)
Data Out:	(1) Updated Product Information (to Product Data Store)
Process:	(1) Receive New Product Information from Receive Product Information Update Process (2) Send Updated Product Information to Product Data Store
Attachment:	(1) Receive Product Information Update Process (2) Product Data Store

Table E.34. Process Specification of Process 5.3 Receive Stock Balance Update.

Items	Description
Process name:	Activity 5.3 – Receive Stock Balance Update
Data In:	(1) New Stock Balance (from Purchasing and Inventory Department)
Data Out:	(1) New Stock Balance (to Update Stock Balance Process)
Process:	(1) Receive Stock Balance from Purchasing and Inventory Department (2) Send Stock Balance to Update Stock Balance Process
Attachment:	(1) Purchasing and Inventory Department (2) Update Stock Balance Process

Table E.35. Process Specification of Process 5.4 Update Stock Balance

Items	Description
Process name:	Activity 5.4 – Update Stock Balance
Data In:	(1) New Stock Balance (from Receive Stock Balance Update Process)
Data Out:	(1) Updated Stock Balance (to Stock Data Store)
Process:	(1) Receive New Stock Balance from Receive Stock Balance Update Process (2) Send Updated Stock Balance to Stock Data Store
Attachment:	(1) Receive Stock Balance Update Process (2) Stock Data Store





APPENDIX F
DATA DICTIONARY

Table F.1. Data Dictionary of Order Processing Database.

Field Name	Meaning
Brand	Brand of product
Color	Color of product
consist of	Relationship between QUOTATION and PRICE QUOTE
consist of	Relationship between SALES ORDER and ORDER
ContactPerson	Customer contact person name
Cost	Cost of product per unit
CreditTerm	Customer credit term
CustA/CNO.	Customer account number
CustEmail	Customer email address
CustFax	Customer fax number
CustID	Identification number of customer
CustName	Name of customer
CUSTOMER	Customer who contact company
CustPassword	Customer password
CustTel	Customer telephone number
CustUsername	Customer username
determine	Relationship between PRICE and PRICE QUOTE
FirstDisc	First step discount of product price - 5%
FreeStock	Availabe Stock which are Shelf stock minus reserved stock
FromDate	Start date that price record is valid
FromDate	Start date that stock record is valid
FullPRice	Full price of product per unit
has	Relationship between PRODCUT and PRICE
has	Relationship between PRODCUT and STOCK
has	Relationship between PRODCUT and PROCUT
Image	Image of product
inquire	Relationship between CUSTOMER and QUOTATION
InvDate	Date in invoice
InvNO.	Invoice number of sales order
is a	Relationship between PRODCUT and ORDER PRODUCT
JobDeliveryDate	Date in Job Delivery Order
JobDeliveryOrderID	Document to confirm job delivery
ORDER PRODUCT	Each product order items in sales order, the association between sales order and product
place	Relationship between CUSTOMER and SALES ORDER
Prby	Name of person who requests
PRDate	Date of product requisition
PRICE	Price of product
PRICE QUOTE	Quoted price of each product in quotation, the association between quotation and price
PriceID	Identification number of price
PriceID	Identification of price quote

Table F.1. Data Dictionary of Order Processing Database (Continued).

Field Name	Meaning
PRID	Identification number of product requisition
PRODUCT	Product that company sell
PRODUCT REQUISITION	Product requisition for shortage product
ProductID	Identification number of product
ProductName	Name of product
PRQuantity	Quantity of product requisition
Qamount	Amount of price quote record
Qdate	Date stated in the quotation
Qprice	Price of price quote record
Qquantity	Quantity of price quote record
Qstatus	Possibility status of quotation in percentage
QUOTATION	Quotation that company quote to customer
QuotationID	Identification of quotation
QuoteCase	Case of quote price, ie. First discount, Second discount
SALES ORDER	Sale order that received from customer
SalesOrderID	Identification of sales order
Salesperson	Name of salesperson who is responsible for quotation
Salesperson	Name of salesperson who is responsible for sales order
SecondDisc	Second step discount of product price - 10%
SERVICE	Service that provide to customer
ServiceOrderID	Identification of service
ServiceStatus	Status of service progress
ServiceTeam	Service staff who take responsibility of job
ServieDate	Date that record service
ShipAddress	Customer address for shipping
ShipCountry	Country of customer address for shipping
ShipDistrict	District of customer address for shipping
ShippingDate	Shipping date of order product
ShipPostalCode	Postal Code of customer address for shipping
ShipProvince	Province of customer address for shipping
ShipRoad	Road of customer address for shipping
ShipSoi	Soi of customer address for shipping
Size	Size per pack of product
SOAmount	Amount of order product
SODate	Date that sales order is received
SOPrice	Price of order product
SOQuantity	Quantity of order product
SOSatus	Completion status of sales order, ie. Wait of product, Wait for delivery, Delivered
Specification	Specification and description of product
STOCK	Stock balance of product
TaxAddress	Customer address for invoice

Table F.1. Data Dictionary of Order Processing Database (Continued).

Field Name	Meaning
TaxCountry	Country of customer address for invoice
TaxDistrict	District of customer address for invoice
TaxPostalCode	Postal Code of customer address for invoice
TaxProvince	Province of customer address for invoice
TaxRoad	Road of customer address for invoice
TaxSoi	Soi of customer address for invoice
ToDate	End date that price record is valid
ToDate	End date that stock record is valid
Type	Type of product





APPENDIX G
DATABASE DESIGN

Table G.1. Structure of CUSTOMER Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
CustID	Character (10)	Not	-	-	Primary Key
CustName	Character (50)	Not	-	-	Attribute
TaxAddress	Character (30)	Not	-	-	Attribute
TaxSoi	Character (20)	Null	-	-	Attribute
TaxRoad	Character (20)	Null	-	-	Attribute
TaxDistrict	Character (20)	Not	-	-	Attribute
TaxProvince	Character (20)	Not	-	-	Attribute
TaxCountry	Character (20)	Not	-	-	Attribute
TaxPostalCode	Integer (5)	Not	-	-	Attribute
ShipAddress	Character (30)	Not	-	-	Attribute
ShipSoi	Character (20)	Null	-	-	Attribute
ShipRoad	Character (20)	Null	-	-	Attribute
ShipDistrict	Character (20)	Not	-	-	Attribute
ShipProvince	Character (20)	Not	-	-	Attribute
ShipCountry	Character (20)	Not	-	-	Attribute
ShipPostalCode	Integer (5)	Not	-	-	Attribute
CustTel	Integer (9)	Not	-	-	Attribute
CustFax	Integer (9)	Not	-	-	Attribute
CustEmail	Character (30)	Null	-	-	Attribute
ContactPerson	Character (50)	Not	-	-	Attribute
CustUsername	Character (10)	Not	-	-	Attribute
CustPassword	Character (10)	Not	-	-	Attribute
CreditTerm	Integer (3)	Not	-	-	Attribute
CustA/CNO.	Integer (10)	Not	-	-	Attribute

Table G.2. Structure of PRODUCT Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
ProductID	Character (10)	Not	-	-	Primary Key
ProductName	Character (30)	Not	-	-	Attribute
Type	Character (20)	Not	-	-	Attribute
Brand	Character (30)	Not	-	-	Attribute
Specification	Character (50)	Not	-	-	Attribute
Color	Character (10)	Null	-	-	Attribute
Image	Character (20)	Null	-	-	Attribute

Table G.3. Structure of PRICE Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
PriceID	Character (10)	Not	-	-	Primary Key
ProductID	Character (10)	Not	PRODUCT	-	Attribute
Size	Character (10)	Not	-	-	Attribute
Cost	Float (7)	Not	-	-	Attribute
FullPRice	Float (7)	Not	-	-	Attribute
FirstDisc	Float (7)	Not	-	-	Attribute
SecondDisc	Float (7)	Not	-	-	Attribute
FromDate	Date (8)	Not	-	-	Attribute
ToDate	Date (8)	Not	-	-	Attribute

Table G.4. Structure of QUOTATION Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
QuotationID	Character (10)	Not	-	-	Primary Key
CustID	Character (10)	Not	CUSTOMER	-	Attribute
Qdate	Date (8)	Not	-	-	Attribute
Salesperson	Character (50)	Not	-	-	Attribute
Qstatus	Character (10)	Not	-	-	Attribute

Table G.5. Structure of SALES ORDER Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
SalesOrderID	Character (10)	Not	-	-	Primary Key
CustID	Character (10)	Not	CUSTOMER	-	Attribute
SODate	Date (8)	Not	-	-	Attribute
Salesperson	Character (50)	Not	-	-	Attribute
SOSStatus	Character (10)	Not	-	-	Attribute
InvNO.	Character (10)	Null	-	-	Attribute
InvDate	Date (8)	Null	-	-	Attribute

Table G.6. Structure of SERVICE Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
ServiceOrderID	Character (10)	Not	-	-	Primary Key
CustID	Character (10)	Not	Customer	-	Attribute
ServieDate	Date (8)	Not	-	-	Attribute
ServiceTeam	Character (50)	Not	-	-	Attribute
ServiceStatus	Character (10)	Not	-	-	Attribute
SalesOrderID	Character (10)	Null	Sales Order	-	Attribute
JobDOrderID	Character (10)	Null	-	-	Attribute
JobDeliveryDate	Date (8)	Null	-	-	Attribute

Table G.7. Structure of PRODUCT REQUISITION Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
PRID	Character (10)	Not	-	-	Primary Key
ProductID	Character (10)	Not	PRODUCT	-	Attribute
PRDate	Date (8)	Not	-	-	Attribute
PRQuantity	Integer (10)	Not	-	-	Attribute
DeliveryDate	Date (8)	Not	-	-	Attribute
Prby	Character (50)	Not	-	-	Attribute

Table G.8. Structure of STOCK Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
ProductID	Character (10)	Not	PRODUCT	-	Primary Key
FromDate	Date (8)	Not	-	-	Primary Key
ToDate	Date (8)	Not	-	-	Primary Key
FreeStock	Integer (10)	Not	-	-	Attribute
ShelfStock	Integer (10)	Null	-	-	Attribute

Table G.9. Structure of PRICE QUOTE Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
PriceID	Character (10)	Not	PRICE	-	Primary Key
QuotationID	Character (10)	Not	QUOTATION	-	Primary Key
ProductID	Character (10)	Not	PRODUCT	-	Attribute
CustID	Character (10)	Not	CUSTOMER	-	Attribute
QuoteCase	Character (10)	Not	-	-	Attribute
Qprice	Float (7)	Not	-	-	Attribute
Qquantity	Integer (10)	Not	-	-	Attribute
Qamount	Float (10)	Not	-	-	Attribute

Table G.10. Structure of ORDER PRODUCT Table.

Name	Type	Null	Foreign Key to Table	Check	Key Type
SalesOrderID	Character (10)	Not	SALES ORDER	-	Primary Key
ProductID	Character (10)	Not	PRODUCT	-	Primary Key
CustID	Character (10)	Not	CUSTOMER	-	Attribute
SOQuantity	Integer (10)	Not	-	-	Attribute
SOPrice	Float (7)	Not	-	-	Attribute
SOAmount	Float (10)	Not	-	-	Attribute
ShippingDate	Date (8)	Null	-	-	Attribute



APPENDIX H
USER INTERFACE DESIGN

Customer Registration

Username :

Password :

Company Name :

Contact Person :

Tax Address :

Address :

Sol :

Road :

Figure H.1. User Interface Design: Customer Registration.

Sign In

Username :

Password :

Figure H.2. User Interface Design: Sign In.

Customer Inquiry

Customer ID:

Item	Product Name	Specification	Quantity	Service Detail
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Figure H.3. User Interface Design: Customer Inquiry.

Sales Order

Customer ID:

Item	Product Name	Specification	Quantity	Unit Price (฿)	Amount (฿)	Service
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Figure H.4. User Interface Design: Sales Order.

Service Order

Staff ID:

Sales Order Ref. :

Service Details :

Site :

Figure H.5. User Interface Design: Service Order.

Product Requisition

Item	Product Name	Specification	Quantity	Status	Ref. Document
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Figure H.6. User Interface Design: Product Requisition.

Update Product Information ::: - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address: C:\Documents and Settings\Phinhip.R\Desktop\Interface\newproduct.htm

บริษัท วิสแพค จำกัด
VISPACK CO., LTD.

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[Quotation](#) [Sales Order](#) [Service Order](#)
[Product Requisition](#) [Update Product](#) [Update Stock](#) [Generate Report](#)

New Product Information

Name :
Brand :
Specification :
Color :
Lead Time :
Size :

Figure H.7. User Interface Design: Update Product.

Update Price / Stock ::: - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address: C:\Documents and Settings\Phinhip.R\Desktop\Interface\Stock.htm

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[Product Requisition](#) [Update Product](#) [Update Stock](#) [Generate Report](#)

Update Stock

Item	Product Name	Specification	Free Stock	Shelf Stock	Cost (฿)
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Figure H.8. User Interface Design: Update Stock.



APPENDIX I
REPORT DESIGN

Quotation

บริษัท วิสแพค จำกัด
VISPACK CO., LTD.

272 Rain Tree Garden, 3rd Floor, Huay Kwang, Bangkapi, Bangkok
 Tel: 0-2310-9955 Fax: 0-710-6472
 Tax Id.No.: 3011808214

Quotation

Customer:	Planet T&S Co., Ltd.	Quotation No.:	Q000200/2004
Address:	42 Suan Luang, Bangkapi Tel: 0 2319 9955 Fax: 0 2719 6472	Salesperson:	Chate
		Date:	10 November 2004

No.	Code	Description	Quantity	Unit Price	Amount
1	P50647	ACCOLADE PLUS	500	120.50	60,250.00

Done My Computer

Figure I.1. Report Design: Quotation.

Invoice

บริษัท วิสแพค จำกัด
VISPACK CO., LTD.

272 Rain Tree Garden, 3rd Floor, Huay Kwang, Bangkapi, Bangkok
 Tel: 0-2310-9955 Fax: 0-710-6472
 Tax Id.No.: 3011808214

Date	Payment Term	Invoice No.
10/11/2004	30 day	IM00150/2004

Tax Invoice

Customers: Planet T&S Co., Ltd.

Address: 272 Rain Tree Garden, 3rd Floor, Huay Kwang, Bangkapi, Bangkok

No.	Code	Description	Quantity	Unit Price	Amount
1	P50647	ACCOLADE PLUS 1.83 x 16 x 0.02 m. Ceduna White	500 P	120.50	60,250.00
	S50648	Installation Service	1	10,000.00	10,000.00

Done My Computer

Figure I.2. Report Design: Sales Invoice.

Product Delivery Order :: Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address: C:\Documents and Settings\Phinhip.R\Desktop\Interface\Report\POO.htm

บริษัท วิสแพค จำกัด
VISPAK CO., LTD.
 272 Rain Tree Garden, 3rd Floor, Huay Kwang, Bangkapi, Bangkok
 Tel: 0-2319-9955 Fax: 0-710-0472
 Tax Id.No.: 3011808214

Date	Payment Term	PDO No.
10/11/2004	30 day	PDO0150/2004

Product Delivery Order

Customers: Planet T&S Co., Ltd.

Address: 272 Rain Tree Garden, 3rd Floor, Huay Kwang, Bangkapi, Bangkok

No.	Code	Description	Quantity	Unit Price	Amount
1	P50647	ACCOLADE PLUS 1.83 x 16 x 0.02 m. Ceduna White	500 P	120.50	60,250.00

Done My Computer

Figure I.3. Report Design: Product Delivery Order.

Job Delivery Order :: Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address: C:\Documents and Settings\Phinhip.R\Desktop\Interface\Report\JDO.htm

บริษัท วิสแพค จำกัด
VISPAK CO., LTD.
 272 Rain Tree Garden, 3rd Floor, Huay Kwang, Bangkapi, Bangkok
 Tel: 0-2319-9955 Fax: 0-710-0472
 Tax Id.No.: 3011808214

Date	Payment Term	Invoice No.
10/11/2004	30 day	JV00150/2004

Job Delivery Order

Customers: Planet T&S Co., Ltd.

Address: 272 Rain Tree Garden, 3rd Floor, Huay Kwang, Bangkapi, Bangkok

No.	Code	Description	Quantity	Unit Price	Amount
1	S50648	Installation Service	1	10,000.00	10,000.00

Done My Computer

Figure I.4. Report Design: Job Delivery Order.

Product Requisition :: Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address C:\Documents and Settings\Phinhip.R\Desktop\Interface\Report\PR.htm

บริษัท วิสแพค จำกัด
VISPACK CO., LTD.

272 Rain Tree Garden, 3rd Floor, Huay Kwang, Bangkapi, Bangkok
 Tel: 0-2310-0055 Fax: 0-710-8472
 Tax Id. No.: 3011808214

Product Requisition

PR No.	567/2004	Date:	10 November 2004
--------	----------	-------	------------------

PRNo.	Code	Description	Quantity	Due Date
1	P50648	ARMALON 1.50x20.00 m. Ceduna White	800	15-11-04

Done My Computer

Figure I.5. Report Design: Product Requisition.

Customer Summary Report :: Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address C:\Documents and Settings\Phinhip.R\Desktop\Interface\Report\Customer Summary.htm

Customer Summary Report

Date: 31 October 2003

Customer No.	Customer Name	Salesperson
C1000015	Punty House Co., Ltd.	Chate
C1000016	Siam Kurebo Co., Ltd.	Chate
C1000017	Thai Taketa Co., Ltd.	Chate
C1000018	Koventure Co., Ltd.	Songkhat
C1000019	Durschem Co., Ltd.	Songkhat
C1000020	Planet T&S., Ltd.	Samart
C1000021	Toyota Motors Co., Ltd.	Samart

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Figure I.6. Report Design: Customer Summary Report.

Quotation Summary Report

Date: 10 November 2004

Quotation Report by Cu

No.	Customer Name	Quoted Product	Qty	Inquire Date	Status	Salespers
1	Purity House Co., Ltd.	ACCOLADE PLUS 1.83 x 16 x 0.02 m. Ceduna White	500	31/10/2004	80%	Chate
2	Purity House Co., Ltd.	ARMALON 1.50x20.00 m. Natural Hessian	400	3/11/2004	50%	Chate
3	Durachem Co., Ltd.	ACCOLADE PLUS 1.83 x 16 x 0.02 m. Lavender Blue	500	3/10/2004	90%	Songkiet
4	Durachem Co., Ltd.	ARMALON 1.50x20.00 m. Lavender Blue	200	31/10/2004	60%	Songkiet
5	Siam Kurabo Co., Ltd.	ARMALON 1.50x20.00 m. Lavender Blue	100	5/11/2004	40%	Songkiet

Figure I.7. Report Design: Quotation Summary Report.

Sales Summary Report

Date: 28 November 2004

Sales Report by Customer

No.	Customer Name	No. of Invoice	Total Amount
C1000015	Purity House Co., Ltd.	12	2,689,500.30
C1000016	Siam Kurabo Co., Ltd.	10	938,568.00
C1000017	Thai Takate Co., Ltd.	6	644,020.50
C1000018	Koventure Co., Ltd.	4	1,567,568.00
C1000019	Durachem Co., Ltd.	3	900,560.75
C1000020	Planet T & S Co., Ltd.	6	545,600.00
C1000021	Toyota Motors Co., Ltd.	15	710,000.00

Figure I.8. Report Design: Sales Summary Report.

Microsoft Internet Explorer

Address: C:\Documents and Settings\Phinhip.R\Desktop\Interface\Report\Sales Info.htm

Sales Report

Date: 28 November 2003

No.	Customer Name	Product Name	Qty	Unit Price	Amount	Unit Cost
1	Purity House Co., Ltd.	ACCOLADE PLUS 1.83 x 16 x 0.02 m. Ceduna White	100	61.24	6,124.00	47.10
2	Purity House Co., Ltd.	ARMALON 1.50x20.00 m. Natural Hessian	400	24.53	9,812.00	18.86
3	Durachem Co., Ltd.	ACCOLADE PLUS 1.83 x 16 x 0.02 m. Lavender Blue	500	48.95	24,475.00	37.63
4	Durachem Co., Ltd.	ARMALON 1.50x20.00 m. Lavender Blue	200	98.68	19,736.00	75.90
5	Siam Kurebo Co., Ltd.	ARMALON 1.50x20.00 m. Lavender Blue	100	20.00	2,000.00	15.38
6	Siam Kurebo Co., Ltd.	FLOTEX TILE 3 sqm. x 12 pcs.	400	61.24	24,496.00	47.10
7	Thai Takata Co., Ltd.	ACCOLADE PLUS 1.83 x 16 x 0.02 m. Coolgardie Grey	500	24.53	12,265.00	18.86
8	Koventure Co., Ltd.	ARMALON 1.50x20.00 m. Natural Hessian	200	48.95	9,790.00	27.45

Done My Computer

Figure I.9. Report Design: Sales Report.

Microsoft Internet Explorer

Address: C:\Documents and Settings\Phinhip.R\Desktop\Interface\Report\Service Summary.htm

Service Summary Report

Date: 28 November 2004

Service Report by Customer

No.	Customer Name	No. of Invoice	Total Amount
C1000015	Purity House Co., Ltd.	12	2,689,500.30
C1000016	Siam Kurebo Co., Ltd.	10	958,568.00
C1000017	Thai Takata Co., Ltd.	6	644,020.50
C1000018	Koventure Co., Ltd.	4	1,567,568.00
C1000019	Durachem Co., Ltd.	3	900,560.75
C1000020	Planet T & S Co., Ltd.	6	545,600.00
C1000021	Toyota Motors Co., Ltd.	15	710,000.00

Done My Computer

Figure I.10. Report Design: Service Summary Report.

Service Report

Date: 28 November 2004

No.	Customer Name	Service Details	Site	Job Status	Due Date	Inspection Date	Service Staff
1	Punty House Co., Ltd.	Floor Tile Installation	Bangpoo	Complete	31/10/2004	31/11/2003	Somjai
2	Punty House Co., Ltd.	Floor Tile Installation	Rama IX	WP	3/11/2004	3/12/2003	Somjai
3	Punty House Co., Ltd.	Floor Tile Installation	Silom	Pending	3/10/2004	3/12/2003	Alongkom
4	Punty House Co., Ltd.	Floor Tile Installation	Sathorn	Complete	31/10/2004	31/12/2003	Alongkom
5	Siam Kurebo Co., Ltd.	Roof Installation	Semutr	Complete	5/11/2004	5/12/2003	Alongkom

Figure I.11. Report Design: Service Report.

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