SALES MANAGEMENT INFORMATION SYSTEM FOR APICES GLASS CO., LTD.

by

Ms. Supanida Jitchaipoka

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

eport

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

November, 2000

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

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ABSTRACT

The aim of this system analysis and development project designed for APICES GLASS Co., Ltd. is to improve the company's performance in the area of sales management information system.

The existing information system is based on a manual system. All data is collected in paper documents. The current system is affected by the common problems in data maintenance. It is difficult to summarize the required amount of data in the same report from different data stores. Therefore this project offer a rational solution to decrease errors in manual processing.

The new proposed information system has been developed to retain the needed data in an easier way for retrieval. The extensive data can be stored, updated, deleted, and inserted via a computerized information system and being kept in a database server. Microsoft Visual and Access are applied to serve the application process. The proposed information system can decrease use the employees' work load.

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Moreover, this project cannot be succeeded unless the Sales Department of Dechin (1982) Co., Ltd. would give assistance and useful information of the company to support her study and analysis of the Sales Management Information System of this company.

And she would like to thank every member of the faculty for a precious knowledge in computer information systems.

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I. INTRODUCTION

1.1 Background of the Project

This system development is designed for APICES GLASS Co., Ltd., in order to facilitate the day-to-day operation in the area of sales order processing. Which is normally concerned with a lot of information for retrieving and reusing. The company's staffs must record redundant data every time as needed. Moreover, the Sales department has an important responsibility to provide services and to fulfill the customer's requirements and ensure the company's success.

As a result, the information about the customers and the products must be correct, precise, and valuable. From a research, the company uses manual processes that is time consuming and a lot of paperwork. The real-time information not reach the proper demands so the data is not utilized.

APICES GLASS Co., Ltd., is an agency of Thai Asahi Co., Ltd., which is one of the glass dealers in Thailand. It has been established since 1968 and is located at 378 Phrasumen Road, Phranakorn, Bangkok 10200 Thailand. The company has an objective to sell glass to retailers and customers. The glass is sold for installing windows and doors in internal and external buildings and houses. Another purpose is for decorating the interior of any room. Our products have many categories such as clear float glass, dark gray sheet glass, and figured/pattern glass. Their sizes are 2 – 19 millimeters for various needs.

1.2 Objectives of the Project

The objectives of the Sales Management Information System are the following:

(1) To study and analyze the existing system of the company

(2) To identify the existing problems of the old system

(3) To evaluate the problems and identify their causes

(4) To analyze and develop a new system for using in Sales Department

(5) To implement the new Sales Management Information System for increasing the efficiency

(6) To provide the require reports for users within the company and customers

(7) To utilize the use of the computer for order and sales controlling

(8) To reduce the paperwork

(9) To make the salesperson aware of detail about required to meet the customer's requirements

1.3 Scope of the Project

This project will cover the major areas of Sales system as follows:

(1) Customer Order Management:

(a) Customers File

(b) Principals File

(2) Sales Management:

(a) Sales Order File

(b) Invoice File

(c) Generate Sales Order Report

(d) Generate Invoice Report

(e) Customer Order & Sales Analysis

(3) Information Management:

(a) Monthly Report

1.4 Deliverables

The deliverables are referred to the requirements of the users so the new proposed system should fulfill user's needs and facilitate the employees according to the following lists:

(1) Project Introduction

- (a) Background of the Project
- (b) Objectives of the Project
- (c) Scope of the Project
- (d) Project Plan

(2) Description of the Existing System

- (a) Background of the Organization
- (b) Current Problems and Areas for Improvement
- (c) Existing Computer System

(3) Description of the Proposed System

- (a) System Specification
  - (1) Context Diagram
  - (2) Data Flow Diagram
- (b) System Design
- (c) Hardware and Software Requirement
- (d) Security and Control
- (e) Cost / Benefit Analysis

(4) Project Implementation

- (a) Overview of project implementation
- (b) Test plan
- (c) Conversion

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(5) Conclusions and Recommendations

(a) Conclusions

(b) Recommendations

1.5 Project Plan

Project plan for the proposed system is described in the Figure 1.1.

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No.	Task Name
	I. Analysis of the Existing System
1	Define the Objective and Scope
2	Study the Existing System
3	Identify the Existing Problems
4	Develop Context Diagram
5	Develop Data Flow Diagram
6	Cost and Benefit Analysis
	II. Analysis and Design of the Proposed System
7	Report Design
8	Database Design
9	Network Design
10	Program Design
	III. Implementation of the Proposed System
11	Coding
12	Testing
13	Hardware Installation
14	Software Installation

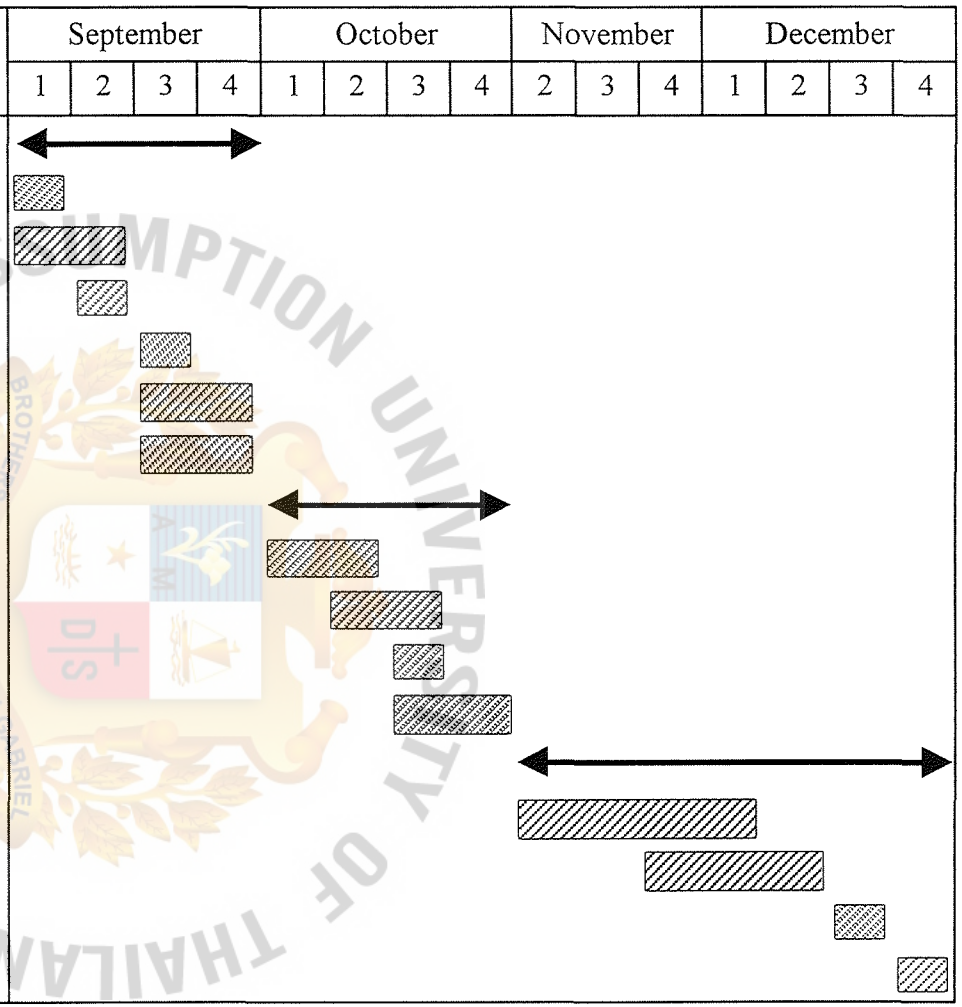

Figure 1.1. Project Plan of Sales Order Information System.

II. EXISTING SYSTEM

2.1 Background of the Organization

APICES GLASS Co., Ltd. has been established since 1968. It was located at 464/1 Mahachai Road in 1994 the company moved to 378 Phrasumen Road, Bovonnivej, Phranakorn, and Bangkok 10200. The company is one of glass dealers of Thai Asahi Co., Ltd. The product is a sheet glass that is used for installing buildings and houses. The types of glass are clear sheet glass, dark sheet glass, and figured/pattern glass, which have many colors, for example; amber, blue, green, or purple. The cost of the product is fixed by Thai Asahi Co., Ltd. and is changed frequently to reflect the material costs and the state of the economy.

When a customer orders any kind of products, it is very convenient to keep the stock available for immediate delivery. As a result, the stock should be often checked and the stock record must be updated immediately for the non-redundant selling.

Each order, invoice, and delivery form will be written manually by the salesman who takes order from the customer. It means that the order can be lost in processing or transmission and this manual system takes time to recover the problems delivery to the customers may take more time. Departments cannot share the same data resources because each department has an individual data processing. Moreover, the manual process spends a lot of expense for paper and human resources, so that the company needs a good management to supervise employees and data processing. All of the information must be updated and managed carefully for the efficient sales order processing.

APICES GLASS Co., Ltd. is a small company and has a simple organization chart without a complex level of executive. The company's organization structure consists of the three levels of Top-down hierarchy:

(1) The Top level – at the top level of the hierarchy is the President and Managing Director of the company.

(2) The Middle level – the Middle level consists of:

   (a) The Upper Middle level – includes all the Managers in the organization.

   (b) The Lower Middle level – includes all the Assistant Managers and the Supervisors.

(3) The Operational level – this level consists of the Technicians, Leaders, and the Operators.

Each department has its own management, and information flow, and report format. The organization chart is shown in Figure 2.1.

The Sales Department of the organization has the responsibility in:

(1) Issuing the Sales Order for the customers

(2) Sending the Sales Order to Stock Controller for checking products in the warehouse

(3) Issuing the Invoice for request the products from the warehouse

(4) Issuing the Invoice to acknowledge the customer

(5) Purchasing Request for the products that out of stock

(6) Keeping customers and order record

(7) Preparing monthly report for the Sales Manager

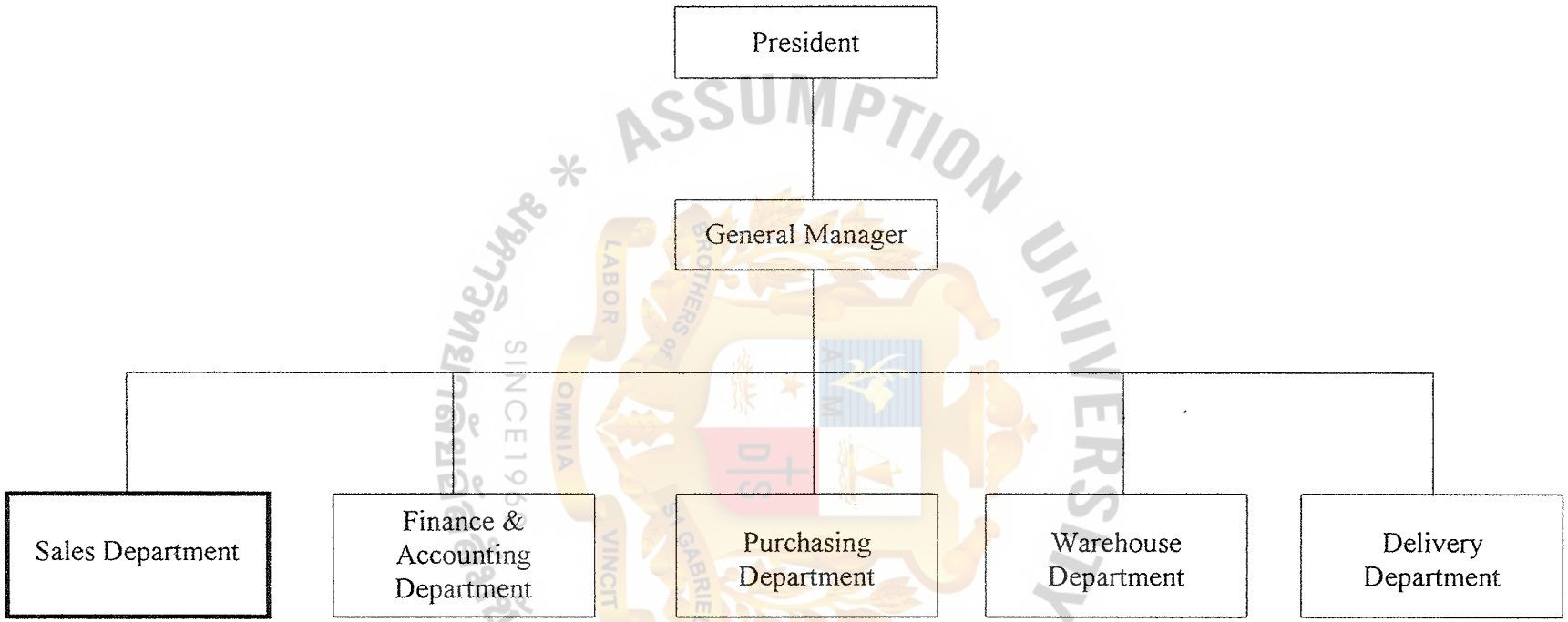

Figure 2.1. Organization Chart of APICES GLASS Company Limited.

2.2 Current Problems and Areas for Improvement

The current system has problems as discussed below:

(1) The data collecting system is manual and the information may be misunderstood.

(2) There is a lot of paperwork in each process.

(3) Spent a long time is to collect and get the information.

(4) The information is unique and cannot be shared in the different department.

(5) Redundancy in checking data.

(6) Different format of the report from each department.

(7) Information can be lost due to the change of employees.

(8) In making any order, the detail must be filled properly for all the customer's needs so this system cannot alert the salesperson to cover all customers' needs.

As the discussion above, the problems of the exiting system can be summarized as follows:

(1) The sales processing is slow and inconvenient because of manual processing by the employees. It takes time to check the stock of each type of product. Each product has a unique size, color, and price. And the available stock record may represent an out-of-date amount of products.

(2) No sufficient information for management to plan, forecast, and determines market trends for each year.

(3) Reports are generated slowly and unreliably because of the separated documents and different departments. Every data item has to be listed out and rearranged in order to get the required information.

(4) Order and Sales records are not updated regularly that can cause late of delivery.

(5) The information cannot be shared between departments since each department has its own filing system for the same record e.g. customer record.

(6) The information may be lost due to a change of employees.

There are 3 areas for improving into the computerized system:

(1) Customer

The customer will order directly or indirectly (such as by phone, mail, or e-mail) from the salesperson, who will keep the order information and make an order for each customer. Customer will not be kept systematically, and data may be lost because data are kept on paper.

After the salesperson receives the sales order and responsible for completing the while order the product details and quantity must be checked and updated. The payment term and sales condition are based on each salesperson's standard and the customer's history.

(2) Sales Department

Sales Department needs its owns customer database and customer order that are different from other department; for example, warehouse or Finance and Accounting Department. Sales data and reports are used for Sales Performance Analysis and will be separated from this department.

If the ordered product is available in stock, the invoice will be generated and sent to Warehouse for receipt of goods and then delivery to customer. If the ordered product is unavailable in stock, the booking item is recorded and back-ordered item will be processed and sent to Purchasing

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Department for Purchasing Process. Stock Controller will generate Purchase Request.

(3) Accounting and Financial Department

Sales Order Information will be used for generating invoices and collecting money on terms and conditions specified in Sales Order.

Sales Order Information will be provided for updating the inventory file and booking record.

2.3 Existing System

Each department has a different database design and format of report according to the manual processing.

The order and invoice will be written on a printed form and sent to the customer. Copies of the document are sent to the warehouse, delivery unit, and finance department according to the individual purpose of each department.

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III. PROPOSED SYSTEM

The proposed computerized system will facilitate the day-to-day operation and set up an information base for management instead of a manual system. The proposed system will serve all user requirements, utilize existing resources and increase effectiveness in Sales Department. Furthermore, the proposed computerized system will increase the potential of the employees and decrease the amount redundant updating.

3.1 System Specification

The proposed system needs a centralized database, which can be shared in a different department. Therefore, the data can be recorded and updated immediately at the time of ordering. The correct data will be recommended to all users and the proposed system can be upgraded conveniently in the future.

3.1.1 Output Requirements

(1) Sales Order

(2) Invoice

(3) Sales Order Report

(4) Invoice Report

(5) Products on Order Report

(6) Back Ordered Item Report

(7) Sales Amount by Principle Report

3.1.2 Input Requirements

(1) Order Forms

(2) Add New Customer

(3) Add New Product

(4) Inquiry for Inventory Item

3.2 System Design

3.2.1 Data Flow Diagram

The operational requirements for proposed system are depicted in Data Flow Diagram in Appendix F.

3.2.2 Input and Output Design

The input and output design are the effective way for users to interface with computer and documents so the design needs to be simple and easy to understand. For the development of the Sales Management Information System, the proposed system was designed to satisfy the user's requirements and with the objectives as follows:

(1) Effectiveness

(2) Consistency

(3) Simplicity

(4) Ease use

(5) Correctness

Moreover, the input design needs to interact with external users such as customers or the complete information may not be fulfilled.

Input Forms

Preprinted document requires user (salesperson) to fill out the information on the customer and his orders in order to generate the order in the computer system. And another product form is for registering the new product line to extend the various product alternatives. The input forms are shown in Appendix A.

(1) Order Form

(2) New Product Form

The information of new products has to be kept in database file as product master files to be shared by Sales Department and Inventory Department.

Input Screen

The input screen is designed in a way that is easy for users to interface with. All input screens for the Sales Management Information System are shown in Appendix A.

Output Forms

Printed documents are required to print out for each sales process unit after entering the validation and complete data. The output documents have 2 categories: printed form and report. Customer, system users, and the Sales Manager use the output as hard copy. The effective designed output should meet:

(1) Objectives of the system

(2) Users' requirements

(3) Various cost of implementation

(4) Law and regulation

3.2.3 Database and Data File Design

There are 2 types of data file:

Master File: data are designed to help the organization. For example: the Sales history master file for customers: it contains records of each sale made to customers over a specified period.

Transaction File: this is the temporary file which is used for accumulating data amount events as they occur and for updating master file to reflect the result of current situation.

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3.2.4 Database Design

The database designs are for specified the database functions that can ease the users to understand the design shown in Appendix C.

3.3 Hardware and Software Requirement

The office is on the first floor of the building on Phrasumen Road. The proposed system is the LAN system to utilize the proposed hardware and software efficiently.

The server will be located at the Sales Department, where the Manager will responsible for overall computer system. The salesperson will use

For the wiring job, the Star Wired Topology is an applied configuration for this system by using UTP cable that can be extended to meet future requirements.

In the proposed system, the hardware for the server is specified to cooperate with a large amount of database to support users efficiently in an accepted response time. The Laser jet printer is set for printing report that is different from the billing preparation of the salesperson. The hardware and software specifications for the proposed Server are shown in the Tables 3.1 and 3.2 respectively.

Table 3.1. The Hardware Specification for the Server.

Hardware	Specification
CPU	Pentium III 500 MHz
Memory	128 MB ECC RAM
Hard Disk	9.1 UW (GB)
CD-Rom Drive	50X
Floppy Drive	1.44 MB
Network Adapter	10/100TX Network Interface Card Ultra/Wide SCSI HDD Interface
Display Adapter	4MB VGA Card
Display	14" Monitor
Printer	HP Laser jet 1100A

Table 3.2. The Software Specification for the Server.

Software	Specification
Operation System	Microsoft Windows NT Server 4.0
Application Server	Microsoft Visual Basic 4.0 or higher
Database Server	Microsoft Access 95 or higher

For the Sales Department, the terminal for the client should run Microsoft Internet Explorer in order to communicate with customers and other departments immediately. And other software application must at lease support the fundamental requirements for report preparation, document processing, etc. the hardware and software specifications for each terminal are should in the Tables 3.3 and 3.4 respectively.

Table 3.3. The Hardware Specification for the Terminals.

Hardware	Specification
CPU	Pentium III 533 MHz
Memory	64 MB RAM
Hard Disk	8.5 GB
CD-Rom Drive	50X
Floppy Drive	1.44 MB
Network Adapter	LAN card 10/100 Mbps
Display Adapter	S3 Savage 4 AGP 16 MB
Display	15" Flat Monitor
Printer	Dot Matrix

Table 3.4. The Software Specification for the Terminals.

Software	Specification
Operating System	Microsoft Window 95
Application Software	Microsoft Office 95 or higher Microsoft Visual Basic 4.0 or higher

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The connection of this proposed system is established to connect the Server and its Terminals in the Local Area Network (LAN). The network peripherals of the proposed system are shown in the Table 3.5.

Table 3.5. The Network Peripherals Specification for the Proposed System.

Network Peripheral	Specification
HUB	10/100 Mbps 8 UTP Ports
UPS	1000 VA
Cable	UTP Cable 100 meters

From the proposed hardware and software requirements, the proposed system can be depicted its network configuration in Figure 3.1 which describes the system connection in the Sales Department. And in Table 3.6, The feasibility analysis will rank the 3 candidate systems in a matrix. It describes the operational, technical, economic, and schedules feasibility and calculates their scores due to its importance that the highest scores are selected as a proposed system.

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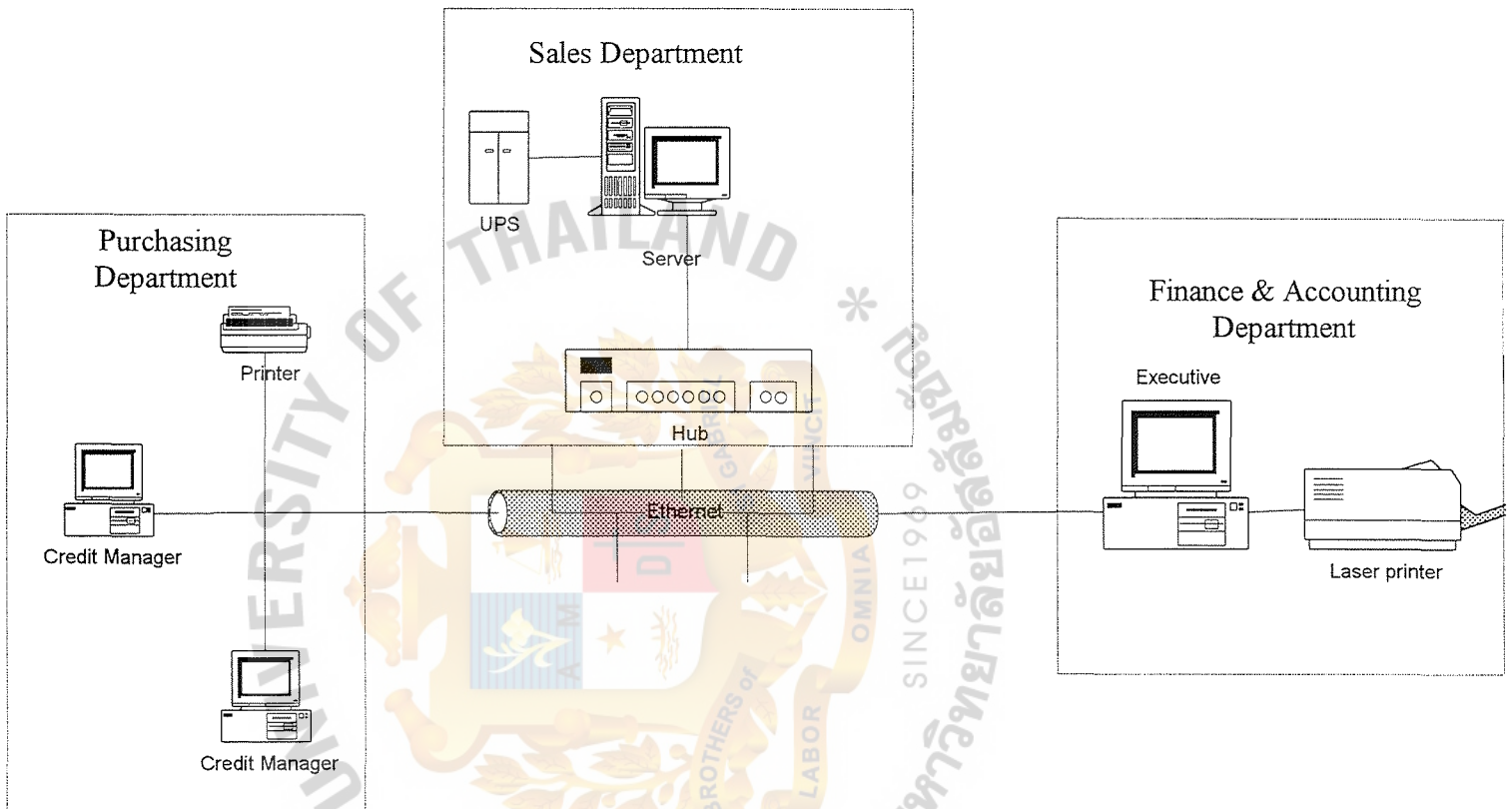

Figure 3.1. Network Configuration.

Table 3.6. 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 system would work. Political. A description of how well received this solution would be from user management, user, and organization perspective.	25%	Fully supports user required functionality and user friendly interface. Score: 85	Business processes would have to be modified to take advantage of software functionality. Score: 70	Same as candidate 2. Score: 70
Technical Feasibility Technology. An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate. Expertise. An assessment of the technical expertise needed to develop, operate, and maintain the candidate system.	25%	Current program in MS Access and MS Visual Basic 4.0 is mature technology based on version number. The technical staff can facilitate in upgrade the advance version in the future requirements. Required hiring expertise to integrate required program and training employees. Score: 85	MS SQL Server is developed in the information system with client/server DBMS and it needs a high experience of users to modify program. Score: 60	Easy to modify with the new version program in the future because C++ is a standard programming language widely used in the market. Required hiring and training C++ expertise to perform modifications for integration requirements. Score: 70
Economic Feasibility Cost to develop: Payback period (discounted): Net present value:	30%	Approximately 812,645 baht. Approximately 2.9 years. Approximately 573,956 baht Score: 85	Approximately 892,965 baht Approximately 3.2 years Approximately 458,339 baht Score: 60	Approximately 923,460 baht Approximately 3.6 years Approximately 380,313 baht Score: 55
Schedule Feasibility An assessment of how long the solution will take to design and implement.	20%	Less than 4 months. Score: 90	8-10 months. Score: 50	6-8 months. Score: 65
Ranking	100%	86	60.5	64.5

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3.4 Security and Control

To enhance the system performance, the system should have security to ensure data validity and correctness. The following security techniques are recommended for the proposed computerized system:

3.4.1 User Identification

The use of a password is applied to ensure user authentication. When a user starts the program, the password identification is performed. And the process is terminated when more than 3 incorrect passwords are entered. If the wrong password is entered, the system will alert the user to reenter the correct password.

Every user has a unique user ID and password to access the system. Each user can reset his password by himself for individual security to get into the accessible data file. A password will automatically outdated if the user does not change it within three months.

Passwords keyed in the system use encryption technique so that no one will understand when the password is retrieved from the system or when someone looks at the screen while the user enters password.

3.4.2 Automatic Switch on/off Machine

The system will not be used after 10 p.m. until 8 a.m. in order to prevent unauthorized person from access in data during the closed hours. If work needs to be done during the switch off time, both the Sales Manager and System Analyst can switch on the machine together in a special case.

3.4.3 Program Security

Programs may be changed intentionally or unintentionally so there should be the configuration management to protect the program. When it is practised, the system controls and records all changes of a program and documents.

Program security can be performed at the operating system by using the access log to list who did the access, when, and for what purpose the data was discussed.

3.4.4 Protection of Access to General Objects

In Sales Management System, the process depends on the amount of data in general file that is used by many people. Therefore the system needs the standard to retain the validity and the correctness of the data. The file should not be distorted or get too much access it. There is one access control list for each object and the list shows all subjects who should have access to the object and what their access is, for example: read, write, execute, etc.

There are three-bit access codes for each user and each bit represents read-only bit, write-only bit, and access bit.

The people outside Sales Department are able to read some report of Sales Management System but cannot write or access data.

3.4.5 Database Security

Two phase update is done to ensure the complete update because the system may fail at any time, for example: electronic problem.

3.4.6 Personal Computer Security

The necessary rules should be set at the work place to protect the computer and its equipment.

(1) Do not smoke or drink at the work place.

(2) Periodic backup is a must.

(3) Please close the computer before leaving the room.

And to avoid natural disaster, computers should be placed on the table and use the Uninterrupted Power Supply (UPS) and the fire alarm should be set in the computer room.

3.5 Cost / Benefit Analysis

For the existing system, cost and benefit are analyzed into separated year in order for fascinating the system decision-maker in evaluating the advantages and disadvantages between the manual system and the proposed system. The cost analysis of the existing system are described in Table 3.7:

Table 3.7. The Estimated Costs for the Existing System, Baht.

Cost items	Years				
	1	2	3	4	5
<u>Fixed Cost</u>					
Implementation Cost:					
Training Cost	3,000.00	-	-	-	-
Total Implementation Cost	3,000.00	-	-	-	-
Office Equipment Cost:					
Telephone 9 units @ 1,600	14,400.00	-	-	-	-
Typewriter 2 units @ 9,500	19,000.00	-	-	-	-
Calculator 7 units @ 3,400	23,800.00	-	-	-	-
Facsimile 2 units @ 15,500	31,000.00	-	-	-	-
Total Office Equipment Cost	88,200.00	-	-	-	-
Maintenance Cost:					
Equipment Maintenance Cost	*	2,100.00	2,310.00	2,541.00	2,795.10
Total Maintenance Cost	*	2,100.00	2,310.00	2,541.00	2,795.10
Total Fixed Cost	91,200.00	2,100.00	2,310.00	2,541.00	2,795.10
<u>Operation Cost</u>					
People-Ware Cost:					
Sales Manager 1 person @ 32,000	32,000.00	35,200.00	38,720.00	42,592.00	46,851.20
Staff:					
Salesperson 5 persons @ 12,000	60,000.00	66,000.00	72,600.00	79,860.00	87,846.00
Dispatch Officer 1 person @ 7,000	7,000.00	7,700.00	8,470.00	9,317.00	10,248.70
Total Monthly Salary Cost	99,000.00	108,900.00	119,790.00	131,769.00	144,945.90
Office Supplies & Miscellaneous Cost:	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Stationary 2,500 per month	24,000.00	26,400.00	29,040.00	31,944.00	35,138.40
Printed Form 2,000 per month	6,000.00	6,600.00	7,260.00	7,986.00	8,784.60
Paper 500 per month	36,000.00	39,600.00	43,560.00	47,916.00	52,707.60
Miscellaneous 3,000 per month					
Annual Office Supplies & Miscellaneous Cost	96,000.00	105,600.00	116,160.00	127,776.00	140,553.60
Total Operating Cost	195,000.00	214,500.00	235,950.00	259,545.00	285499.50
Total Existing System Cost	286,200.00	216,600.00	238,260.00	262,086.00	288,294.60

* The equipment maintenance cost is prepared for the office equipment warrantee and repairing cost.

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

Year	Total Existing System Cost	Accumulated Cost
1	286,200.00	286,200.00
2	216,600.00	502,800.00
3	238,260.00	741,060.00
4	262,086.00	1,003,146.00
5	288,294.60	1,291,440.60
Total	1,291,440.60	–

The development costs and operating costs are estimated for a selected candidate 1 in order to describe the specifications in the proposed system. The annual operating costs will be occurred repeatedly each year and concluded in calculation the cost / benefit analysis. The estimated costs for the proposed system for candidate 1 is shown in the Table 3.9.

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Table 3.9. Estimated Costs for Client-Server System Alternative for Candidate 1, Baht.

Cost items	Cost per Unit	Amount	Price
I. Development Costs:			
Personnel:			
Systems Analysts (28,000 Baht/month)	28,000	2	56,000
Programmer/Analysts (24,000 Baht/month)	24,000	2	48,000
GUI Designer	20,000	1	20,000
Telecommunications Specialist	20,000	1	20,000
System Architect	22,000	1	22,000
Database Specialist	15,000	1	15,000
System Librarian	15,000	1	15,000
Expenses:			
Training Registration (2,500 Baht/person)	2,500	6	15,000
Site Preparation	17,500	1	17,500
New Hardware & Software:			
Server (ATEC Pentium III)	76,900	1	76,900
Terminals (ATEC Premier 500)	37,900	5	189,500
Application Software	160,000	1	160,000
Network Peripheral	58,500	1	58,500
Printers (1 Laser jet, 2 Dot Metric)	77,245	1	77,245
Installation Charges	22,000	1	22,000
Total Development Costs			812,645
II. Projected Annual Operating Costs			
Personnel:			
Programmer/Analysts (15,000 Baht/month)	15,000	2	30,000
System Librarian (8,000 Baht/ month)	8,000	1	8,000
Expenses:			
Maintenance Agreement for Server & Terminals	22,500	1	22,500
Maintenance Agreement for NT Server Software	8,000	1	8,000
Annual Application Trainer (4,000 Baht/month)	4,000	1	4,000
Preprinted forms (1.20 Baht/form)	1.20	20,000	24,000
Report blank paper (0.54 Baht/sheet)	0.54	1,000	540
Printer ink ribbon, Laser jet ink	1,200	4	4,800
Total Project Annual Costs			101,840

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The payback analysis will be determined from the benefit gained in the proposed system candidate 1. The development costs and the operating costs are covered to calculate in this period and the additional operating costs must be included in each year.

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Table 3.10. Payback Analysis for the Proposed System (Candidate 1), Baht.

Cost items	Years					
	0	1	2	3	4	5
Development cost:	-812,645.00	-	-	-	-	-
Operation & maintenance cost:	-	-40,600.00	-43,400.00	-46,400.00	-49,600.00	-53,000.00
Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs (adjusted to present value):	-812,645.00	-36,255.80	-34,589.80	-33,036.80	-31,545.60	-30,051.00
Cumulative time-adjusted costs over lifetime:	-812,645.00	-848,900.80	-883,490.60	-916,527.40	-948,073.00	-978,124.00
Benefits derived from operation of new system:	0	380,000.00	420,000.00	440,000.00	460,000.00	480,000.00
Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits (adjusted to present value):	0	339,340.00	334,740.00	312,280.00	292,560.00	272,160.00
Cumulative time-adjusted benefits over lifetime:	0	339,340.00	674,080.00	987,360.00	1,279,920.00	1,552,080.00
Cumulative lifetime time-adjusted costs + benefits:	-812,645.00	-509,560.80	-209,410.60	70,832.60	331,847.00	573,956.00

Payback analysis of candidate 1

Payback period: lifetime benefits will overtake the lifetime costs between year 2 and 3.

= -209,410.60/(209,410.60+70,832.60)

= -209,410.60/280,243.20

= 0.75*12

= 9 months

Therefore, candidate 1 uses 2 years and 9 months.

Return-on-Investment: = (Estimated lifetime benefits – Estimated lifetime costs)/ Estimated lifetime costs

= (1,552,080.00 – 978,124.00) / 978,124.00

= 573,956.00 / 978,124.00 = 0.5868

= 0.5868*100

= 58.68%

Net Present Value: = 573,956.00 Baht

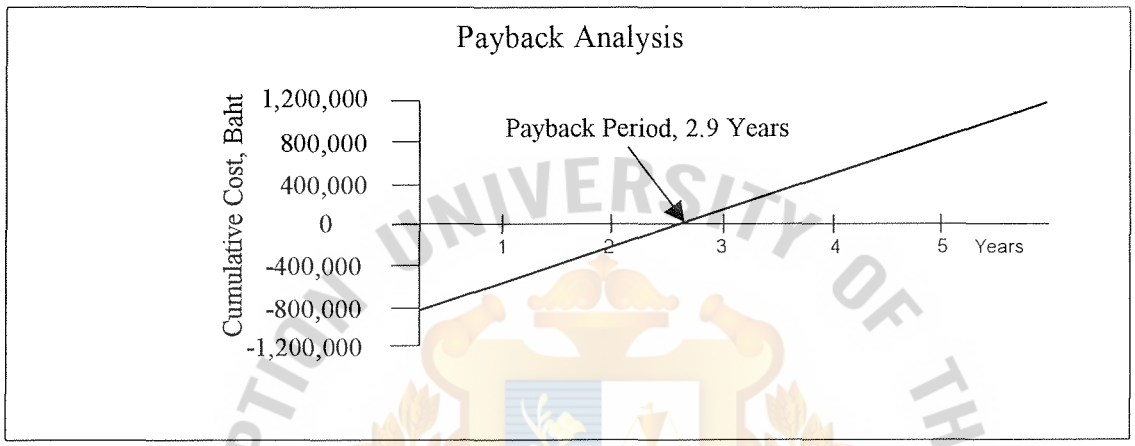

Figure 3.2. Payback Analysis Graph for the Proposed System Candidate 1.

The development costs and operating costs of a selected candidate 2 is shown in the Table 3.11.

Table 3.11. Estimated Costs for Client-Server System Alternative for Candidate 2, Baht.

Cost items	Cost per Unit	Amount	Price
I. Development Costs:			
Personnel:			
Systems Analysts (28,000 Baht/month)	28,000	2	56,000
Programmer/Analysts (24,000 Baht/month)	24,000	2	48,000
GUI Designer	20,000	1	20,000
Telecommunications Specialist	20,000	1	20,000
System Architect	22,000	1	22,000
Database Specialist	15,000	1	15,000
System Librarian	15,000	1	15,000
Expenses:			
Training Registration (2,500 Baht/person)	3,000	6	18,000
Site Preparation	25,500	1	25,500
New Hardware & Software:			
Server (ACER Pentium III)	138,720	1	138,720
Terminals (ACER Celeron)	32,500	5	162,500
Application Software	180,000	1	180,000
Network Peripheral	60,000	1	60,000
Printers (1 Laser jet, 2 Dot Metric)	77,245	1	77,245
Installation Charges	35,000	1	35,000
Total Development Costs			892,965
II. Projected Annual Operating Costs			
Personnel:			
Programmer/Analysts (15,000 Baht/month)	15,000	2	30,000
System Librarian (10,000 Baht/ month)	10,000	1	10,000
Expenses:			
Maintenance Agreement for Server & Terminals	30,000	1	30,000
Maintenance Agreement for NT Server Software	12,000	1	12,000
Annual Application Trainer (4,000 Baht/month)	4,000	1	4,000
Preprinted forms (1.20 Baht/form)	1.20	20,000	24,000
Report blank paper (0.54 Baht/sheet)	0.54	1,000	540
Printer ink ribbon, Laser jet ink	1,200	4	4,800
Total Project Annual Costs			115,340

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The payback analysis will be determined from the benefit gained in the proposed system candidate 1. The development costs and the operating costs are covered to calculate in this period and the additional operating costs must be included in each year.

Figure 3.12. Payback Analysis for the Proposed System (Candidate 2), Baht.

Cost items	Years					
	0	1	2	3	4	5
Development cost:	-892,965.00	-	-	-	-	-
Operation & maintenance cost:	-	-50,000.00	-56,000.00	-63,280.00	-71,500.00	-80,795.00
Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs (adjusted to present value):	-892,965.00	-44,650.00	-44,632.00	-45,055.36	-45,474.00	-45,810.77
Cumulative time-adjusted costs over lifetime:	-892,965.00	-937,615.00	-982,247.00	-1,027,302.30	-1,072,776.30	-1,118,587.07

Benefits derived from operation of new system:	0	380,000.00	420,000.00	458,000.00	470,000.00	490,000.00
Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits (adjusted to present value):	0	339,340.00	334,740.00	326,096.00	298,920.00	277,830.00
Cumulative time-adjusted benefits over lifetime:	0	339,340.00	674,080.00	1,000,176.00	1,299,096.00	1,576,926.00

Cumulative lifetime time-adjusted costs + benefits:	-892,965.00	-598,275.00	-308,167.00	-27,126.30	226,319.70	458,338.93

Payback analysis of candidate 2

Payback period: lifetime benefits will overtake the lifetime costs between year 3 and 4.

= -27,126.30/(27,126.30+226,319.70)

= -27,126.30/253,446.00

= 0.11*12

= 1.28 months

Therefore, candidate 2 uses 3 years and 2 months.

Return-on-Investment: = (Estimated lifetime benefits – Estimated lifetime costs)/ Estimated lifetime costs

= (1,576,926.00 – 1,118,587.07) / 1,118,587.07

= 458,338.93 / 1,118,587.07 = 0.4097

= 0.409*100

= 40.97%

Net Present Value: = 458,338.93 Baht

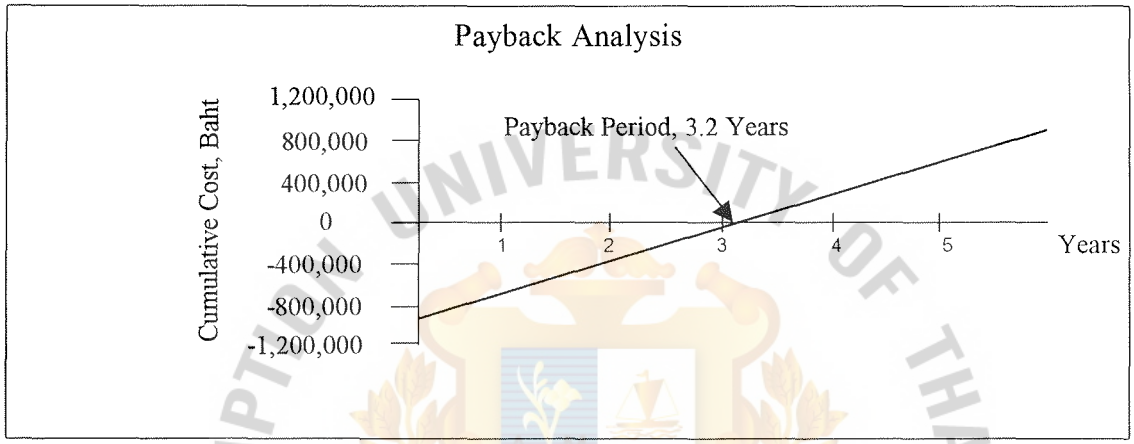

Figure 3.3. Payback Analysis Graph for the Proposed System Candidate 2.

For the proposed system of candidate 3 is estimated in the Table 3.13 below:

Table 3.13. Estimated Costs for Client-Server System Alternative for Candidate 3, Baht.

Cost items	Cost per Unit	Amount	Price
I. Development Costs:			
Personnel:			
Systems Analysts (30,000 Baht/month)	30,000	2	60,000
Programmer/Analysts (25,000 Baht/month)	25,000	2	50,000
GUI Designer	20,000	1	20,000
Telecommunications Specialist	20,000	1	20,000
System Architect	22,000	1	22,000
Database Specialist	15,000	2	30,000
System Librarian	15,000	1	15,000
Expenses:			
Training Registration (2,500 Baht/person)	2,500	6	15,000
Site Preparation	17,500	1	17,500
New Hardware & Software:			
Server (ACER Pentium III)	81,960	1	81,960
Terminals (ACER Premier 500)	50,900	5	254,500
Application Software	170,000	1	170,000
Network Peripheral	60,000	1	60,000
Printers (1 Laser jet, 2 Dot Metric)	77,500	1	77,500
Installation Charges	30,000	1	30,000
Total Development Costs			923,460
II. Projected Annual Operating Costs			
Personnel:			
Programmer/Analysts (15,000 Baht/month)	15,000	3	45,000
System Librarian (8,000 Baht/ month)	10,000	1	10,000
Expenses:			
Maintenance Agreement for Server & Terminals	25,500	1	25,500
Maintenance Agreement for NT Server Software	7,000	1	7,000
Annual Application Trainer (4,000 Baht/month)	3,000	1	3,000
Preprinted forms (1.20 Baht/form)	1.20	20,000	24,000
Report blank paper (0.54 Baht/sheet)	0.54	1,000	540
Printer ink ribbon, Laser jet ink	1,200	4	4,800
Total Project Annual Costs			119,840

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The payback analysis will be determined from the benefit gained in the proposed system candidate 3. The development costs and the operating costs are covered to calculate in this period and the additional operating costs must be included in each year.

Table 3.14. Payback Analysis for the Proposed System (Candidate 3), Baht.

Cost items	Years					
	0	1	2	3	4	5
Development cost:	-923,460.00	-	-	-	-	-
Operation & maintenance cost:	-	-40,500.00	-45,000.00	-48,700.00	-51,000.00	-55,000.00
Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs (adjusted to present value):	-923,460.00	-36,166.50	-35,865.00	-34,674.40	-32,436.00	-31,185.00
Cumulative time-adjusted costs over lifetime:	-923,460.00	-959,626.50	-995,491.50	-1,030,165.90	-1,062,601.90	-1,093,786.90
Benefits derived from operation of new system:	0	330,000.00	380,000.00	430,000.00	460,000.00	490,000.00
Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits (adjusted to present value):	0	294,690.00	302,860.00	306,160.00	292,560.00	277,830.00
Cumulative time-adjusted benefits over lifetime:	0	294,690.00	597,550.00	903,710.00	1,196,270.00	1,474,100.00
Cumulative lifetime time-adjusted costs + benefits:	-923,460.00	-664,936.50	-397,941.50	-126,455.90	133,668.10	380,313.10

Payback analysis of candidate 3

Payback period: lifetime benefits will overtake the lifetime costs between year 3 and 4.

= -126,455.90/(126,455.90+133,668.10)

= -126,455.90/260,124.00

= 0.486*12

= 5.8 months

Therefore, candidate 3 uses 3 years and 6 months.

Return-on-Investment: = (Estimated lifetime benefits – Estimated lifetime costs)/ Estimated lifetime costs

= (1,474,100.00 – 1,093,786.90) / 1,093,786.90

= 380,313.10 / 1,093,786.90 = 0.3477

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= 0.3477*100

= 34.77%

Net Present Value: = 380,313.10 Baht

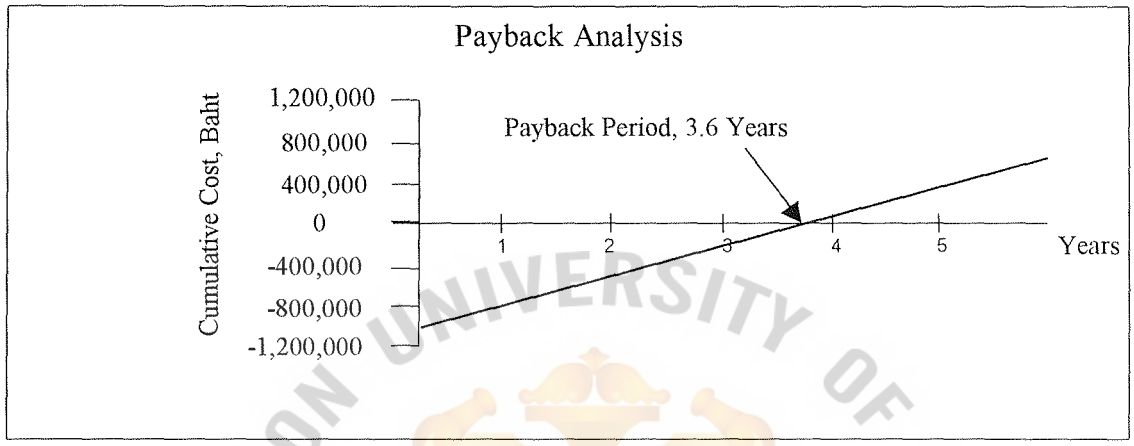

Figure 3.4. Payback Analysis Graph for the Proposed System Candidate 3.

The selected solution of the proposed system is candidate 1, which can gain the best benefit to the company. The project can return payback within less than 3 years.

The cost of the existing manual system will be compared in the next Table to view its benefit of the proposed system.

Table 3.15. Cost Comparison of the Proposed System, Baht.

Year	Accumulated Existing Cost	Accumulated Cost of Candidate 1
1	286,200.00	848,900.80
2	502,800.00	883,490.60
3	741,060.00	916,527.40
4	1,003,146.00	948,073.00
5	1,291,440.60	978,124.00

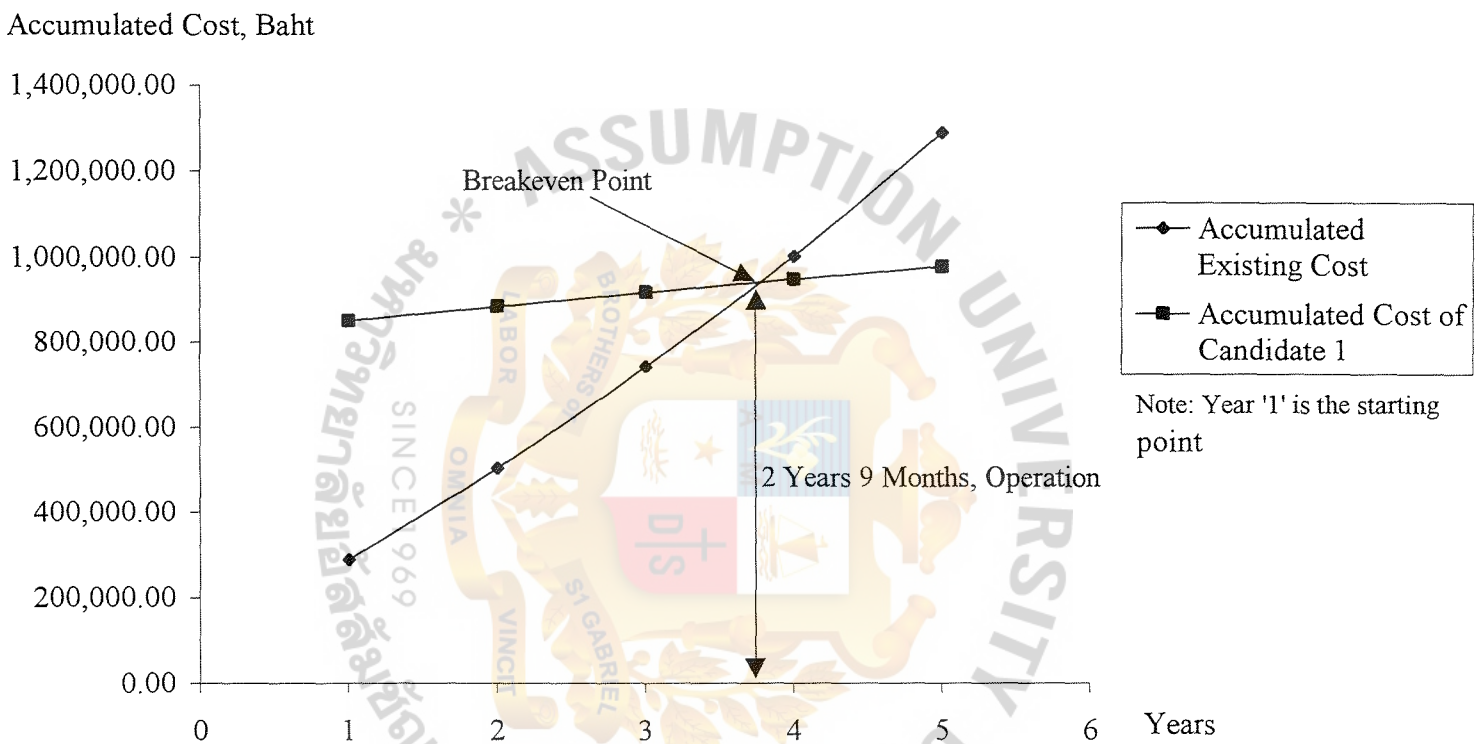

Figure 3.5. Cost Comparison between Existing and Proposed System.

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

When the summary of the proposed information system, problems, and a draft proposed system has been presented to user and owner for acceptance. The proposed system in detail will be modified for implementation.

(1) Site preparation

The first the step of system implementation is that the company should consider the preparation activities, for example: electricity, space, communications, climate control, etc. The space is provided for new computers and output devices the convenience of users to manage the computer work and document work must be considered. Computers and their devices require the standard electric capability. The company should determine about the available electricity to support the system before the installation is began. This stage, the electrical engineer has an important function to complete the requirements.

4.2 Test Plan

Before the computer system operation is admitted for a permanent installation, a test should be conducted and developed in conjunction with the design of the system. The suggested method for making the test is:

Black box testing: this method is derived to test the data in the scope of the boundary analysis testing. It concentrates on the data input to or output from a module as either a range or ordered set of values. The tested value can be identified as follows:

(1) value at the lower boundary of the range

(2) value at the upper boundary of the range

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(3) value that is less than lower boundary

(4) value that is greater than the upper boundary

4.3 Conversion

4.3.1 System Conversion

From the development lift cycle, the installation phase comprises of two activities:

(1) Data Conversion

(2) System Installation

Methods that are used to convert files depend on the alternative selected for installation of the new system. But the existing system is a manual system; as a result, the data conversion be processing of input data into files. This process requires time because the operator needs to key in all of the company's data into the files.

After that, the application system is installed and the business process will be tested.

4.3.2 Training and Support

The on-site training program will be conducted by users, system operator and management according to their related work and authorization of each group. And an operation manual is also provided to support users.

A seminar in the related field should be offered to users in order to update their knowledge and skills.

System tuning should be provided periodically to ensure the maximum performance.

The training schedules are available repeatedly to review each operation.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The problems can be summarized into main categories as follows:

The information and documentation are scattered among individual staff of each department and the same information cannot be shared between a different department. This problem can causes redundant document and the staff cannot separate the update and the non-updated documents.

The computing resources cannot be shared between each function efficiently.

To prepare report, the staff needs to do a complicate workload and that can cause mistakes, the incorrect or non-update data is resulted in the report.

It takes a long time to collect necessary information.

The management staff does not receive the reliable and high quality information that is needed for planning.

It is inconvenient for customers to check the status of their orders.

Moreover, each departments work is manual. All documents are prepared in manually and may have mistakes or the duplicated work may cause delays in communication between each department.

The record cannot be shared because the company does not use the computer system to collect the customer, product, and sales record; As a result, the Inventory Department, Finance and Accounting Department cannot use the most correct data from the Sales Department.

From those problems, we can summarize the company's requirements to improve business transaction:

(1) Automating Sales System.

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(2) DBMS for customer file, inventory file, sales order record, and invoice for credit customer record.

(3) Reducing redundant work.

(4) Data Communication Network to communicate between departments.

However a successful system requires training staff now to use the new system and ways to work more efficiently, effectively, and accurately with the computerized technique.

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

Process	Existing System	Proposed System
Order Process	20 minutes	10 minutes
Order Generating Process	20 minutes	5 minutes
Invoice Generating Process	1 hour	5 minutes
Printing Process	-	1 minute
Total	1 hour 40 minutes	21 minutes

Order Process

In this process, the customers give his information in case of the new customer and make an order to the salesperson; the salesperson will check the stock availability for the ordered product. The existing system will manually check the stock list and inform the customer.

Order Generating Process

The salesperson input the customer and order information and the quantity of the product would be update immediately. In the existing process, the salesperson cannot tell that the updated data is come from which order and there is the complicity in arranging the correct data. This process in the proposed system can correct this problem and it helps the staff not to confuse with the data updating.

Invoice Generating Process

The order is generated to be an invoice manually in the existing system, which consume times due to the length of the order lines. But the proposed system can minimize time in this stage that the customers will not waste their time for waiting.

Printing Process

This is the necessary process that will be occurred only in the proposed system in order to print the orders and invoices for the customers, the warehouse, and other concerned department.

The existing system consumes times in order processing that after the customers make an order, the salesperson needs to take time to check stock of the product in warehouse. And then the customer's order will be generated in an official form. As a result, the customer needs at least 1 hour and 40 minutes to finish his purchasing.

While the proposed system uses the computerized system in arranging products and customers information, and it is easier for salesperson to retrieve the quantity of the product in stock or to check the customer's status. And when the stock is needed to reorder, the proposed system can report within the end of the day.

5.2 Recommendations

To gather the current manual system with the computerized system of the Sales Department

The company should assign a group of staff to handle the new central database and the application program

The company should allow the Sales Department staff to get involved with the system development team so that they would be willing to cooperate in this project.

APPENDIX A

INPUT AND OUTPUT INTERFACE DESIGN

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LABOR OMNIA VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

APICES GLASS CO., LTD.

Sales Order

Date _____

Customer ID _____

(For new customer only)
Company's Name _____
Contact Name _____ Tax ID _____
Address _____
City _____ Code _____
Phone _____ FAX _____

(For new customer or changed information)
Ship to _____
Address _____

Bill to _____
Address _____

Product Name	Size	Qty.	Unit Price	Amount

Payment Cash
Check
Term

Sub Total _____
Discount _____
VAT _____
Total _____

Remark

_____
Salesperson
(Date_____)

_____
Sales Manager
(Date_____)

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST. GABRIEL
LABOR OMNIA VINCIT
SINCE 1969
มหาวิทยาลัยอัสสัมชัญ

Figure A.1. Sales Order Input Form.

APICES GLASS CO., LTD.

Product Form

Date _____

Vendor ID _____

(For new product only)
Vendor's Name _____
Contact Name _____ Tax ID _____
Address _____
City _____ Code _____
Phone _____ FAX _____

Product ID	Description	Size	Qty.	Unit Price

Remark

_____
Stock Controller
(Date_____)

_____
System Librarian
(Date_____)

_____
Inventory Manager
(Date_____)

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST GABRIEL
LABOR OMNIA VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

Figure A.2. Product Input Form.

APICES GLASS CO., LTD.

Sales Order

Date 2 Sep 2000

Customer ID PJ-25004

(For new customer only)
Company's Name YK Engineering
Contact Name Sompob Tax ID 310 5 17024 5
Address 438/12-3 Ladpraw 24, Jatujak
City Bangkok Code 10900
Phone 753-2496 FAX 753-2499

(For new customer or changed information)
Ship to
Address

Bill to
Address

Product Name	Size	Qty.	Unit Price	Amount
3 mm. Clear	18x36	50	11.6	2,610.00
5 mm. Clear	4.5x30	100	24.2	2,268.75
5 mm. Clear	18x30	200	28.9	21,675.00

Payment			
	Cash	Sub Total	26,553.75
	Check	Discount	1,327.69
	Term	VAT	1,765.82
		Total	26,991.88

Remark

Salesperson
(Date_____)

Sales Manager
(Date_____)

Figure A.3. Sales Order Input Form Example.

APICES GLASS CO., LTD.

Product Form

Date 1 Sep 2000

Vendor ID TA-0001

(For new product only)
Vendor's Name Thai-Asahi Glass Public
Contact Name Visanu Tax ID 310 0125928
Address 200 Moo 1 Suksawad Rd., PhraSamut Chedi
City Samut Prakan Code 10290
Phone 425-8970 FAX 425-8816

Product ID	Description	Size	Qty.	Unit Price
CO3-1236	Clear	12x36	300	11.60

Remark

Stock Controller
(Date_____)

System Librarian
(Date_____)

Inventory Manager
(Date_____)

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST GABRIEL
LABOR OMNIA VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

Figure A.4. Product Input Form Example.

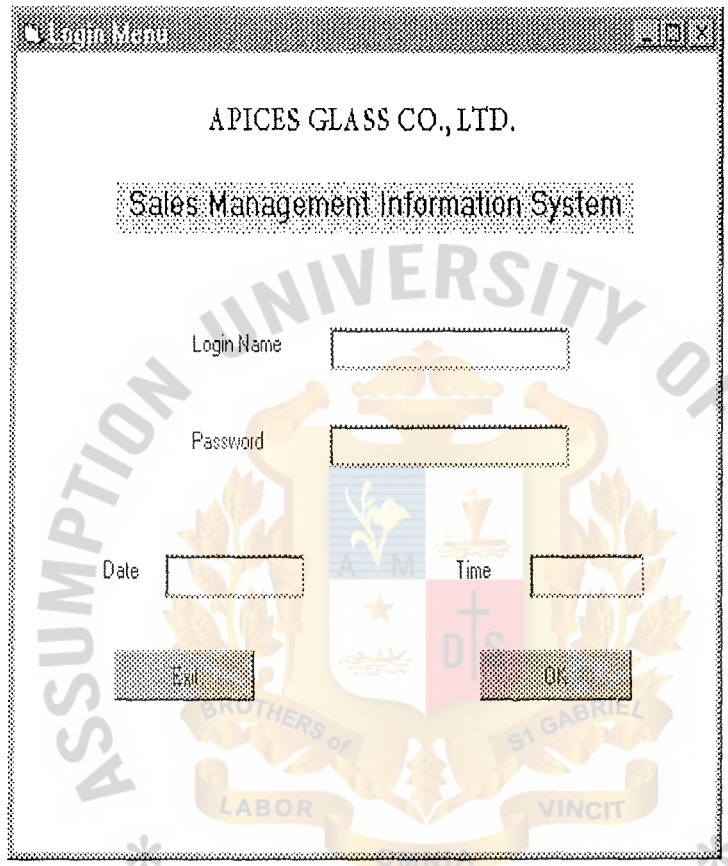

Figure A.5. Login Menu.

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST GABRIEL
LABOR VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

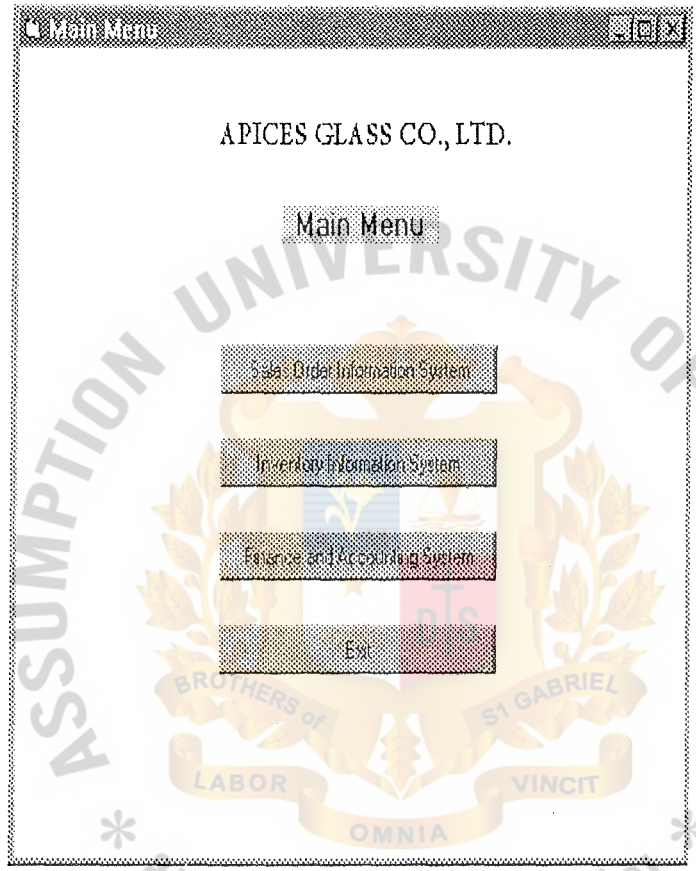

Figure A.6. Main Menu.

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST GABRIEL
LABOR OMNIA VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

St. Gabriel's Library

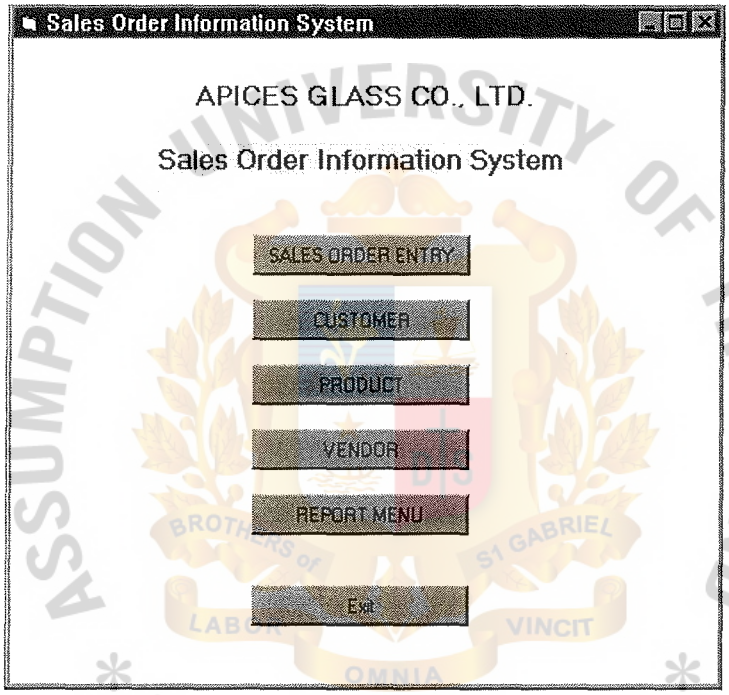

Figure A.7. Sales Order Information System Menu.

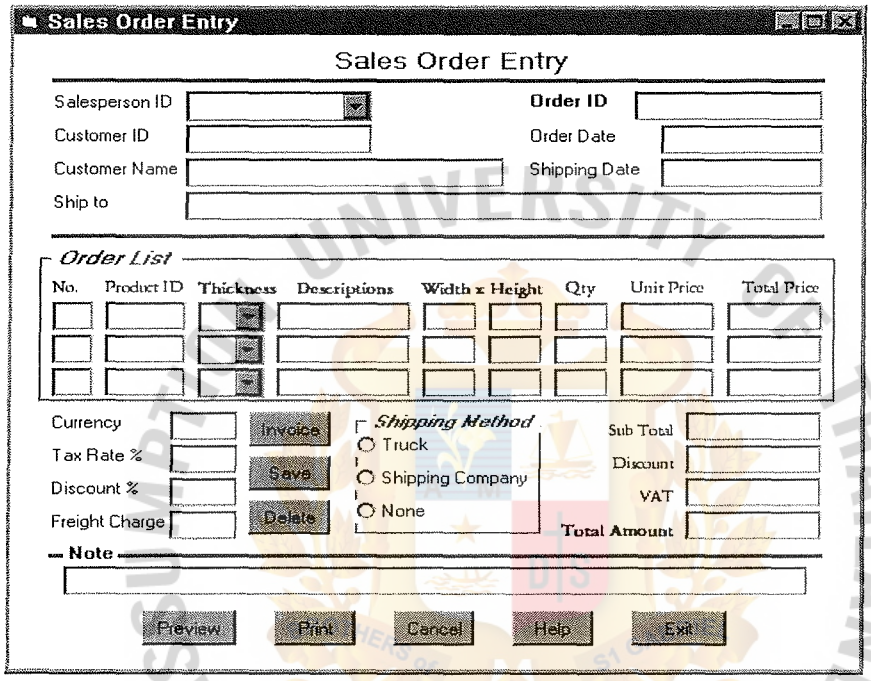

Figure A.8. Sales Order Entry Form.

UNIVERSITY OF THAI ASSUMPTION
LABOR VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

Figure A.9. Customer Form.

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST. GABRIEL
LABOR VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

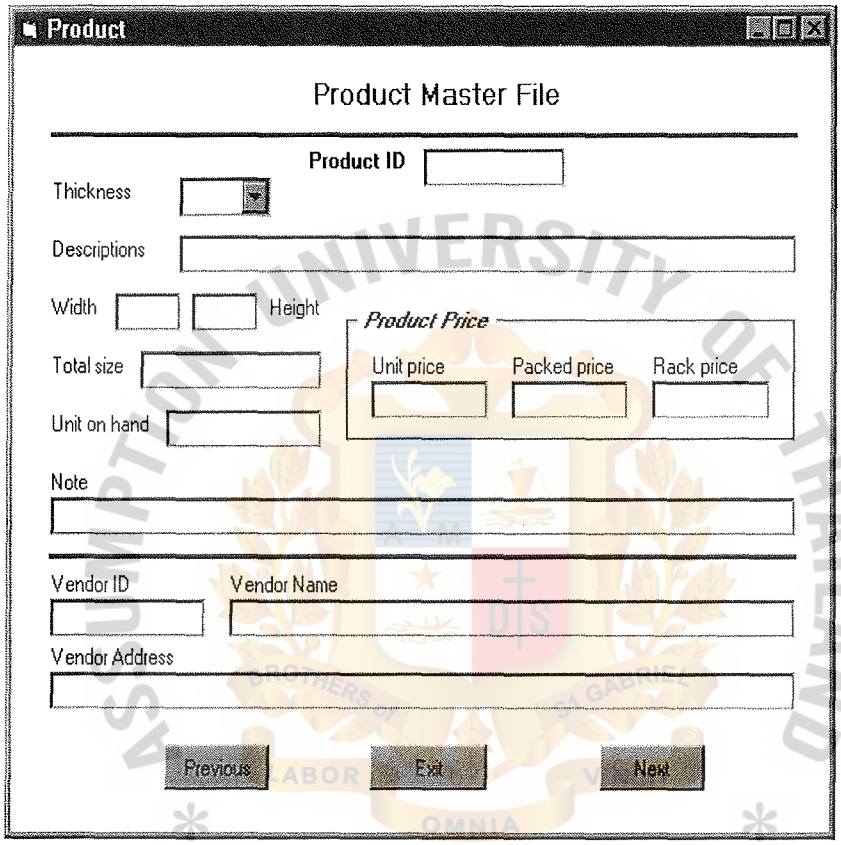

Figure A.10. Product Form.

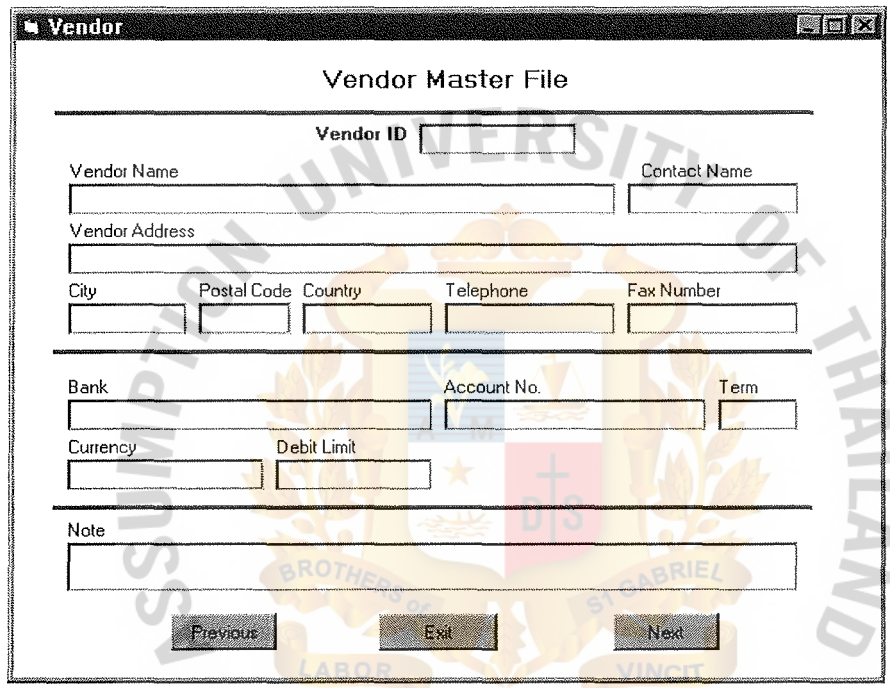

Figure A.11. Vendor Form.

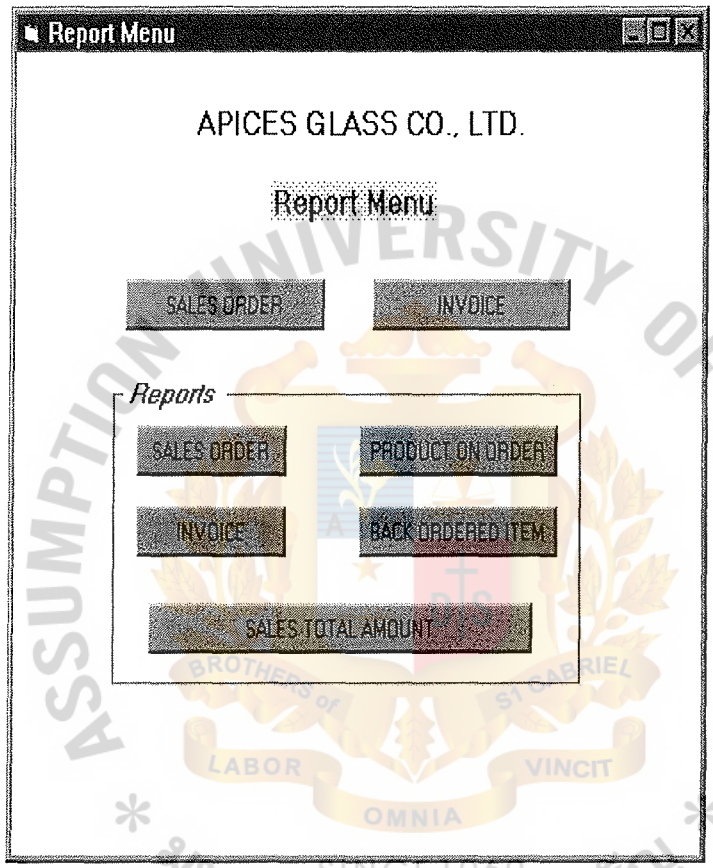

Figure A.12. Report Menu.

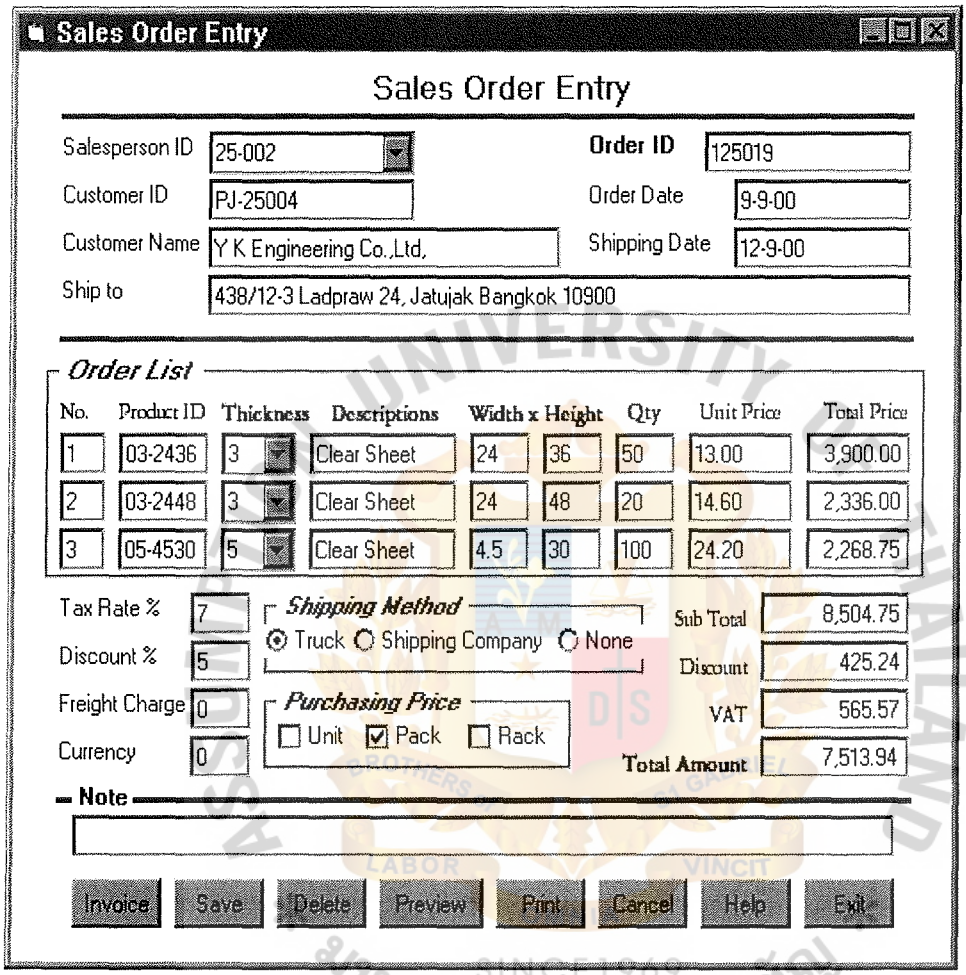

Figure A.14. Sales Order Entry Menu Example.

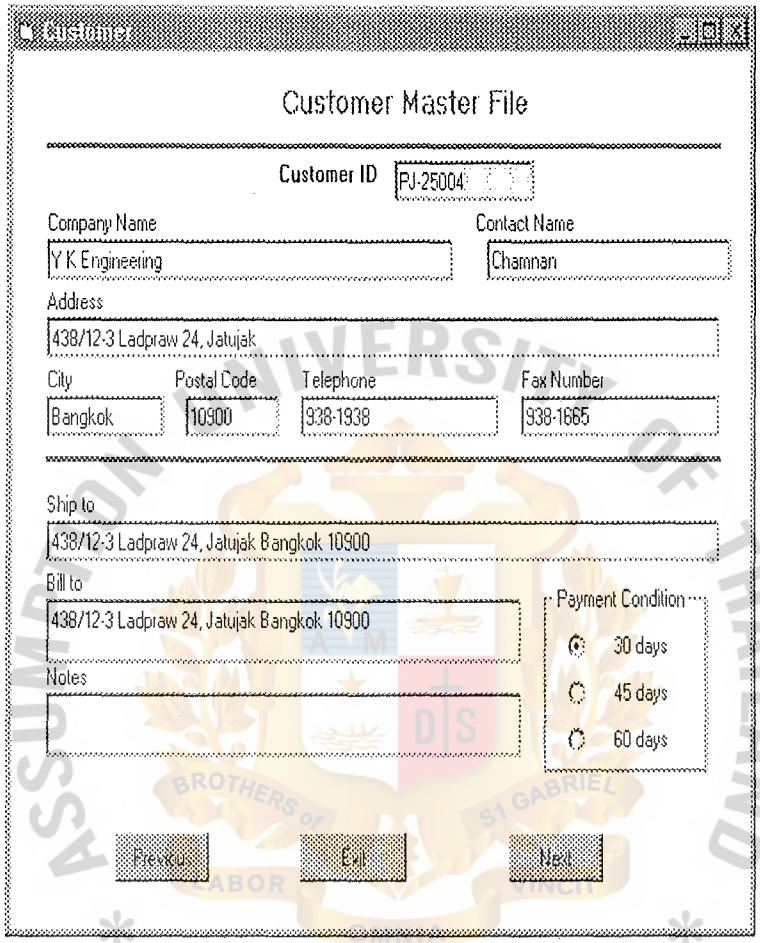

Figure A.15. Customer Menu Example.

St. Gabriel's Library

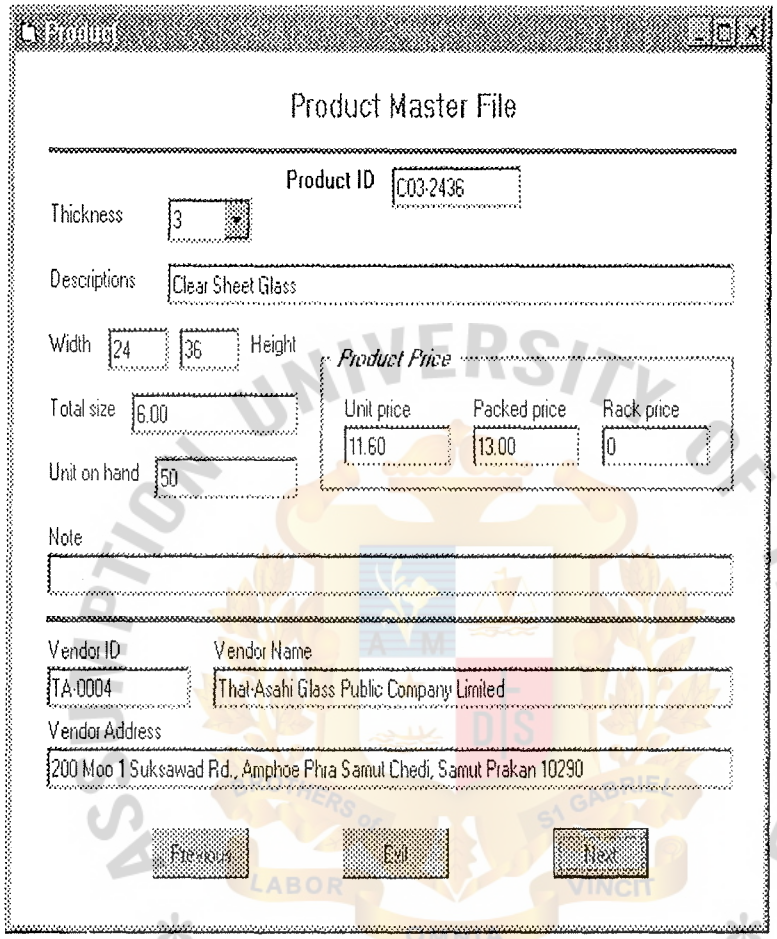

Figure A.16. Product Menu Example.

SAINT LOUIS UNIVERSITY OF THAILAND
SINCE1969

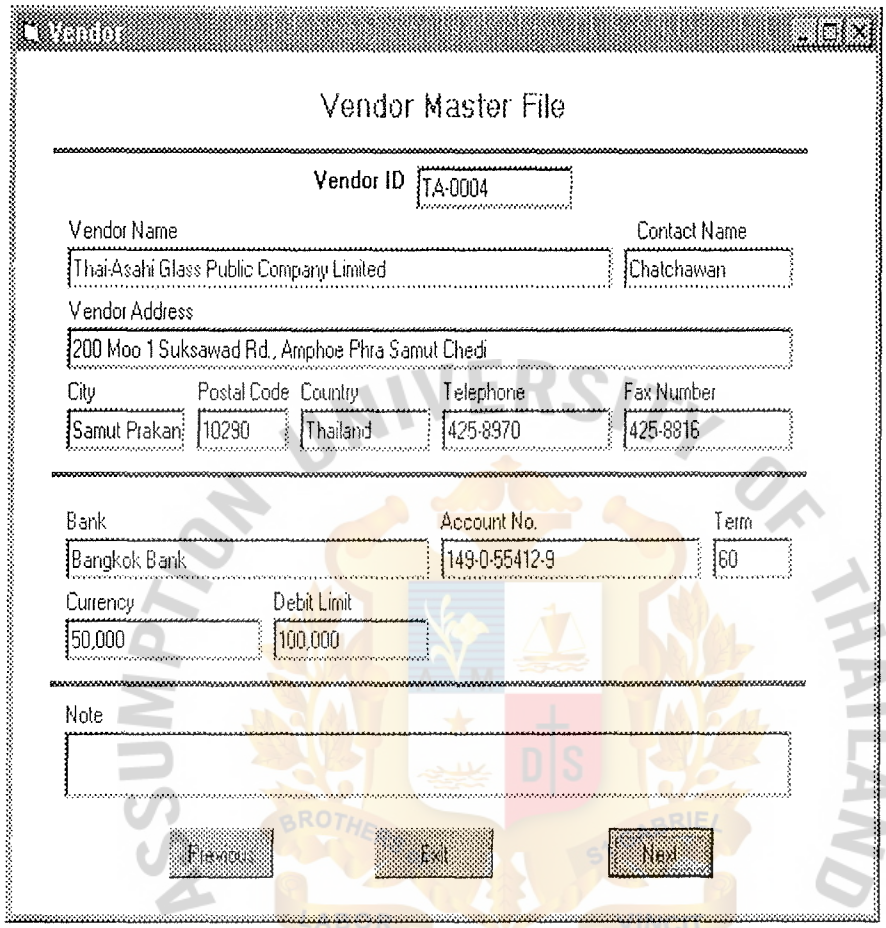

Figure A.17. Vendor Menu Example.

SUMPTION UNIVERSITY OF THAILAND
OMNIA
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

APICES GLASS CO., LTD.

78 Phrasumen Road, Bovonnivej, Phranakorn, Bangkok 10200 Thailan

Telephone (662) 280-1613-6 Facsimile (662) 629-1062-3

Tax ID 310 1234 978

SALES ORDER

Salesperson	
Customer ID	Order No.
Name	Date
Address	

Item	Prod. ID	Description	Qty.	Size	Total Size	Unit Price	Amount
		E.& O.E.					

BAHT		SUB TOTAL	
		DISCOUNT	
Price valid within	days	V.A.T.	
Payment Condition	days	TOTAL AMOUNT	

Ship to

Remark

Receiver Deliverer Authorized Signature

Figure A.18. Sales Order Form.

APICES GLASS CO., LTD.

78 Phrasumen Road, Bovonnivej, Phranakorn, Bangkok 10200 Thailan

Telephone (662) 280-1613-6 Facsimile (662) 629-1062-3

Tax ID 310 1234 978

INVOICE / TAX INVOICE

Salesman	Invoice No.
Customer ID	Ref. Order No.
Name	Date
Address	Payment Condition
	Payment Date

ITEM	Prod. ID	Description	Qty.	Size	Total Size	Unit Price	Amount
		E.& O.E.					

BAHT	SUB TOTAL	
	DISCOUNT	
All goods sold remain property of seller until full payment has been received by seller.	V.A.T.	
	TOTAL AMOUNT	

Ship to

Received the above mentioned commodities and (or) invoices in good order and condition.

.....	.....
Receiver	Deliverer
(Date .....)	(Date .....)

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST. GABRIEL
LABOR OMNIA VINCIT
SINCE 1969
มหาวิทยาลัยอัสสัมชัญ

Figure A.19. Invoice Form.

APICES GLASS CO., LTD.

78 Phrasumen Road, Bovonnivej, Phranakorn, Bangkok 10200 Thailan

Telephone (662) 280-1613-6 Facsimile (662) 629-1062-3

Tax ID 310 1234 978

SALES ORDER

Salesperson Pornvipa

Customer ID PJ-25004 | Order No 125009

Nam YK Engineering | Date 01-Sep-00

Address 438/12-3 Ladpraw 24, Jatujak Bangkok 10900

Item	Prod. ID	Description	Qty.	Size	Total Size	Unit Price	Amount
1	C03-1836	Clear Sheet	50	18 x 36	4.50	11.60	2,610.00
2	C05-4530	Clear Sheet	100	4.5 x 30	0.94	24.20	2,268.75
3	C05-1830	Clear Sheet	200	18 x 30	3.75	28.90	21,675.00

E.& O.E.

BAHT

SUB TOTAL	26,553.75
DISCOUNT	1,327.69
V.A.T.	1,765.82
TOTAL AMOUNT	26,991.88

Price valid within 30 days

Payment Condition 30 days

Ship to YK Engineering
438/12-3 Ladpraw 24, Jatujak Bangkok 10900

Remark

Receiver Deliverer Authorized Signature

Figure A.20. Sales Order Example.

APICES GLASS CO., LTD.

78 Phrasumen Road, Bovonnivej, Phranakorn, Bangkok 10200 Thailan

Telephone (662) 280-1613-6 Facsimile (662) 629-1062-3

Tax ID 310 1234 978

INVOICE / TAX INVOICE

Salesman	Pornvipa	Invoice No.	00001-0095
Customer ID	PJ-25004	Ref. Order No.	125009
Name	YK Engineering	Date	02-Sep-00
Address	438/12-3 Ladpraw 24, Jatujak Bangkok 10900	Payment Condition	30
		Payment Date	02-Oct-00

ITEM	Prod. ID	Description	Qty.	Size	Total Size	Unit Price	Amount
1	C03-1836	Clear Sheet	50	18 x 36	4.50	11.60	2,610.00
2	C05-4530	Clear Sheet	100	4.5 x 30	0.94	24.20	2,268.75
3	C05-1830	Clear Sheet	200	18 x 30	3.75	28.90	21,675.00

E.& O.E.

BAHT	SUB TOTAL	26,553.75
	DISCOUNT	1,327.69
All goods sold remain property of seller until	V.A.T.	1,765.82
full payment has been received by seller.	TOTAL AMOUNT	26,991.88

Ship to YK Engineering
438/12-3 Ladpraw 24, Jatujak Bangkok 10900

Received the above mentioned commodities
and (or) invoices in good order and condition.

.....	.....
Receiver	Deliverer
(Date .....)	(Date .....)

Figure A.21. Invoice Example.

APPENDIX B

REPORT DESIGN

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST GABRIEL
LABOR OMNIA VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

Printed Date ..... APICES GLASS CO., LTD. Page No. .....

Sales Order Report

Period : .....

Order ID	Date	Customer ID	Customer Name	Amount	Discount	VAT	Total Sales Amount

Figure B.1. Sales Order Report.

Printed Date .....

APICES GLASS CO., LTD.

Page No. .....

Invoice Report

Period : .....

Invoice ID	Inv. Date	Order ID	Customer ID	Customer Name	Term	Amount	Discount	VAT	Total Amount

Figure B.2. Invoice Report.

Printed Date .....

APICES GLASS CO., LTD.

Page No. .....

Product on Order Report

Period :.....

Product ID	Product Name	Size	Total Size	Unit Price	Unit in Stoc	Unit on Orde	Vendor ID	Vendor Name

Figure B.3. Product on Order Report.

Printed Date: ..... APICES GLASS CO., LTD. Page No. .....

Back Ordered Item Report

Period: .....

Order ID.	Product ID	Product Name	Size	Unit in Stock	nit on Orde	Quantity	Extension

Figure B.4. Back Ordered Item Report.

Printed Date : ..... APICES GLASS CO., LTD. Page No. .....

Sales Total Amount by Principal Report

Period : .....

Product ID	Product Name	Size	Unit Price	Sales Amount			
				Quantity	Amount	VAT	Total Amount

Figure B.5. Sales Total Amount by Principle Report.

Printed Date 2-10-2000 **APICES GLASS CO., LTD.** Page No. 1

Sales Order Report

Period : October 2000

Order ID	Date	Customer ID	Customer Name	Amount	Discount	VAT	Total Sales Amount
125009	01-Sep-00	PJ-25004	Y K Engineering	26,553.75	1,327.69	1,765.82	26,991.88
125010	01-Sep-00	CH-29568	Siva Trading	20,600.00	247.20	1,424.70	21,777.50
125011	03-Sep-00	AR-22500	C S I (Thailand)	9,500.00	950.00	598.50	9,148.50
125012	03-Sep-00	BK-10203	Lucent Technologies	15,320.00	1,838.40	943.71	14,425.31
125014	03-Sep-00	PK-72093	Loha Pratip Industrial	70,000.00	3,500.00	4,655.00	71,155.00
125015	03-Sep-00	BK-10203	Lucent Technologies	20,520.00	2,462.40	1,264.03	19,321.63
125016	04-Sep-00	BK-10203	Lucent Technologies	65,000.00	6,500.00	4,095.00	62,595.00
125017	05-Sep-00	BK-00253	P 49 Interior	2,560.00	128.00	170.24	2,602.24
125018	05-Sep-00	CH-10994	Siam Perstorp	900.00	45.00	59.85	914.85
125020	06-Sep-00	CR-00922	K C Baring	450.00	22.50	29.93	457.43
125021	06-Sep-00	CB-10329	Duriflex	15,000.00	1,500.00	945.00	14,445.00
125022	07-Sep-00	BK-00046	First Furniture	8,360.00	418.00	555.94	8,497.94

Figure B.6. Sales Order Report Example.

St. Gabriel's Library

Printed Date 2-10-2000

APICES GLASS CO., LTD.

Page No. 1

Invoice Report

Period : October 2000

Invoice ID	Inv. Date	Order ID	Customer ID	Customer Name	Term	Amount	Discount	VAT	Total Amount
00001-0095	02-Sep-00	125009	PJ-25004	Y K Engineering	30	26,553.75	1,327.69	########	26,991.88
00001-0096	02-Sep-00	125010	CH-29568	Siva Trading	30	20,600.00	247.20	########	21,777.50
00001-0097	04-Sep-00	125011	AR-22500	C S I (Thailand)	30	9,500.00	950.00	598.50	9,148.50
00001-0098	04-Sep-00	125012	BK-10203	ucent Technologie	60	15,320.00	1,838.40	943.71	14,425.31
00001-0099	04-Sep-00	125014	PK-72093	Loha Pratip	30	70,000.00	3,500.00	########	71,155.00
00001-0100	04-Sep-00	125015	BK-10203	ucent Technologie	60	20,520.00	2,462.40	########	19,321.63
00001-0101	05-Sep-00	125016	BK-10203	ucent Technologie	60	65,000.00	6,500.00	########	62,595.00
00001-0102	06-Sep-00	125017	BK-00253	P 49 Interior	30	2,560.00	128.00	170.24	2,602.24
00001-0103	06-Sep-00	125018	CH-10994	Siam Perstorp	30	900.00	45.00	59.85	914.85
00001-0105	07-Sep-00	125020	CR-00922	K C Baring	90	450.00	22.50	29.93	457.43
00001-0106	07-Sep-00	125021	CB-10329	Duriflex	30	15,000.00	1,500.00	945.00	14,445.00
00001-0107	08-Sep-00	125022	BK-00046	First Furniture	60	8,360.00	418.00	555.94	8,497.94

Figure B.7. Invoice Report Example.

Printed Date 2-10-2000

APICES GLASS CO., LTD.

Page No. 1

Product on Order Report

Period : October 2000

Product ID	Product Name	Size	Total Size	Unit Price	Unit in Stoc	Unit on Orde	Vendor ID	Vendor Name
C02-1826	Clear Sheet	18 x 26	3.25	990.00	4	20	TA-0001	Thai-Asahi
G05-4884	Gray Sheet	48 x 84	28.00	30.00	20	200	SP-0023	Siam Plate Glass
M04-3660	Mistlite Clear	36 x 60	15.00	20.40	10	300	SG-0108	Siam Pattern
C05-2638	Clear Sheet	26 x 38	6.86	27.20	30	500	TA-0001	Thai-Asahi
C05-4530	Clear Sheet	4.5 x 30	0.94	22.50	40	500	TA-0001	Thai-Asahi
C03-2430	Clear Sheet	24 x 30	5.00	11.60	60	500	TA-0001	Thai-Asahi
B10-8412	Bronze Sheet	84 x 120	70.00	80.00	50	200	SP-0023	Siam Plate Glass
C03-1636	Clear Sheet	16 x 36	4.00	11.60	2	600	SG-0152	Siam Gardian
K05-3684	Kasumi Clear	36 x 84	21.00	24.00	0	200	SG-0108	Siam Pattern
F03-3648	Flora Blue	36 x 48	12.00	14.80	10	200	SG-0108	Siam Pattern
F03-3660	Flora Green	36 x 60	15.00	14.80	10	200	SG-0108	Siam Pattern
C06-1836	Clear Sheet	18 x 36	4.50	30.80	30	500	TA-0001	Thai-Asahi

Figure B.8. Product on Order Report Example.

Printed Date: 2-10-2000 **APICES GLASS CO., LTD.** Page No. 1

Back Ordered Item Report

Period: October 2000

Order ID.	Product ID	Product Name	Size	Unit in Stock	Unit on Order	Quantity	Extension
125008	C02-1826	Clear Sheet	990.00	4	2	1	
125010	G05-4884	Gray Sheet	30.00	20	10	2	
125010	C03-2448	Clear Sheet	13.20	10	5	1	
125012	C05-2638	Clear Sheet	27.20	30	20	1	
125012	C05-4530	Clear Sheet	27.20	40	40	5	
125012	C03-2430	Clear Sheet	11.60	60	50	7	
125016	B10-8412	Bronze Sheet	80.00	50	33	3	
125017	C03-1636	Clear Sheet	13.00	100	10	1	
125018	C03-3030	Clear Sheet	13.00	100	30	1	
125018	C03-1648	Clear Sheet	14.60	200	100	2	
125018	C05-3060	Clear Sheet	30.00	300	20	5	
125022	C06-1836	Clear Sheet	32.50	30	6	1	

Figure B.9. Back Ordered Item Report Example.

Printed Date : 2-10-2000 **APICES GLASS CO., LTD.** Page No. 1

Sales Total Amount by Principal Report

Period : October 2000

Product ID	Product Name	Size	Unit Price	Sales Amount			
				Quantity	Amount	VAT	Total Amount
C02-1636	Clear Sheet	16 x 36	990.00	5	4,950.00	346.50	5,296.50
C03-1636	Clear Sheet	16 x 36	11.60	200	9,280.00	649.60	9,929.60
C03-2436	Clear Sheet	24 x 36	11.60	250	17,400.00	1,218.00	18,618.00
C03-2448	Clear Sheet	24 x 48	13.20	160	16,896.00	1,182.72	18,078.72
C03-2638	Clear Sheet	26 x 38	13.20	300	27,170.00	1,901.90	29,071.90
C03-3060	Clear Sheet	30 x 60	13.20	220	36,300.00	2,541.00	38,841.00
C04-3072	Clear Sheet	30 x 72	22.00	120	39,600.00	2,772.00	42,373.00
C05-4530	Clear Sheet	4.5 x 30	22.50	200	4,218.75	295.31	4,514.06
C05-1236	Clear Sheet	12 x 36	20.00	500	30,000.00	2,100.00	32,100.00
C05-1836	Clear Sheet	18 x 36	27.20	450	55,080.00	3,855.60	58,935.60
C06-1248	Clear Sheet	12 x 48	30.80	160	19,712.00	1,379.84	21,091.84

Figure B.10. Sales Total Amount by Principle Report Example.

St. Gabriel's Library

APPENDIX C

DATABASE DESIGN

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERS OF ST GABRIEL
LABOR OMNIA VINCIT
SINCE1969
มหาวิทยาลัยอัสสัมชัญ

Table C.1. Structure of Orders Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	Order ID	Numeric(Counter)	Y	Y				Primary Key
2	Salesperson ID	varchar(6)	Y			Salespersons		Attribute
3	Customer ID	varchar(8)	Y		Y	Customers		Attribute
4	Customer Name	varchar(20)	Y			Customers		Attribute
5	Ship to	varchar(60)						Attribute
6	Order Date	Date			Y		<1-Jan-2000	Attribute
7	Shipping Date	Date			Y		<1-Jan-2000	Attribute
8	No.	Numeric(Counter)		Y				Attribute
9	Product ID	Numeric(General)	Y		Y	Products		Attribute
10	Thickness	Numeric(General)						Attribute
11	Descriptions	varchar(20)			Y			Attribute
12	Width	Numeric(General)						Attribute
13	Height	Numeric(General)						Attribute
14	Qty	Numeric(General)						Attribute
15	Unit Price	Numeric(Fixed)			Y			Attribute
16	Total Price	Numeric(Fixed)			Y			Attribute
17	Tax Rate	Numeric(Percent)						Attribute
18	Discount	Numeric(Percent)			Y			Attribute
19	Currency	Numeric(Fixed)						Attribute
20	Shipping Method	varchar(20)			Y	Shipping Methods		Attribute
21	Purchasing Price	varchar(5)						Attribute
22	Note	varchar(60)			Y			Attribute

Table C.2. Structure of Customers Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	Customer ID	Numeric(Counter)	Y	Y				Primary Key
2	Customer Name	varchar(20)	Y					Foreign Key
3	Contact Name	varchar(10)			Y			Attribute
4	Address	varchar(60)						Attribute
5	City	varchar(10)	Y					Attribute
6	Postal Code	Numeric(General)			Y		5 digits	Attribute
7	Telephone	Numeric(General)			Y			Attribute
8	Fax Number	Numeric(General)			Y			Attribute
9	Ship to	varchar(60)			Y			Attribute
10	Bill to	varchar(60)			Y			Attribute
11	Payment Condition	Numeric(Fixed)			Y			Attribute
12	Notes	varchar(60)			Y			Attribute

Table C.3. Structure of Products Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	Product ID	Numeric(Counter)	Y	Y				Primary Key
2	Thickness	Numeric(Fixed)	Y				Between 2 and 1	Attribute
3	Descriptions	varchar(20)	Y					Attribute
4	Width	Numeric(General)						Attribute
5	Height	Numeric(General)						Attribute
6	Total Size	Numeric(General)			Y			Attribute
7	Unit on hand	Numeric(General)			Y			Attribute
8	Unit Price	Numeric(General)			Y			Attribute
9	Packed Price	Numeric(General)						Attribute
10	Rack Price	Numeric(General)						Attribute
11	Notes	varchar(60)			Y			Attribute
12	Vendor ID	Numeric(Fixed)	Y		Y	Vendors		Attribute
13	Vendor Name	varchar(20)	Y			Vendors		Attribute
14	Vendor Address	varchar(60)			Y			Attribute

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Table C.4. Structure of Vendors Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	Vendor ID	Numeric(Counter)	Y	Y				Primary Key
2	Vendor Name	varchar(20)	Y					Foreign Key
3	Contact Name	varchar(20)			Y			Attribute
4	Vendor Address	varchar(20)						Attribute
5	City	varchar(10)						Attribute
6	Postal Code	Numeric(General)			Y		5 digits	Attribute
7	Country	varchar(10)	Y		Y			Attribute
8	Telephone	Numeric(General)						Attribute
9	Fax Number	Numeric(General)			Y			Attribute
10	Bank	varchar(20)	Y		Y			Attribute
11	Account No.	Numeric(General)			Y			Attribute
12	Term	Numeric(Fixed)			Y		3 digits	Attribute
13	Currency	Numeric(Fixed)			Y			Attribute
14	Debit Limit	Numeric(Fixed)			Y			Attribute
15	Note	varchar(60)			Y			Attribute

Table C.5. Structure of Shipping Methods.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	Shipping ID	Numeric(Counter)	Y	Y				Primary Key
2	Shipping Method	varchar(20)	Y					Foreign Key
3	Shipping Fee	Numeric(General)			Y			Attribute
4	Time Required	Numeric(General)			Y			Attribute

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Table C.6. Structure of Salespersons Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	Salesperson ID	Numeric(Counter)	Y	Y				Primary Key
2	Name	varchar(20)	Y					Foreign Key
3	Last Name	varchar(25)						Attribute
4	Title	varchar(20)	Y					Attribute
5	Work Status	varchar(10)			Y			Attribute
6	Salary	Numeric(General)			Y			Attribute
7	Start Date	Date			Y		<1-Jan-2000	Attribute
8	Address	varchar(60)						Attribute
9	City	varchar(10)						Attribute
10	Postal Code	Numeric(General)			Y		5 digits	Attribute
11	Home Phone	Numeric(General)						Attribute
12	Notes	varchar(60)			Y			Attribute

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APPENDIX D

PROCESS SPECIFICATION

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Table D.1. Process Specification of Process Create Sales Order.

Process Name	Create Sales Order
Data In:	Customer Information Customer Order Form Salesperson Information Product Information
Data Out:	Customer Record New Order Record
Process:	1. Get customer data, name, address, phone number, etc. 2. Assign only for the new customer. 3. Record the customer data into Customer Master File. 4. Get order from the Order Form. 5. Get salesperson name fron the Salesperson database. 6. Get product ID, details, and other descriptions from Product.
Attachment:	Sales Order Entry

Table D.2. Process Specification of Process Produce Sales Report.

Process Name	Produce Sales Report
Data In:	Order Information
Data Out:	Order Report
Process:	1. Receive the sales order record from Order Master File. 2. Make Sales Order report. 3. Record Sales Order Reports.
Attachment:	Sales Report

Table D.3. Process Specification of Process Check Products in Stock.

Process Name	Check Products in Stock
Data In:	Order Information Product Information
Data Out:	In-Stock Product In-Stock Item Unavailable Item Products on Order
Process:	1. Receive Sales Order quantity from the Order Master File. 2. Check products in stock. 3. Report in-stock item to process Invoice. 4. Record out-stock item to Back-Ordered Item Master File. 5. Update product quantity to Products
Attachment:	Products

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Table D.4. Process Specification of Process Request Purchasing.

Process Name	Request Purchasing
Data In:	Back-Ordered Item
Data Out:	Out-Stock Purchasing Order
Process:	1. Receive the out-stock item record from the Back-Order Item. 2. Report the out-stock item to make purchasing order.
Attachment:	Purchasing Order

Table D.5. Process Specification of Process Create Invoice.

Process Name	Create Invoice
Data In:	Sales Orders Information Customer Information Product Information
Data Out:	New Invoice Record
Process:	1. Receive the sales order record. 2. Get the customer ID, name from Customer Master File. 3. Get product information to calculate sales amount. 4. Record new invoice to the database.
Attachment:	Invoice

Table D.6. Process Specification of Process Calculate TAX Invoice.

Process Name	Calculate TAX Invoice
Data In:	Salesperson Information Product Price Customer Status Order ID
Data Out:	Invoice Record
Process:	1. Get salesperson ID, product price, customer credit conditions, and order ID to assign new TAX invoice. 2. Calculate product amount, TAX, discount, and total amount. 3. Record new invoice.
Attachment:	Invoice

Table D.7. Process Specification of Process Accumulate Total Sales Amount Report.

Process Name	Accumulate Total Sales Amount Report
Data In:	Invoices Information
Data Out:	Invoice Report
Process:	1. Get invoice data from Invoice Master File. 2. Record invoice report to the database.

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APPENDIX E

DATA DICTIONARY

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Table E.1. Data Dictionary of Order Database.

Field Name	Meaning
Order ID	The identification of each order
Salesperson ID	The identification number of the salesperson
Customer ID	The identification number of customer
Customer Name	The name of the customer's company
Address	The address of the customer
Ship to	The place to ship the product to
Order Date	The date at making order
Shipping Date	The date at shipping
No.	The number of the product item
Product ID	The product identification number
Thickness	The thickness of the glass (product)
Descriptions	Other descriptions of the product: color, pattern, etc.
Width	The width of the glass
Height	The height of the glass
Qty	The quantity of the product
Unit Price	The price of the product per unit
Total Price	The calculated price of that item
Tax Rate	The Tax rate in percent
Discount	The discount in percent
Currency	The limit credit for each customer
Shipping Method	The way to ship the product
Purchasing Price	The type of purchasing price that dealed with unit buying
Note	The special request of the product from the customer

Table E.2. Data Dictionary of Customers Database.

Field Name	Meaning
Customer ID	The identification number of the customer
Customer Name	The name of the customer's company
Cantact Name	The contact name of the customer's company
Address	The address of the customer
City	The city that customer located at
Postal Code	The postal code of the customer's address
Telephone	The telephone of the customer
Fax Number	The fax number of the customer
Ship to	The place to ship the product to
Bill to	The billing address
Payment Condition	The limited condition for each customer (days)
Notes	The special order an history of the customer

Table E.3. Data Dictionary of Products Database.

Field Name	Meaning
Product ID	The identification number of the product
Thickness	The thickness of the product (glass)
Descriptions	The other descriptions of the glass: color, pattern, etc
Width	The width of the glass
Height	The height of the glass
Total Size	The calculated price per unit (sheet)
Unit on hand	The amount of the product in stock
Unit Price	The price per unit
Packed Price	The price per unit in one pack
Rack Price	The price of the product in one rack
Notes	The special note for the product
Vendor ID	The identification number of the vendor
Vendor Name	The name of the vendor
Vendor Address	The address of the vendor

Table E.4. Data Dictionary of Vendor Database.

Field Name	Meaning
Vendor ID	The identification of the vendor
Vendor Name	The name of the vendor's company
Contact Name	The contact person of the vendor's company
Vendor Address	The vendor address
City	The city that vendor located
Postal Code	The postal code of the vendor's address
Country	The name of the country in the case that vendor is not in Thailand
Telephone	The telephone number of the vendor
Fax Number	The fax number of the vendor
Bank	The bank that vendor has an account
Account No.	The account no. of the vendor to transfer product price
Term	The term condition that the vendor give to the company
Debit Limit	The limit currency that vendor give to the company
Note	The history or other note of vendor

Table E.5. Data Dictionary of Salesperson Database.

Field Name	Meaning
Salesperson ID	The identification of the salesperson
Name	The name of the salesperson
Last Name	The lastname of the salesperson
Title	The position title of the salesperson in the Sales Department
Work Status	The status of the employee
Salary	The salary of the salesperson
Start Date	The starting date at work
Address	The address of the salesperson
City	The city address of the salesperson
Postal Code	The postal code of the salesperson's address
Home Phone	The home phone number of the salesperson
Notes	The history or the contact person of the salesperson

Table E.6. Data Dictionary of Invoice Database.

Field Name	Meaning
Invoice ID	The identification of the invoice
Order ID	The order identification for reference
Order Date	The date that making order
Shipping Date	The date at shipment
Salesperson ID	The identification of the salesperson
Customer ID	The identification of the customer
Customer Name	The name of the customer
Customer Address	The address and city of the customer
Term	The term condition for the customer (days)
Sub Total	The amount of the invoice without including discount and VAT
Discount	The discount total for this invoice
VAT	The calculated VAT from the discounted amount
Total Amount	The total amount of the this invoice
Bill to	The address to bill the invoice to
Ship to	The address of the customer to ship product to
Notes	The special request of the customer

APPENDIX F

DATA FLOW DIAGRAM

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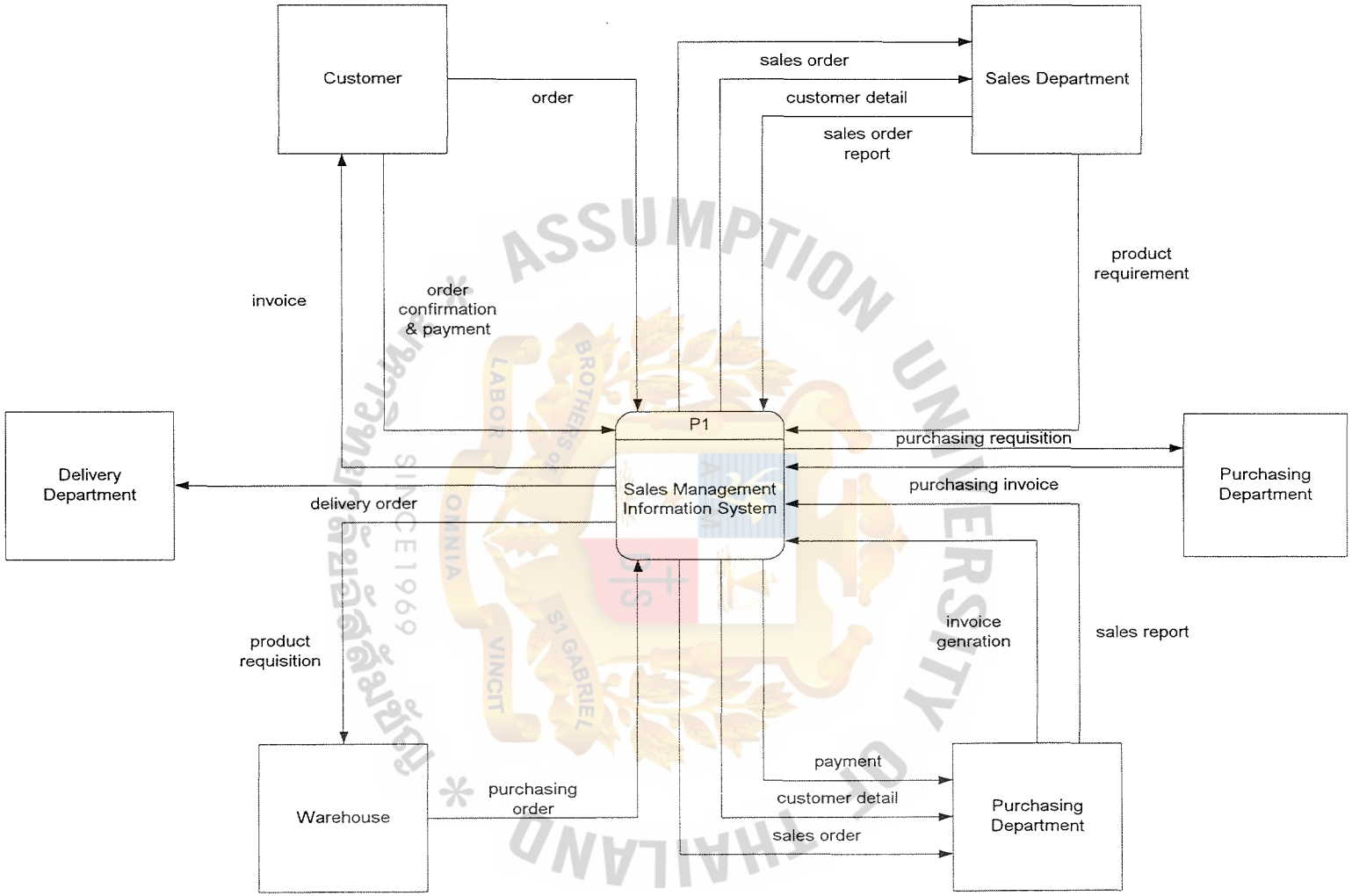

Figure F.1. Context Level Data Flow Diagram of Sales Management Information System.

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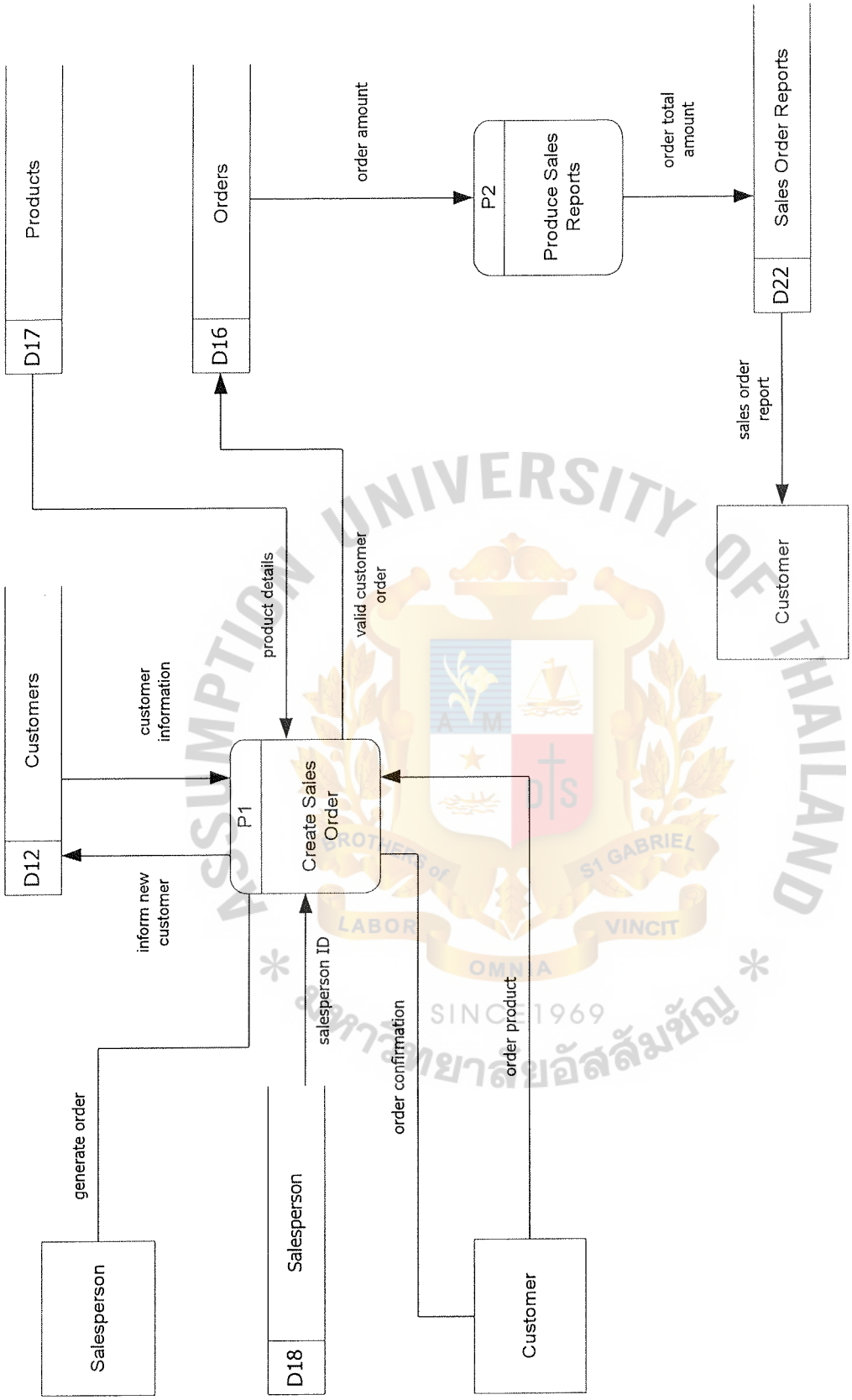

Figure F.2. Level 0 Data Flow Diagram of Sales Management Information System.

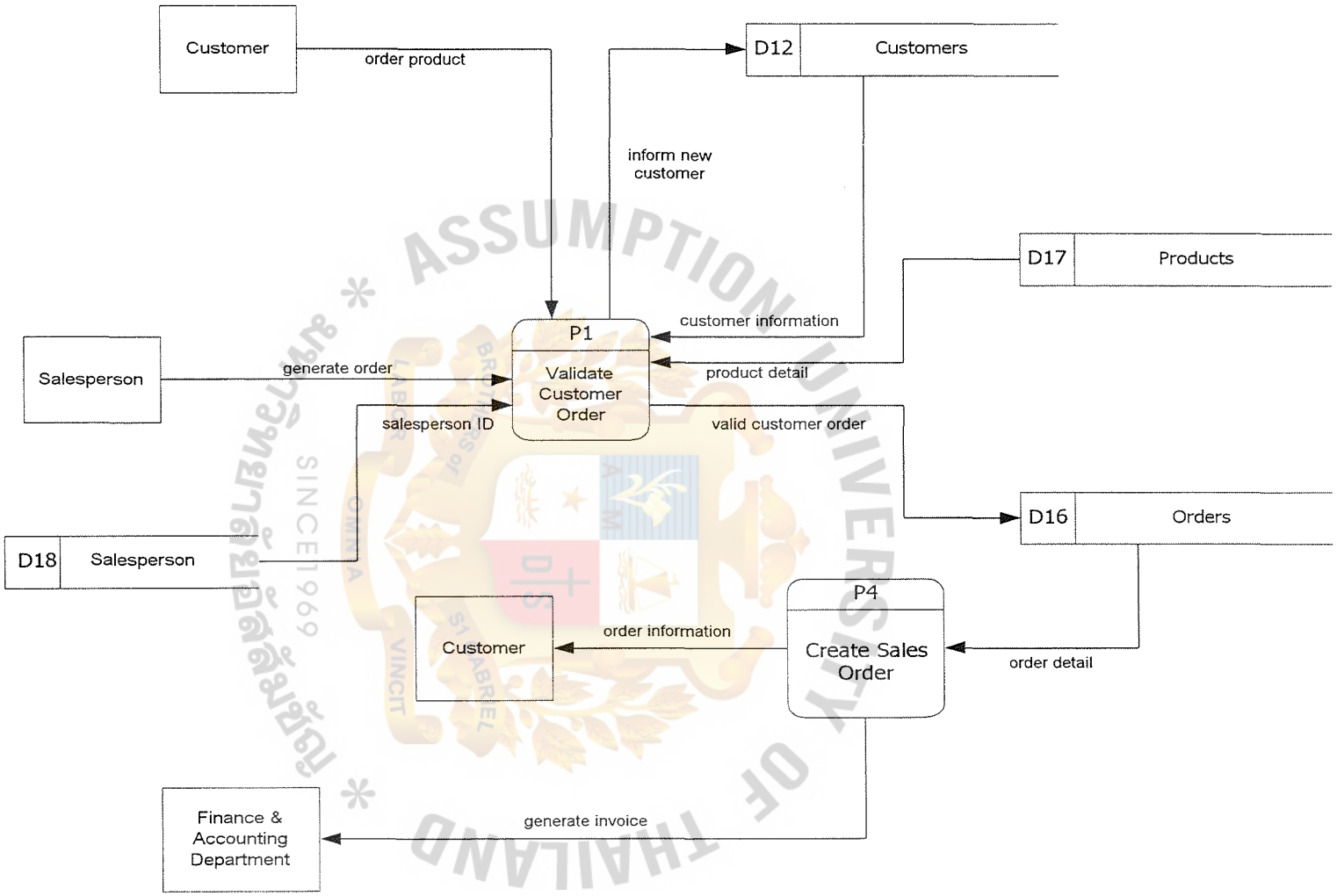

Figure F.3. Level 1 Data Flow Diagram of Sales Order Process of Sales Management Information System.

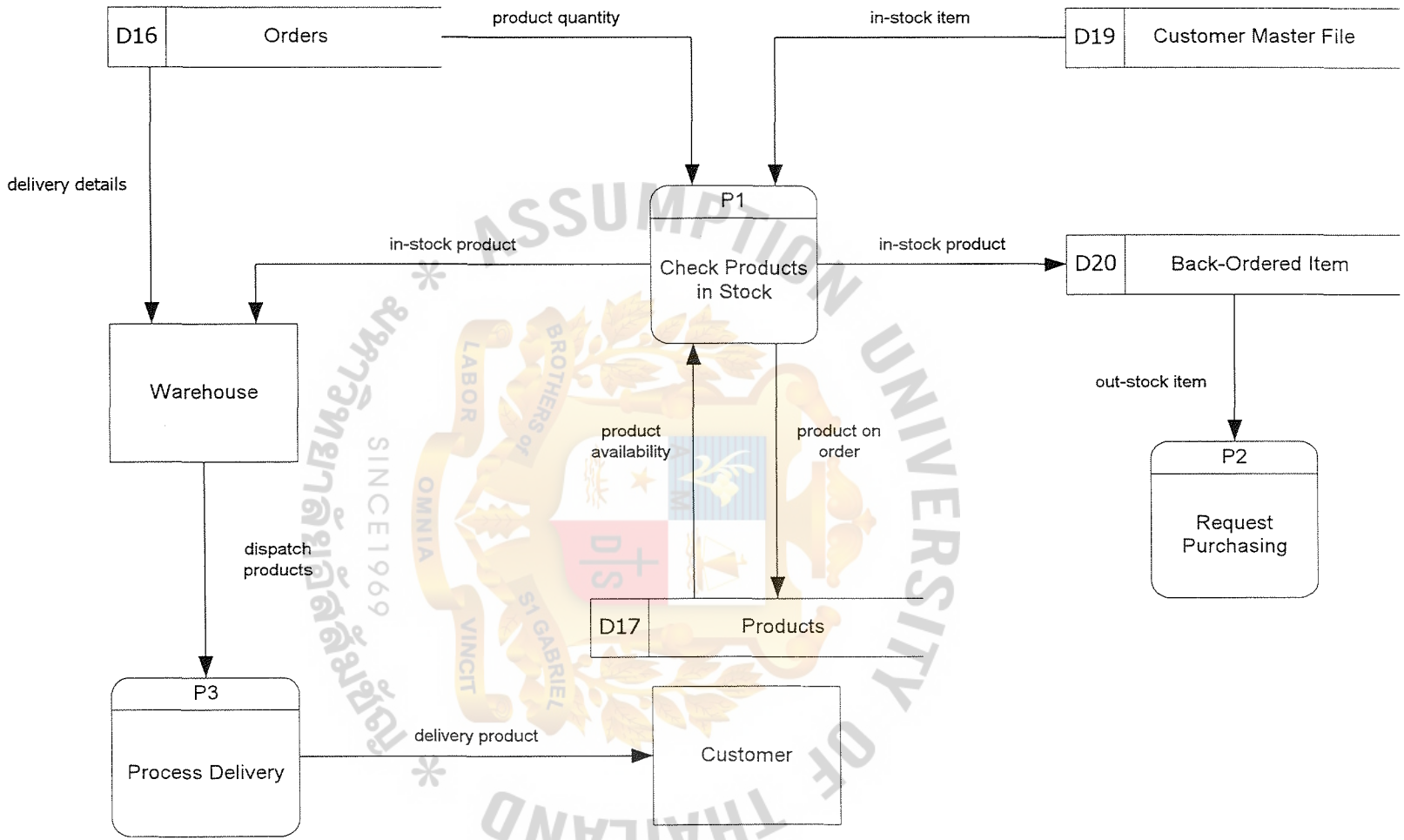

Figure F.4. Level 2 Data Flow Diagram of Product Update Process of Sales Management Information System.

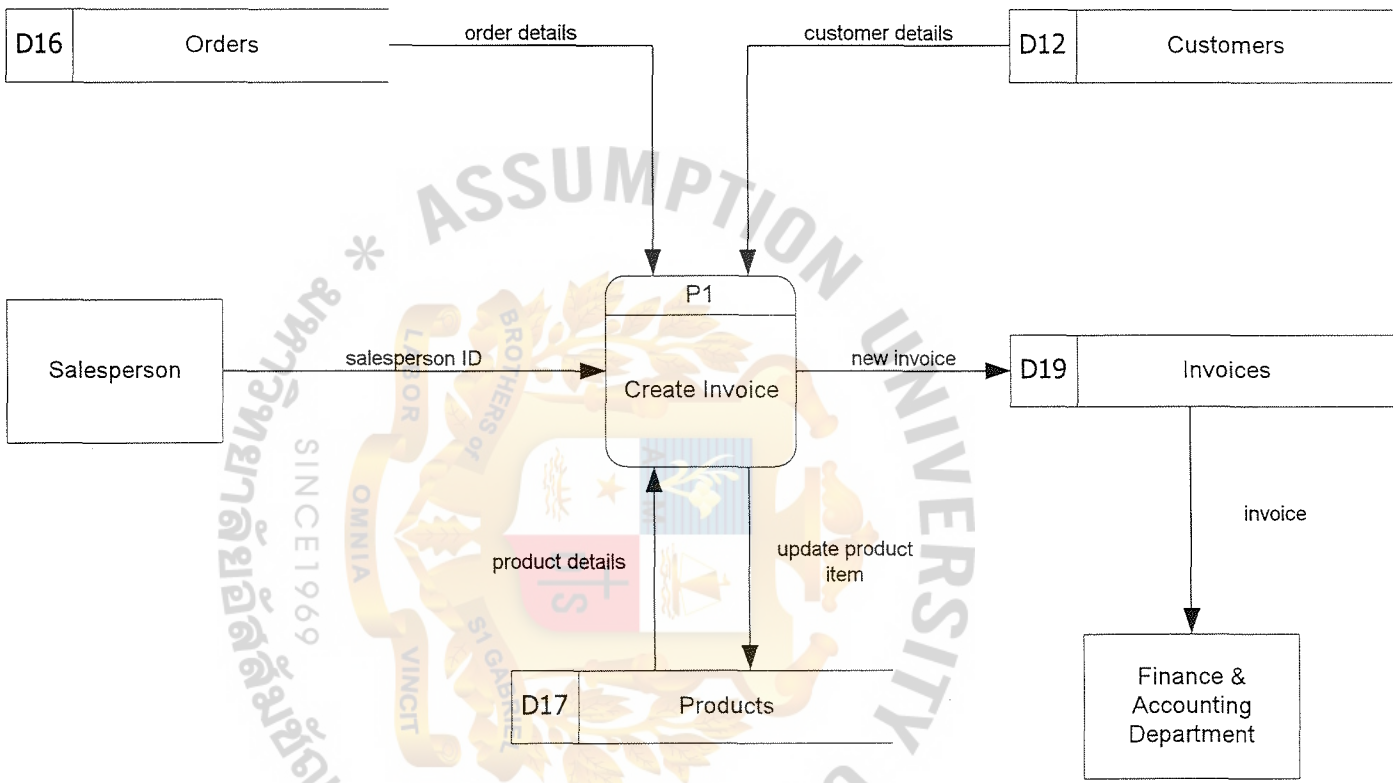

Figure F.5. Level 2 Data Flow Diagram of Invoice Preparation Process of Sales Management Information System.

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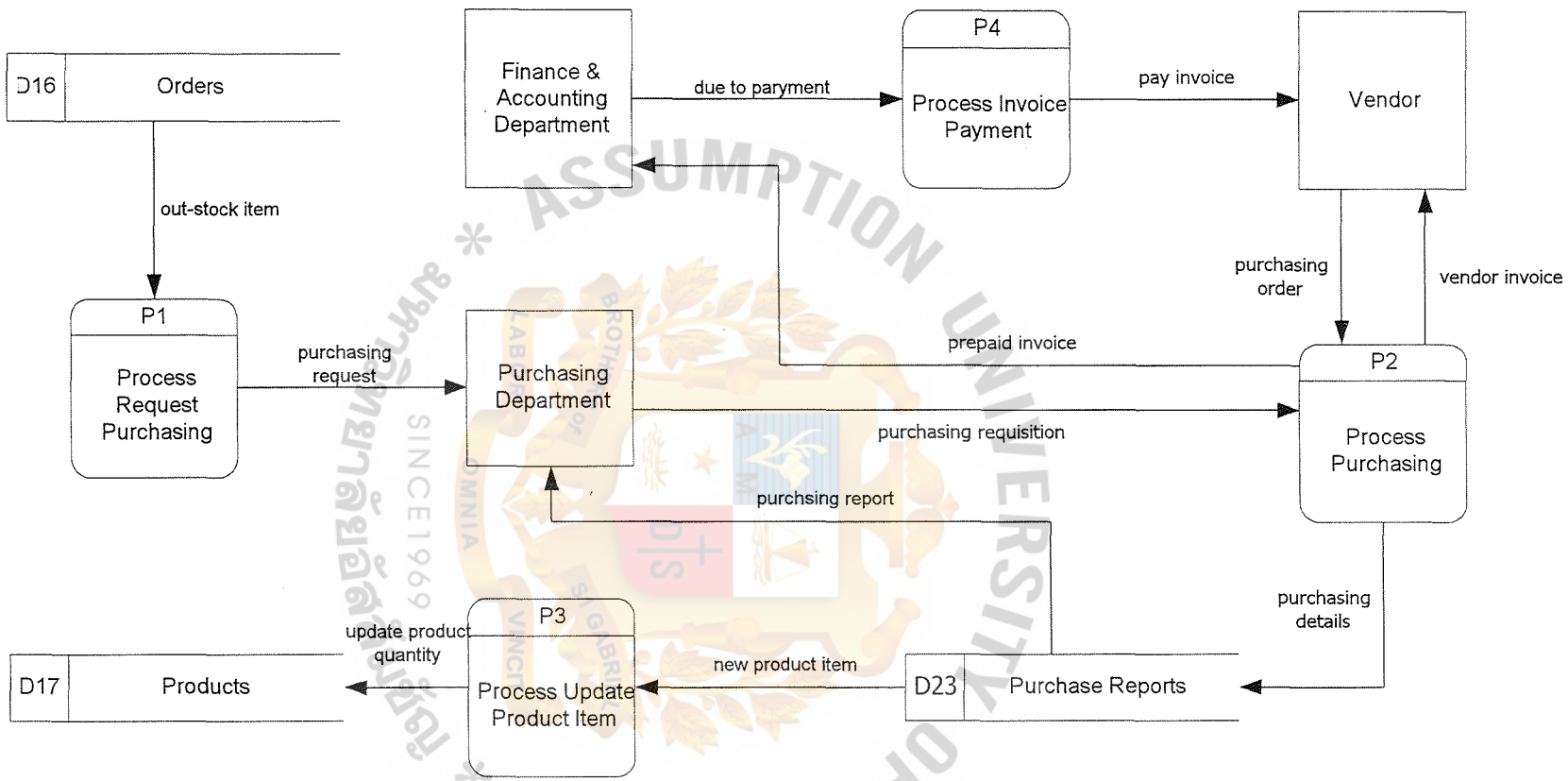

Figure F.6. Level 2 Data Flow Diagram of Product Purchasing Process of Sales Management Information System.

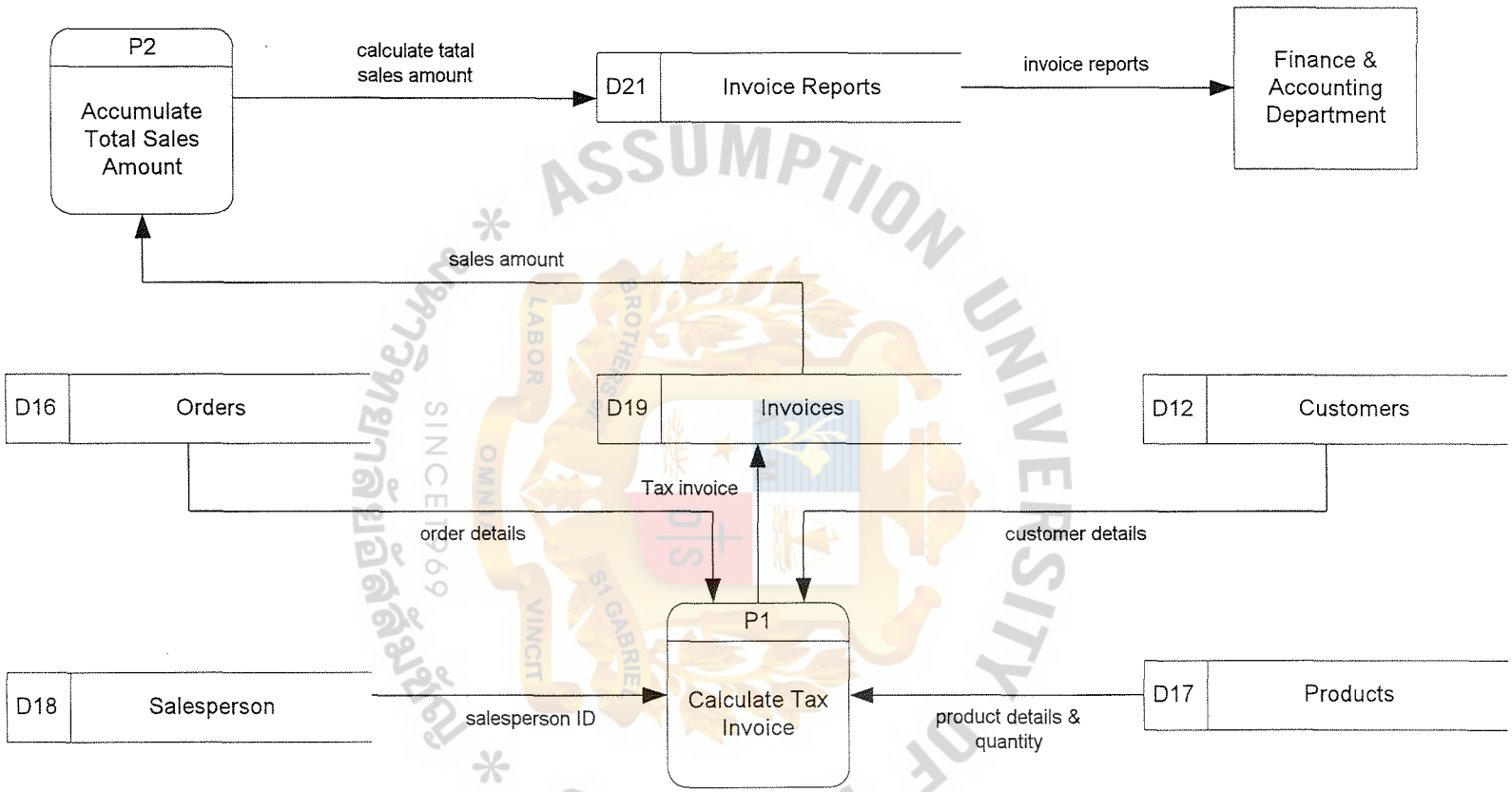

Figure F.7. Level 3 Data Flow Diagram of Invoice Calculation Process of Sales Management Information System.

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