



Bill Discount System

by

Mr. Kanchit Bhalang

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

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

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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

Bangkok Bank came into being through the initiative of a group of Thai courtiers, businessmen and others, who had a strong determination to found a Thai bank able to provide all banking services. Bangkok Bank has built a diversified business base across product and service areas for corporate and individual clients; moreover, Bangkok Bank provides a wide range of investment and securities services. Bill Discount product is one of the Bangkok Bank's products, which compose of Bill of Exchange (B/E), promissory note (P/N) and bond.

The existing system is based on the manual and some computerized system. Most data are stored on paper, while some parts are stored in a spreadsheet in personal computers of the users. It provides a low quality service to our customers, high operating costs, inconsistent data and a lot of human errors' problems. The computerization is a way to improve the quality service, consistent data and reduce operating costs and human errors. The project covers all phases of system analysis and designs. The proposed system is designed to solve the existing problems.

In order to make the proposed system more beneficial in the future, it is recommended that all users be trained and well-educated of how to use the proposed system. End users are introduced to an information system via a training program that includes such information as the purpose and objectives of the system, differences between the existing and the new systems, and the responsibilities of end users.

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I. INTRODUCTION

1.1 Background of the Project

Bill Discount is one of the Bangkok Bank's products, which compose of Bill of Exchange (B/E), promissory notes (P/N) and bond. Nowadays, this product has been maintained manually which causes many problems; all documents are on paper that are often missed and lost. When transaction occurs, the operation has to examine the customer against the credit line manually, and then records it in the logbook. If the operation doesn't record immediately, it will result in a none up-to-date or incorrect data. Moreover, the management would like to have the corporate database, especially the customer information system, which can be retrieved at the right time. Consequently, the Bill Discount will be initiated.

In this project, the author will analyze the Bill Discount System of Bangkok Bank public Company Limited. Then the author will design and implement the program to support the system.

1.2 Objectives of the Project

The objectives of Bill Discount System are as follows:

- (1) To be able to consolidate the corporate customer information of the company.
- (2) To design and develop the computerized system to be able to manipulate the transaction data of the bill discount product for a more efficient and effective process.
- (3) To develop a new application to ease the uses.
- (4) To provide the real-time system with the up-to-date database system.

- (5) To design the database system to support the management information system in order to foster the decision-making.
- (6) To reduce the operation processes.
- (7) To reduce the cost of paper storage.
- (8) To increase productivity in the case of a large amount of transactions as well as report generating.
- (9) To provide the security level of user authorization.

1.3 Scope of the Project

The scopes of the project are as follows:

- (1) The system would be able to record and maintain banks, products and customers information.
- (2) The system would be able to add and update purchase and sale transactions.
- (3) The system would be able to automatically calculate credit line of banks and customers.
- (4) The system would be able to support business rules of the products.
- (5) The system would be able to support real-time application.
- (6) The system would be able to provide operational and exceptional reports.
- (7) The system has a security, which can be able to control users to access appropriate functions.

1.4 Deliverables

The deliverables for the Bill Discount System are as follows:

- (1) An application that is developed by PowerBuilder 6.0.
- (2) Screen layout for user interface.
- (3) Output reports

II. THE EXISITING SYSTEM

2.1 Background of the Organization

Bangkok Bank came into being through the initiative of a group of Thai courtiers, businessmen and others, who had a strong determination to found a Thai bank able to provide all banking services. The founders registered the newly-formed institution as Bangkok Bank Co., Ltd. on 20th November 1944. The Bangkok Bank has built a diversified business base across product and service areas for corporate and individual clients. The organization of the Bangkok Bank is shown in Figure 2.1. The Bangkok Bank's business is divided into three major businesses:

(1) Investment Banking

The bank offers a full range of investment banking services to its corporate clients. The services include project finance, corporate finance, and securities services. The bank has been a leader in the field of investment banking.

(2) Personal Banking

The bank offers a full range of personal banking services to its clients. The services include deposits, mutual fund, bualong loans, credit card, cheque-cashinginterbranch, ATM service, telebanking with bualong phone, telefax, office banking, self service machines, education advisory and travel service. The bank has been a leader in the field of presonal banking

(3) Business Banking

The bank offers a full range of business banking services to its corporate clients. The services include payment and collection services and bahtnet third party fund transfer service

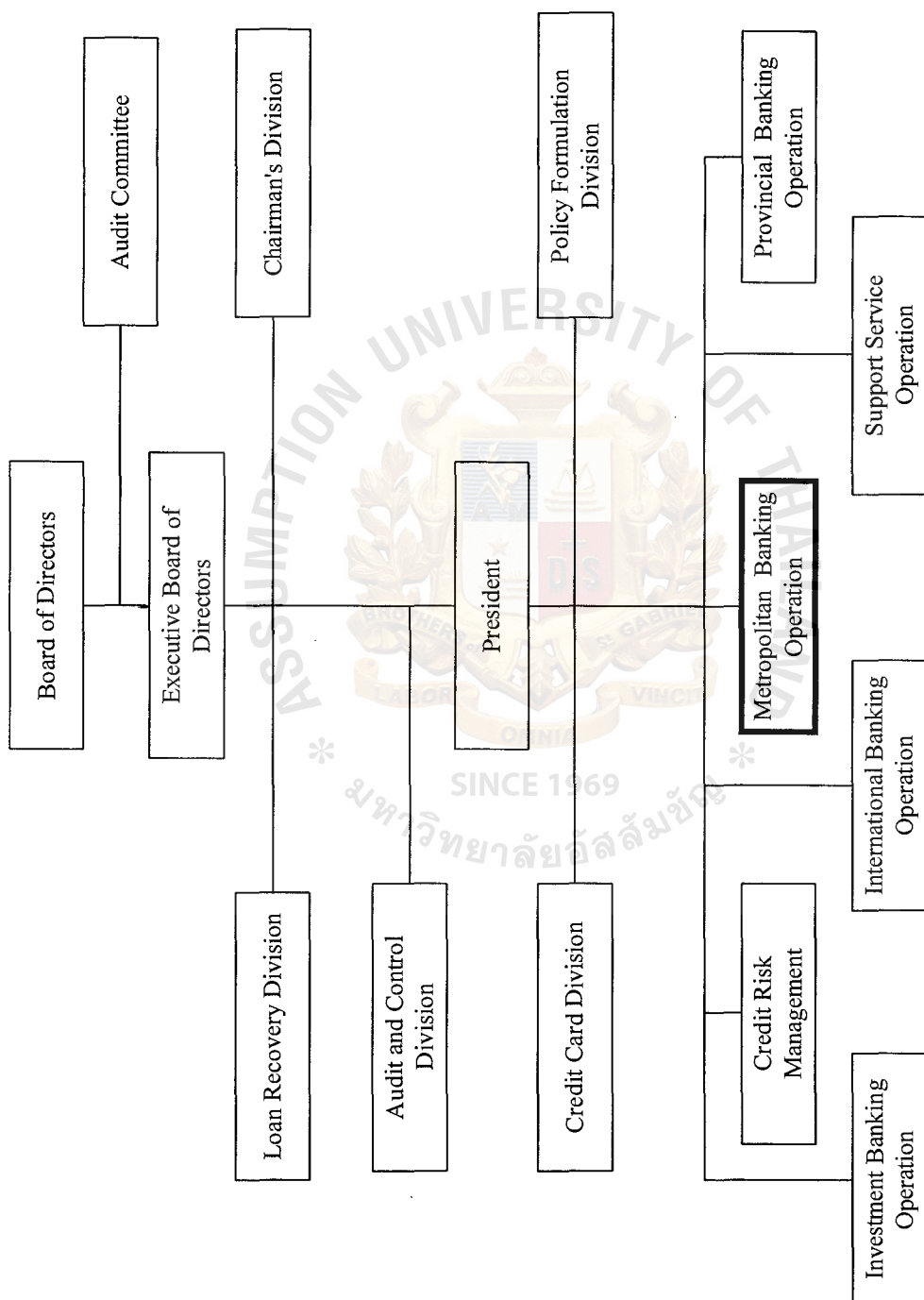


Figure 2.1. Organization Chart.

2.2 Existing Business Function

The existing business functions of Bill Discount System are the combination of processes both in manual and the use of stand-alone PC to manipulate the data. The existing business functions can be summarized as follows:

Process 1: Maintain bank credit information

Credit control staffs have the responsibility to control and approve credit line of banks. The information of credit line of banks is kept in a Microsoft Excel file.

Process 2: Maintain customer information

Credit control staffs have a responsibility to control and approve credit line of customers. If there is no problem, the credit control shall approve the credit. The information of credit line of customers is kept in a Microsoft Excel file.

Process 3: Maintain purchase and sale information

In case of buying, the credit control staffs will decrease the credit line of banks and customers. Then, operation staffs key in the bill information in a Microsoft Excel file in case of both buying and selling.

Process 4: Approve purchase and sales

Supervisor staffs will approve the transaction that is keyed in the bill information by the operation staffs. Then, in case of selling, the credit control staffs will increase the credit line of banks and customers.

Process 5: Generate operational report

At the end of day, the operation staffs shall print operational reports.

The existing system can be presented in form of graphical presentation which is included in the:

- (1) Context Diagram
- (2) Data flow diagram

The details are presented in Appendix B.

2.3 Current Problems and Areas for Improvement

2.3.1 Current Problems

The existing bill discount system is operated by stand-alone PC that causes many problems. The problems are the following:

- (1) There is no proper procedure to control the Bill Discount product.
Therefore, the average response time of each transaction is so slow that the manual system does not support the increasing transactions
- (2) It takes time to generate reports.
- (3) Data or information cannot be stored in the computer for real-time retrieval that results in the delay, unreliability and redundancy of information.
- (4) Illegal data can be entered.
- (5) It is hard to generate exceptional reports.
- (6) The system is costly because of the handling of too many paper works.
- (7) It cannot support a large amount of transactions which causes loss in business opportunities.
- (8) The system is unsecured.
- (9) The system has much unnecessary tasks and procedures.
- (10) The system is unable to consolidate the corporate customer information of the company.
- (11) Data or information cannot be available at the right time as well as unreliable.

2.3.2 Areas for Improvement

- (1) To reduce redundancy step of processing.
- (2) To reduce human errors occurred during daily operations.

- (3) To minimize redundancy data.
- (4) To reduce response time in processing a transaction.
- (5) To reduce expense in handling a lot of papers.
- (6) To examine credit line of banks and customers at the right time.
- (7) To increase productivity in the case of a large amount of transactions as well as report generating.
- (8) To improve the quality of data available for better decision-making.
- (9) To be able to consolidate the corporate customer information of the company.
- (10) To develop a new application to ease the usage.
- (11) To provide the real-time system with the up-to-date database system.

2.4 Existing Computer System

In the existing system, all computers are connected to LAN network for using only shared printer. The main requirements of hardware are 3 computer sets, peripherals, and communication equipments. The 3 computer sets are used as clients.

The application will be designed based on spreadsheet application by using Excel and running on Windows'98.

2.4.1 Hardware Configuration

Client configuration is specified as follows:

Intel Celeron 533 MHz COMPAQ PCs 3 Units

- (1) Intel Celeron 533 MHz CPU
- (2) 64 MB RAM
- (3) 4 GB Hard disk
- (4) 15" Monitor
- (5) 1.44" Floppy Disk Drive

(6) Keyboard & Mouse

(7) 3Com EtherLink 10 MB PCI LAN CARD

Printer configuration is specified as follows:

LaserJet 2100 TN Hewlett Packard	1 Unit
----------------------------------	--------

Dot Matrix Epson LQ1050	1 Unit
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Communication equipment configuration is specified as follows:

Cables and other network interface	3 Units
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2.4.2 Software Configuration

Software configuration is specified as follows:

Microsoft Windows 98 (for client)

Microsoft Office 97

TCP/IP



III. THE PROPOSED SYSTEM

3.1 User Requirements

The user requirements for the proposed system are as follows:

- (1) Designing the system that provides faster response time for more efficient and effective process.
- (2) Providing the system that generates computerized documents for both purchasing and sale process; the purpose for decreasing the investment cost in handling paper work.
- (3) Designing the system that produces meaningful reports to support decision-making.
- (4) Designing and developing the computerized system to be able to manipulate the transaction data of the bill discount product for a more efficient and effective process.
- (5) Designing the system that is able to consolidate the corporate customer information of the company.
- (6) Providing real-time application which users could operate online transaction and could ensure that data will be reliable and up-to-date.
- (7) Providing the system that validates correctness of data automatically; such as bank and customer credit line validation, to guarantee the consistency of data.
- (8) Reducing redundant tasks in some manual processes for better performance and improving work control.

3.2 Candidate Solutions

To identify the candidate solutions, it can be done by system analysts brainstorming among themselves, or gathering technology information from external organization such as computer suppliers and software providers.

The candidate solution can be specified into 3 candidate solutions which are:

- (1) Candidate 1: The solution uses Microsoft Excel to serve users' requirements. It will be faster the construction phase but this package is unsuitable for on-line transaction processing (OLTP) and inflexible to develop a program. So, the business functions aren't being fulfilled completely and hard to generate reports which can support managements.
- (2) Candidate 2: The solution is developed by outsourcing. It will take more construction time than that of the candidate 1 but it will fully serve business functions because the system will be customized for the specific functions.
- (3) Candidate 3: This solution is like the solution of candidate 2. The only difference is developing application by internal staffs instead of outsourcing.

The candidate system matrix is a useful tool for effective organizing and explanation for candidate solutions. So it is used to explain each candidate in details as shown in Table 3.1.

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Table 3.1. Candidate Systems Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Proposed system computerization	Some parts of the system use manual record i.e. The other use computer to calculate interest and profit.	Outsourcing development using ORACLE database and Developer/2000	Development using SQLServer database and PowerBuilder by SA and programmers.
Benefits	No need to invest as the staffs can use the existing technology	The developers in company do not need to develop by themselves.	This solution fulfills all requirements at much cheaper cost than candidate 2.
Servers and Workstations	PC standalone with Microsoft Windows.	Windows NT for server and Microsoft Windows for client.	Same as candidate 2.
Software tools needed	Microsoft Excel 97 keeps records of customer information and generates reports.	ORACLE RDBMS and Developer/2000.	SQLServer RDBMS and PowerBuilder 6.0
Application software	Not applicable.	Custom solution.	Same as candidate 2.
Method of Data processing	PC Standalone.	Real-time processing on client/server architecture.	Same as candidate 2.
Output devices	<ul style="list-style-type: none"> • EPSON 1050 dot-matrix printer • Screen 	<ul style="list-style-type: none"> • HP 2100 LaserJet printer • Screen 	Same as candidate 2.
Input devices	Keyboard & mouse	Same as candidate 1	Same as candidate 1.
Storage devices and Implications	Excel files with 100 MB disk array capability.	ORACLE RDBMS with 2GB disk array capability on server side and 200 disk array capability on client side.	SQLServer RDBMS with 2GB disk array capability on server side and 100 disk array capability on client side.

3.3 Feasibility Analysis

There are 4 feasibility studies concerning the best candidate solution which are:

- (1) Operational feasibility is a measure of how well the solution will work in the company and also how people feel about the system. It can be divided into 2 sub parts as functionality and political.

Functionality: to describe the details of what degree the candidate will benefit the organization and how well the system does.

Political: to describe the detail of how well the system is accepted from user management and organization perspective.

- (2) Technical feasibility is a measure of the practicality of a specific technical solution and the availability of resources. It can be divided into 2 sub parts as well.

Technology: to explain in the computer technology needed to support each candidate solution.

Expertise: to explain the technical expertise needed to develop, operate, and maintain the candidate solution system.

- (3) Economic feasibility is a measure of the cost-effectiveness of the candidate or solution. It is often called the cost-benefit analysis.
- (4) Schedule feasibility is a measure of how reasonable the project schedule is or how long the candidate solution will take to design and to implement.

The details of the feasibility analysis are in 4 parts that are described in Table 3.2. In addition, the calculation of cost-benefit analysis (economic feasibility) has been shown in Appendix G to Appendix H.

Table 3.2. Feasibility Analysis Matrix.

Feasibility Criteria	Wt.	Candidate1	Candidate2	Candidate3
Operational Feasibility	30%	Manual procedures have not only many steps to operate information of customers and products but it also is hard to generate reports score: 50	The customized application would fulfill all user requirements but it's hard to modify in the future score: 80	The customized application would fulfill all user requirements score: 95
Technical Feasibility	20%	Current procedures are hard to deal with the whole information and reports Moreover, the current procedures are suitable for small transactions score: 40	Although ORACLE RDBMS and Developer2000 are well-known , the need of training staffs is required with high cost The need of consultant also is required when problems occur Problems solving consulting may take more time and is more expensive than solving by the technical staff of the company score: 85	PowerBuilder is developed for support GUI and OO methodology Consequently, the programmers can build the applicaion rapidly and it is easy to maintain score: 95
Economic Feasibility Cost to develop Payback Period Net Present Value Details Calculation	40%	Approximately 173,000 can't measure Approximately-1,693,682 See Appendix G score: 40	Approximately 936,000 Approximately 4.23 years Approximately 162,510 See Appendix H score: 80	Approximately 396,000 Approximately 1.75 years Approximately 702,510 See Appendix I score: 95
Schedule Feasibility	10%	Already implement score: 100	3 months score: 85	3 months score: 85
Ranking	100%	49.0	81.5	94.0

3.4 Target System

How to select the best candidate solution is to look for a solution that has the highest score from feasibility analysis matrix. For this project, the candidate 3 has the highest score, so it is the most appropriate solution. The purposed system will be implemented regarding the information explained in feasibility analysis matrix. We have to invest money and time in order to achieve the purposed system and to get maximum benefits from the investment. Therefore, the target system characteristics can be classified into three categories:

(1) Response time

When the daily operations are to be supported by the computer instead of human interaction done in the past, the time taken to complete a transaction is also reduced. Consequently, the overall performance of the organization is also increased.

(2) Information accuracy and integrity

The manual work causes more mistakes than the computer operation. The way for storing and managing valuable information by computer will guarantee and rise the reliability of the system. For example, if customer name and/or customer address are kept in 2 files, when the names are changed, the staff needs to update customer name and/or customer address in those 2 files, otherwise, the inconsistency of data will occur and might affect the future operation.

(3) Document reduction

In an organization, there are a great deal of documents needed to be kept. It is not only costly but also hard to maintain. After the system is computerized in the concept of paperless, the documents produced by the

proposed system will be reduced. The cost of handling paper will be decreased.

3.5 System Analysis and Design

Data flow analysis examines the use of data to carry out specific business processes within the scope of a system investigation. We might think of it as viewing the activities of a system from the view-point of the data: where they originate, how they are used or changed, and where they go, including the stops along the way from their origin to their destination.

The components of data flow strategy span both requirements determination and systems design. A notation facilitates the documentation of the proposed system and its analysis by all participants in the process of determining system requirements.

The new logical data flow diagram will indicate the flow of the requirements and the types of data to develop the program to support the new system. By DFD, the analyst can design the table to match the requirement of the users and support the report design of the system.

The details of system analysis and design on the Bill Discount System have been presented in the form of graphical presentation which includes:

- (1) Context Diagram
- (2) Data flow diagram

The details are presented in Appendix C.

3.5.1 Application Architecture

After we designed a logical data flow diagram, then, we will next prepare a design for the physical application system that consists of Network Architecture, Data Architecture, Interface Architecture, and Process Architecture. The design will cover

technologies to be used and information system of data, process, interface, and network components. The application architectures of Bill Discount System are as follows:

(1) Network Architecture

The system will apply two-tiered Client/Server computing concept. On the NT server's side, data stored using SQLServer (Database Server) and business logic (Application Server). On the clients' side, the clients will be kept in windows98 and compatible. The proposed LAN design is based on Ethernet topology. All nodes of this topology interconnected directly to the central system. It is meant that each client can communicate only with the central server via hub, network communication lines, and protocol TCP/IP. Network configuration of the proposed system is presented in Figure 3.1.

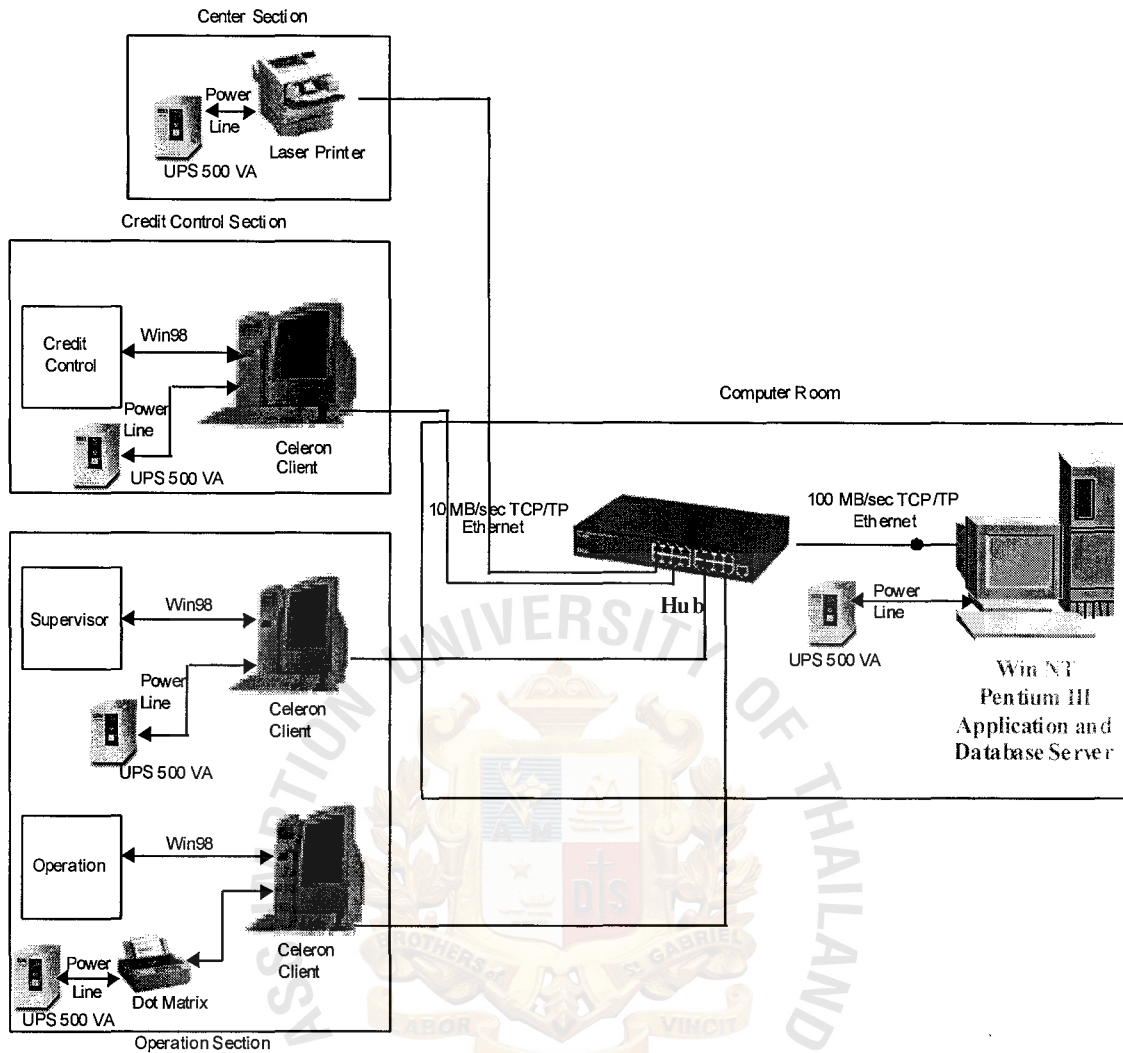


Figure 3.1. Network Configuration of the Proposed System.

(2) Data Architecture

We use SQLServer product, which applied a Relational Database Management System (RDBMS) in our system. All data will be kept in a tabular form, every file is implemented as a table, and have data distribution.

(3) Interface Architecture

We will use Graphical User Interface (GUI) technology to communicate with the users. We will use GUI base on Microsoft Window

developed by PowerBuilder. Distributed on-line computers (on-line processing) will manage data input and editing.

(4) Process Architecture

The architecture will be defined in terms of software languages and tools. The PowerBuilder 6.0 and Informix will be applied in our system. The software development system is a language and tool kit. We will use SDEs for two-tier client/server application consisting of client-based programming language.

3.5.2 Database Design

According to the logical data model derived from System Analysis phase, we can transform such data model to physical database schema by using normalization methodology. After normalization is done, the normalized tables are clearly defined. They guarantee data consistency, integrity and also reduce redundancy. The normalization can be done step by step following the rules, which are:

- (1) Each entity will be converted to a table.
- (2) Each attribute will be transformed to a field.
- (3) Each primary and secondary key will be transformed to an index into the table.
- (4) Each foreign key will be implemented as a relationship between instances of the table.

After transforming, we might achieve only the first normal form (1NF) which needs to be normalized to reach second normal form (2NF), and then third normal form (3NF) later.

We can claim that all entities in the logical data model have been mapped to tables, which have already been third in normal form. The reason is that they contain no

repeating groups and every non-key attribute fully depends on the primary key and no non-key attributes, which depend on any other non-key attributes. Moreover, all tables provide database integrity: key integrity, domain integrity and referential integrity. By this, we ensure that the physical database schema of the purposed system presented in Appendix A also decreases redundancy.

All tables are as follows:

- (1) Bank
- (2) Customer
- (3) AccountOfficer
- (4) Purchase
- (5) Sales

3.5.3 Structure Design

Structure charts are used as the tool in structure design. It depicts a modular design of a program. Structure chart modules are presumed to execute in a top-to-bottom, left-to-right sequence.

There are two popular approaches used to derive a program structure chart from data flow diagram, those are:

- (1) Transform analysis is an examination of the DFD to divide the processes into those that perform input and editing (called Afferent), those that do processing or data transformation (called Central Transform), and those that do output (called Efferent).
- (2) Transaction analysis is an examination of the DFD to identify processes that represent transaction centers. Transaction center is a process that does not do the actual transformation on the incoming data (data flow); rather, it serves as router to route data to two or more processes.

For the Bill Discount System, we revised and redraw the logical DFD in order to include more details needed to be used by the programmer. We use the transform analysis approach to convert logical DFD to structure charts. All DFDs reflecting transform analysis against structure charts are presented process by process sequentially in Appendix D.

3.5.4 Input Design

The Bill Discount System has been developed by using PowerBuilder 6.0 which is run on Windows'95 and up. The input process will be designed with GUI for easy usage and understanding. Moreover, it should facilitate rapid data entry by minimizing key-stroke of user, and should provide the control of input by looking for the appropriate data type of each attribute.

Normally, input design emphasizes on what is the appropriate format and media for a computer input, how you apply human factors to the design the computer inputs, and how you select proper screen-based controls for input attributes that are to appear on a GUI input screen.

The prototype of input screens is presented in Appendix E.

3.5.5 Output Design

System analysts must understand properly in what information that users or management needs to use or to make decision. In order to design the appropriate format of output, we have to know types of outputs first.

There are two basic types of computer outputs, external and internal.

- (1) External outputs are sent out to recipients such as customers, suppliers.

Most external outputs are printed on hard copy (paper). Some external outputs are designed as turnaround documents which are used as input of other system.

- (2) Internal outputs are used inside the company to support the system's users and managements.

The output can be either hard copy (printed report) or soft copy (displayed on screen). There are typically three types of reports:

- (1) Detailed report serves as an audit trail or a history report such as Daily Sales Report.
- (2) Summary report is summarized and used to indicate trends and potential problems such as Inventory Control Report.
- (3) Exception report is presented as an alert to show some exceptional conditions.

The prototype of outputs is presented in Appendix F. For each report, the user can change condition before retrieving the information such as start date, end date, and bill type.

3.6 Hardware and Software Requirements

In the proposed system, all computers are based on 2-tiered Client/Server architecture. The main requirements of hardware are 4 computer sets, peripherals, and communication equipments for supporting an interactive system. All computers are connected to LAN network. A file server will be used to store Bill Discount application and to manage database and shared printer among all clients. The rest of the 3 computer sets are used as clients.

The application will be designed based on GUI interface by using PowerBuilder 6.0 and running on Microsoft Windows NT version 4.0 (for server) and Windows'98 (for clients). The application will be worked on SQLServer 7.0 database installed on the server. In additions, the Bill Discount System provides multi tasking in order to access the database concurrently by multiplying users with powerful concurrency database control.

3.6.1 Hardware Configuration

Client configuration is specified as follows:

Intel Celeron 533 MHz COMPAQ PCs 3 Units

- (1) Intel Celeron 533 MHz CPU
- (2) 64 MB RAM
- (3) 4 GB Hard disk
- (4) 15” Monitor
- (5) 1.44” Floppy Disk Drive
- (6) Keyboard & Mouse
- (7) 3Com EtherLink 10/100 PCI LAN CARD
- (8) UPS 500 VA

Server configuration is specified as follows:

Intel Pentium III 650 MHz COMPAQ PCs 1 Unit

- (1) Intel Pentium III 650 MHz
- (2) CPU128 MB RAM
- (3) 10 GB Hard disk
- (4) 15” Monitor
- (5) 40X CD-ROM
- (6) 1.44” Floppy Disk Drive
- (7) Keyboard & Mouse
- (8) 3Com EtherLink 10/100 PCI LAN CARD
- (9) UPS 500 VA

Printer configuration is specified as follows:

LaserJet 2100 TN Hewlett Packard 1 Unit

Dot Matrix Epson LQ1050 1 Unit

Communication equipment configuration is specified as follows:

Hub 8 ports	1 Unit
Cables and other network interface	5 Units

3.6.2 Software Configuration

Software configuration at server is specified as follows:

Windows NT 4.0

SQLServer 7.0 Enterprise RDBMS

PowerBuilder 6.0

Software configuration at client is specified as follows:

Microsoft Windows 98

ODBC for SQLServer

Client for Microsoft Networks

TCP/IP

3.7 Security and Control

A Bill Discount System should run smoothly under normal circumstances. However, computers sometimes can run out of order and perform malfunctions. Thus, the system control and security control are needed to ensure that the system will run as planned and the mistakes will be reduced. The inappropriate procedures should also be detected and corrected before the system is affected.

To establish the security and control of the proposed system, the following protection and control can be implemented.

3.7.1 To Protect against Unauthorized Access

The system should have both physical security and operation logging. The physical security is the security for physical level in order to secure the computer facility, equipment and software through physical means. The basic physical securities

should be made by controlling the access to the system with keying user login and password, and granting the right privileges on access data in the table to each user such as some users can retrieve data only, some can insert or update but cannot delete and so forth.

3.7.2 To Protect against Loss

The program protection and data protection are involved in protection against loss. The system has to be kept in a copy every time after program changed. The data back up procedures must be set up in such a way that all data in the system are kept securely and can be recovered whenever system fails. The system should be protected from viruses by installation of the anti-virus program in all computers.

3.7.3 To Control Atomic Transaction

Operations in a transaction must either be a success or failure.

3.7.4 To Control Input and to minimize human errors

The validation of input should be embedded in the application in order to protect the invalid data occurring during daily operations.

3.7.5 To Control Process

The system should provide the control to ensure that all processes will be done in the right way.

3.8 System Cost Evaluation and Comparison

Evaluating the costs of existing system and proposed system is a must because of the high investment. The company has to invest in terms of developing, implementing, and maintenance. Moreover, the costs of hardware, software, and peopleware are considerable. As a result, the company has to make reasonable comparison and decision whether the project should be continued or not.

3.8.1 System Cost Analysis

System Cost is divided into two categories which are implementation cost and annual operation cost. The implementation cost is usually onetime cost which is quite high. After the project has been completed, the other cost is annual operation cost including salaries of system analysts, programmers, operators and other staffs as well as maintenance cost. Not only is the computer usage cost used for programming, testing and conversion data, but also cost of computer equipment and hardware depreciation is grouped into maintenance cost. The depreciation of computers is calculated based on the estimated life years which is about 3 years and the scrap value 0 baht.

Total system cost of the existing system is presented as Table 3.3 and Table 3.4. Table 3.5 and Table 3.6 are the description of the system cost of the proposed system.

Table 3.3. Estimated Annual Operation Cost of the Existing System, Baht.

Cost items	Amount
1. Staff Cost	
Credit Control Manager	240,000
Operation Supervisor	120,000
Operation Staff	60,000
Sub Total	420,000
2. Operation Cost	100,000
3. Utility Cost	90,000
4. Maintenance Cost	15,000
Grand Total	625,000

Table 3.4. Estimated Implementation Cost of the Existing System, Baht.

Cost items	Quantity	Unit Price	Amount
Hardware & Software			
Server	1	50,000	50,000
Clients	3	30,000	90,000
Laser Printer	1	15,000	15,000
Dot Matrix Printer	1	10,000	10,000
Cable and Network Interface	3	1,000	3,000
Microsoft Office	3	5,000	15,000
Grand Total			173,000

Table 3.5. Estimated Annual Operation Cost of the Proposed System, Baht.

Cost items	Amount
1. Staff Cost	
Credit Control Manager	80,000
Operation Supervisor	40,000
Operation Staff	20,000
Sub Total	140,000
2. Operation Cost	35,000
3. Utility Cost	20,000
4. Maintenance Cost	35,000
Grand Total	230,000

Table 3.6. Estimated Implementation Cost of the Proposed System, Baht.

Cost items	Quantity	Unit Price	Amount
Hardware & Software			
Server	1	45,000	45,000
Clients	3	30,000	90,000
Laser Printer	1	12,000	12,000
Dot Matrix Printer	1	8,000	8,000
UPS	5	2,000	10,000
Hub	1	3,000	3,000
Cable and Network Interface	5	1,000	5,000
SQLServer 7.0 RDBMS	1	100,000	100,000
PowerBuilder 6.0	1	40,000	40,000
Sub Total			313,000
Development & Implementation			
System Analysis			20,000
System Design			20,000
Programming			30,000
Testing			5,000
Training			3,000
Implementation			5,000
Sub Total			83,000
Grand Total			396,000

3.8.2 Benefit Analysis

The anticipated benefits expected to come along with the new system are classified as tangible and intangible.

Tangible benefits are benefits which can usually be measured in terms of profit to the firm; they are listed with priority as follows:

- (1) To reduce redundancy step of processing.
- (2) To reduce human being errors occurred during daily operations.
- (3) To minimize redundancy data.
- (4) To reduce response time for processing a transaction.
- (5) To reduce expense for handling a lot of papers.
- (6) To examine credit line of banks and customers at the right time.
- (7) To increase productivity in the case of a large amount of transactions as well as report generating.
- (8) To be able to consolidate the corporate customer information of the company.
- (9) To provide the real-time system with the up-to-date database system.

All of tangible benefits discussed above can be estimated in terms of monetary cost as in Table 3.7.

Table 3.7. Estimated Annual Tangible Benefit, Baht.

Benefit	Amount
Saving on Human Resources	280,000
Saving on Handling Paper Works	25,000
Saving on Human Errors	30,000
Saving on Credit Loss	100,000
Increasing Sales Volume	50,000
Total	485,000

Intangible benefits are benefits which are believed to be difficult or impossible to quantify. The following list is ranked in priority from highest to lowest:

- (1) To improve the quality of data available for better decision-making.
- (2) To provide more efficient control credit line of customers and banks
- (3) To provide users with more user-friendly and easy to use applications.
- (4) To be more competitive than our competitors

3.8.3 Payback Period Analysis

The method of calculating for the investment is Payback Period. It will compare the cost of the proposed system to the benefits in order to determine the time the new system takes to recover the initial investment. Calculation is shown in Table 3.8.

Table 3.8. Payback Period Matrix (Discounted Factor 12%), Baht.

Cost items	Years					
	0	1	2	3	4	5
Development cost	-396,000					
Operation maintain cost		-230,000	-253,000	-278,300	-306,130	-336,743
Discount factor for 12 %	1	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs –adjusted to present value	-396,000	-205,390	-201,641	-198,150	-194,699	-190,933
Cumulative time-adjusted cost over lifetime	-396,000	-601,390	-803,031	-1,001,181	-1,195,879	-1,386,813
Benefits derived from operation of new system	0	485,000	533,500	586,850	645,535	710,089
Discount factors for 12%	1	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits -adjusted to present value	0	433,105	425,200	417,837	410,560	402,620
Cumulative time-adjusted benefits over lifetime	0	433,105	858,305	1,276,142	1,686,702	2,089,322
Cumulative lifetime time-adjusted -costs + benefits	-396,000	-168,285	55,274	274,961	490,823	702,510

$$\begin{aligned}
 \text{Payback Period} &= \text{Last year of negative} + \frac{\text{Cumulative difference last negative year}}{\text{Absolute value of cumulative difference}} \\
 &= 1 + \frac{168,285}{(168,285 + 55,274)} \\
 &= 1.75 \text{ Years}
 \end{aligned}$$

Payback Analysis is shown as Figure 3.2.

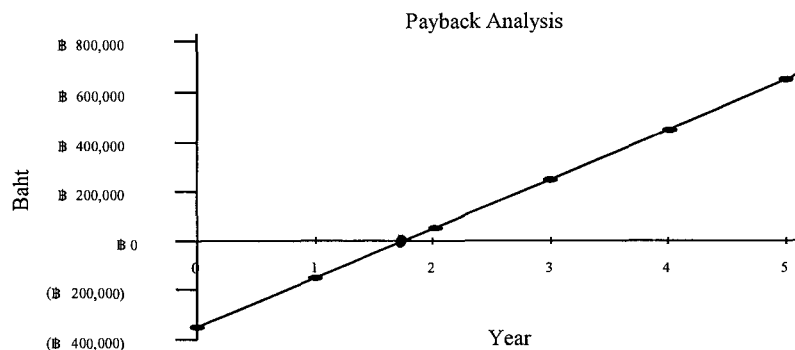


Figure 3.2. Payback Analysis.

3.8.4 Breakeven Analysis

It is a must to analyze the cost between the proposed system and the existing system before starting to develop the new system. The propose is to know when the investment of the propose system will be recovered.

The descriptions of system operation and maintenance cost of the proposed system and the existing system are explained in Table 3.9.

Table 3.9. Cost Comparison between Existing System and Proposed System, Baht.

Cost items	Years				
	1	2	3	4	5
<u>Existing System</u>					
Hardware (118,000 / 3)	39,333	39,333	39,333	-	-
Software (15,000 / 3)	5,000	5,000	5,000	-	-
Maintenance Cost (15,000 + 10%)	15,000	16,500	18,150	19,965	21,962
Operation Cost (100,000 + 10%)	100,000	110,000	121,000	133,100	146,410
Salary (420,000 + 10%)	420,000	462,000	508,200	559,020	614,922
Utility Cost (90,000 + 10%)	90,000	99,000	108,900	119,790	131,769
Total Existing System Cost	669,333	731,833	800,583	831,875	915,063
Cumulative Existing System Cost	669,333	1,401,166	2,201,749	3,033,624	3,948,687
<u>Proposed System</u>					
Development Cost	396,000	-	-	-	-
Hardware (173,000 / 3)	57,667	57,667	57,667	-	-
Software (140,000 / 3)	46,667	46,667	46,667	-	-
Maintenance Cost (35,000 + 10%)	35,000	38,500	42,350	46,585	51,244
Operation Cost (35,000 + 10%)	35,000	38,500	42,350	46,585	51,244
Salary (140,000 + 10%)	140,000	154,000	169,400	186,340	204,974
Utility Cost (20,000 + 10%)	20,000	22,000	24,200	26,620	29,282
Total Proposed System Cost	730,334	357,334	382,634	306,130	336,744
Cumulative Proposed System Cost	730,334	1,087,668	1,470,302	1,776,432	2,113,176

Breakeven Point is shown as Figure 3.3.

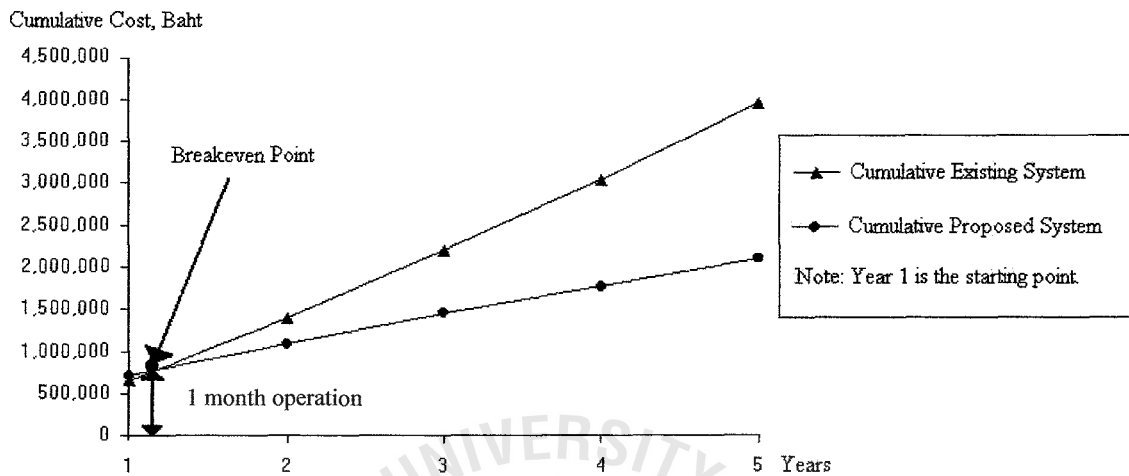


Figure 3.3. Breakeven Point.

Note: In this system costs comparison, the economic life of the existing system cost and the proposed system cost are considered for 3 years respectively.

3.8.5 Return On Investment Analysis

The method of calculating for return on investment (ROI). It will show the worth of the investment in the proposed system to the benefits in order to determine the decision making. Calculation is shown.

$$\begin{aligned}
 \text{Return On Investment (ROI)} &= \frac{1}{\text{Payback}} \\
 &= \frac{1}{1.75} \\
 &= 0.571 \\
 &= 0.571 \times 100 \\
 &= 57.10\%
 \end{aligned}$$

Although the return on investment (ROI) is estimate 57% that is shown the low value for the new investment. But the propose system has not enough tangible profit. It has also the intangible profit that the bank can not neglect such as the following:

- (1) To improve the quality of data available for better decision-making.
- (2) To provide more efficient control credit line of customers and banks
- (3) To provide users with more user-friendly and easy to use applications.
- (4) To be more competitive than our competitors

IV. PROJECT IMPLEMENTATION

4.1 Overview

Project implementation is the construction of the new system and the delivery of that system into production including testing, conversion, and training. The proposed system requires a new database. Therefore, the system needs to be tested in terms of the database and application program. Conversion, the process of changing from an old system to a new one, must also be carefully planned and executed. The conversion plan describes all the activities that must occur to implement the new system and put it into operation. It identifies the tasks and assigns the responsibilities for carrying them out. The conversion plan should also anticipate the most common problems, such as mission documents, incorrect data formats, lost data, and unanticipated system requirements, and provide ways for dealing with them when they occur.

After the system is implemented and the conversion is complete, a review should be conducted to determine whether the system is meeting expectations and where improvements are needed. System quality, user confidence, and operating statistics are assessed through such techniques as event logging, impact evaluation, and attitude surveys. The data collection methods used during analysis are equally effective during the postimplementation review. The review not only assesses how well the current system is designed and implemented, but also is a valuable source of information that can be applied to the next system project.

4.2 Testing

To make sure the new system can run properly, we have to test database and application programs. For database testing, the characteristics of the database are as follows:

- (1) Minimum redundancy – The normalization of database is at least 3 NF
- (2) Maximum integrity such as face amount of bill must be more than zero
- (3) High degree of data security – The system must have 2 levels of login and password (O.S. level and DBMS level) and access permission (select, insert, delete, and update) for each user and group

For programs testing, there are three levels of testing to be performed: stub testing, unit or program testing, and system testing:

- (1) Stub testing is the test performed on individual modules, whether they be main program, subroutine, subprogram, block, or paragraph.
- (2) Unit or program testing is a test whereby all the modules that have been coded and stub tested are tested as an integrated unit.
- (3) Systems testing is a test that ensures that application programs written in isolation work properly when they are integrated into the total system.

Just because a single program works properly doesn't mean that it works properly with other programs. The integrated set of programs should be run through the systems test to make sure one program properly accepts, as input, the output of other programs.

4.3 Conversion

Once a successful proposed system has been set, we can begin preparations to place the new system into operation. The system analyst will develop a detailed conversion plan. This plan will identify database to be installed, end-user training and documentation that needs to be developed, and a strategy for converting from the old system to the new system. For the proposed system, we will use parallel conversion. Under this approach, both the old and new systems are operated for period of time. This is done to ensure that all major problems in the new system have been solved before the old system is discarded. The final cut-over may be either abrupt -usually at the end of

one business period or gradual, as portions of the new system are deemed adequate. This strategy minimizes the risk of major flaw in the new system; however, it is also incurred.

4.4 Training

Converting to a new system necessitates that users be trained and provided with documentation -user manual that guides them through using the new system. For the Bill Discount System, a training program is developed to cover the following topics:

- (1) Purpose and objectives of the system
- (2) Difference between the existing and the proposed systems
- (3) Overview of the system operation and procedures
- (4) Organization and use of the user manual
- (5) Duties and responsibilities of the end users
- (6) Demonstration of the system

The user manual is the primary resource for the user-training program. Since the proposed system is designed with easiest program operation using GUI, the duration of training program will take only a few hours.

4.5 Project Implement Schedule

The details of project implement schedule of the Bill Discount System are shown in Figure 4.1.

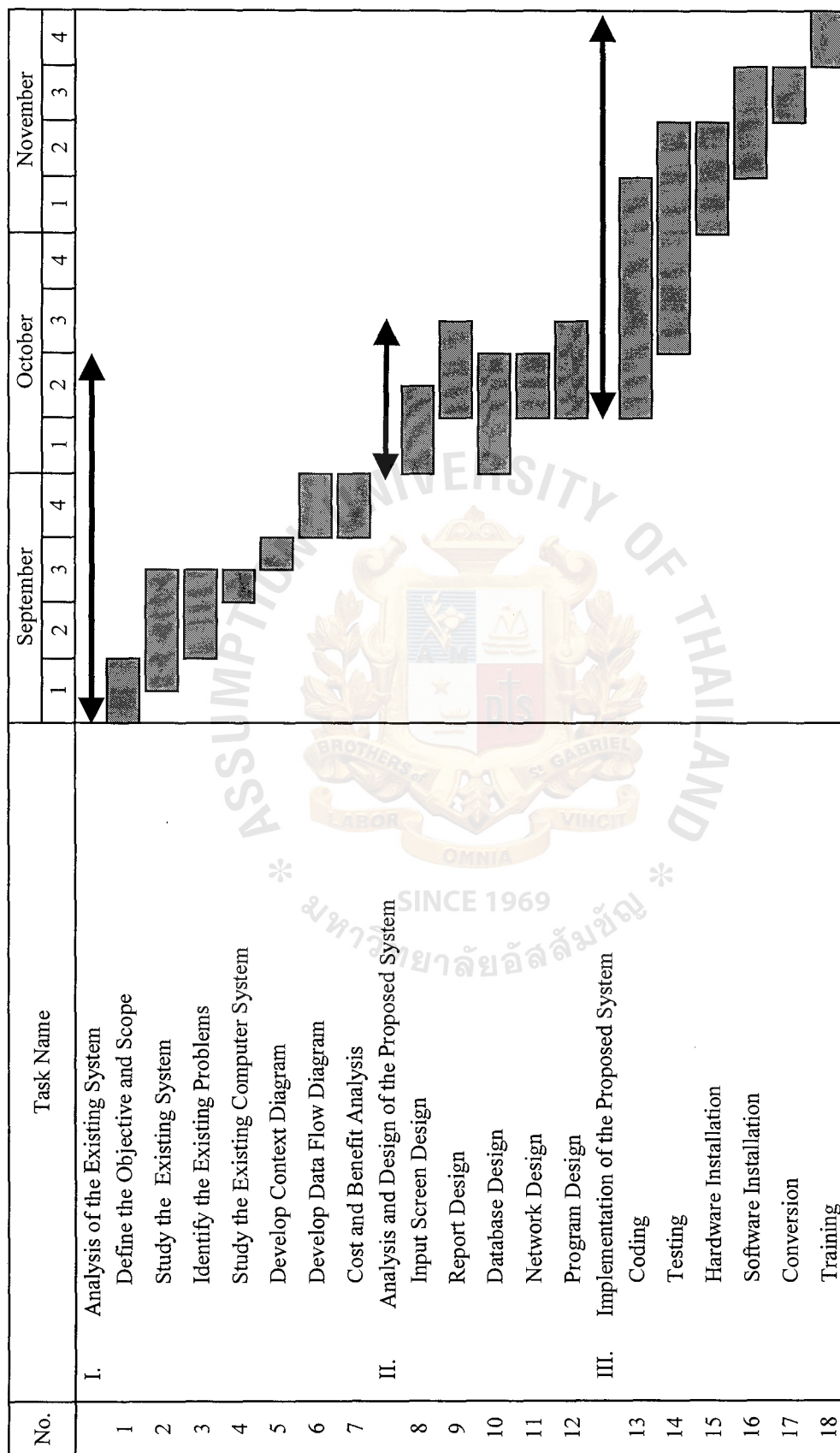


Figure 4.1. Project Implement Schedule.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Bangkok Bank (PCL) is one of the major banks in Thailand. At a competitive growth, the company has to find itself maintain the competitive advantages over its competitors. The company realizes that in order to do so, there are many aspects that the company needs to concern as follows

- (1) To increase customers and users satisfaction
- (2) To increase the speed of operation for each transaction
- (3) To consolidate the customer information to specify the customer's needs
- (4) To control and monitor the bank and customer credit line

To achieve all the aspects stated above, the company needs to reengineer the Bill Discount's existing system. After the preliminary survey of the existing system, we found that procedures of the existing system have been done mostly by manual although the data were kept in conventional files (spreadsheet). Because the data were kept separately by each user, the problems occurred, for instance, data redundancy, inconsistent data. These problems caused the users to take too much time in operation, errors from staffs' operation, lack of the efficiency to check and to control the bank and customer credit line, and so on. Moreover, all users have a computer but they do not use the outmost capacity of their computers.

Thus, the new system has been proposed to solve all the defined problems. To have it done, it requires automation of the system which is providing the database system to share the information of the Bill Discount system. After implementing the proposed system, we trust that the staffs' productivity will increase and service quality will be better. So, these benefits will help our company to reach customer satisfaction. Due to

the new system's speed and accuracy, the company can reduce total cost, time consumptions, and human errors as depicted in Table 5.1.

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

Process	Existing System	Proposed System
Maintain Bank Credit Information	20 mins.	1 min.
Maintain Customer Information	30 mins.	1 min.
Maintain Purchase and Sale Information	40 mins.	3 mins.
Approve Purchase and Sale	30 mins.	2 mins.
Generation Operational Report	45 mins	2 mins.
Total	2 hrs. 45 mins.	9 mins

The above table shows that the proposed system saves a lot of time in overall processing as described in the following:

(1) Process of Maintain Bank Credit Information

This process can be automatically updated on the proposed system in an immediate action upon receiving the Bank Credit Line Approvement. On the other hand, in the existing system, the credit controller must to manually modify the data of the Bank Credit Line Approvement which takes more time than the proposed system.

(2) Process of Maintain Customer Information

This process can be automatically done by receiving the trigger message from the process of 'Maintain Purchase and Sale Information'. For example, if a customer has purchased for whatever type of the Bill Discount, the system will automatically deduct the credit line of the customer simultaneously. On the contrary, if the customer has sold for whatever type

of the Bill Discount, the system will automatically increase the credit line of the customer instead.

(3) Process of Maintain Purchase and Sales Information

Once there is a process of purchase or sales, whereas, in the existing system, the credit controller has to deal with the modification of credit line both the bank's and the customer's, in the proposed system, the credit controller does not have to do anything with the credit line of both the bank's and the customer's, as it all has been done by the system.

(4) Process of Approve Purchase and Sale

In the proposed system, the supervisor will approve the purchase or the sale with the consistent information from the system, whereas, in the existing system, the supervisor has to receive all the information in the manual system. Besides, the supervisor has to carefully inspect all paper of purchase and sale again which takes a lot more time than the proposed system.

(5) Process of Generate Operational Report

In the proposed system, the process can be done with the several of preformats designed. The operation only chooses date and formats to print, then click O.K., all the required reports, then, automatically generate and print out within a few minutes. In the other way, the existing system, the operation has to manually set the format in excel spreadsheet which takes a lot of time to adjust as desired.

All in all, the proposed system not only provides for the fast response in performing, but also provides the data consistency of overall system which is easy to maintain accordingly.

5.2 Recommendations

In order to make the proposed system most beneficial in the future, we would like to recommend that:

(1) Data Warehousing

As there are a lot of product systems that reside on the different platforms with different formats, we should integrate the various business data and load all data into the data warehousing which conform to the standard format of organization. After that, the data can be aggregated into summary level as required. Therefore, the data warehousing shall be the warehouse of centralization of corporate data which can be retrieved by those users who want to analyze the data in their department including the executive management for efficient strategic planning as desired. We can say another way that the data warehousing can be base data of Executive Information System, Data Mining and Decision Support System.

(2) Workflow Based On Messaging Technology

The workflow technology is one part of the reengineer processes which help reducing cost and increase productivity. We can apply this technology with the existing application by developing the application on Intranet and combine with the messaging technology. For example, the users will access the browser and logon to the messaging system to input either purchase or sale and submit the transaction. Then, the system shall automatically send the transaction via electronic mail, and that the authorized user shall perform the operation for approval or reject via electronic mail. Whereas, the currently process of approval request, the

user has sent fax from more than 600 branches to Head Office which cause a lot of expense and is time consuming accordingly.

(3) Standardization of Structure

The design of the data structure of all product systems should conform to the standard format and business rule, especially, the common data or base data which will be used by all systems. For example, the format type of the customer code, the customer name must go to the same way and can be easily understood. Moreover, it must be flexible enough to be easily modified, if needed, for some other products which may occur in the future.





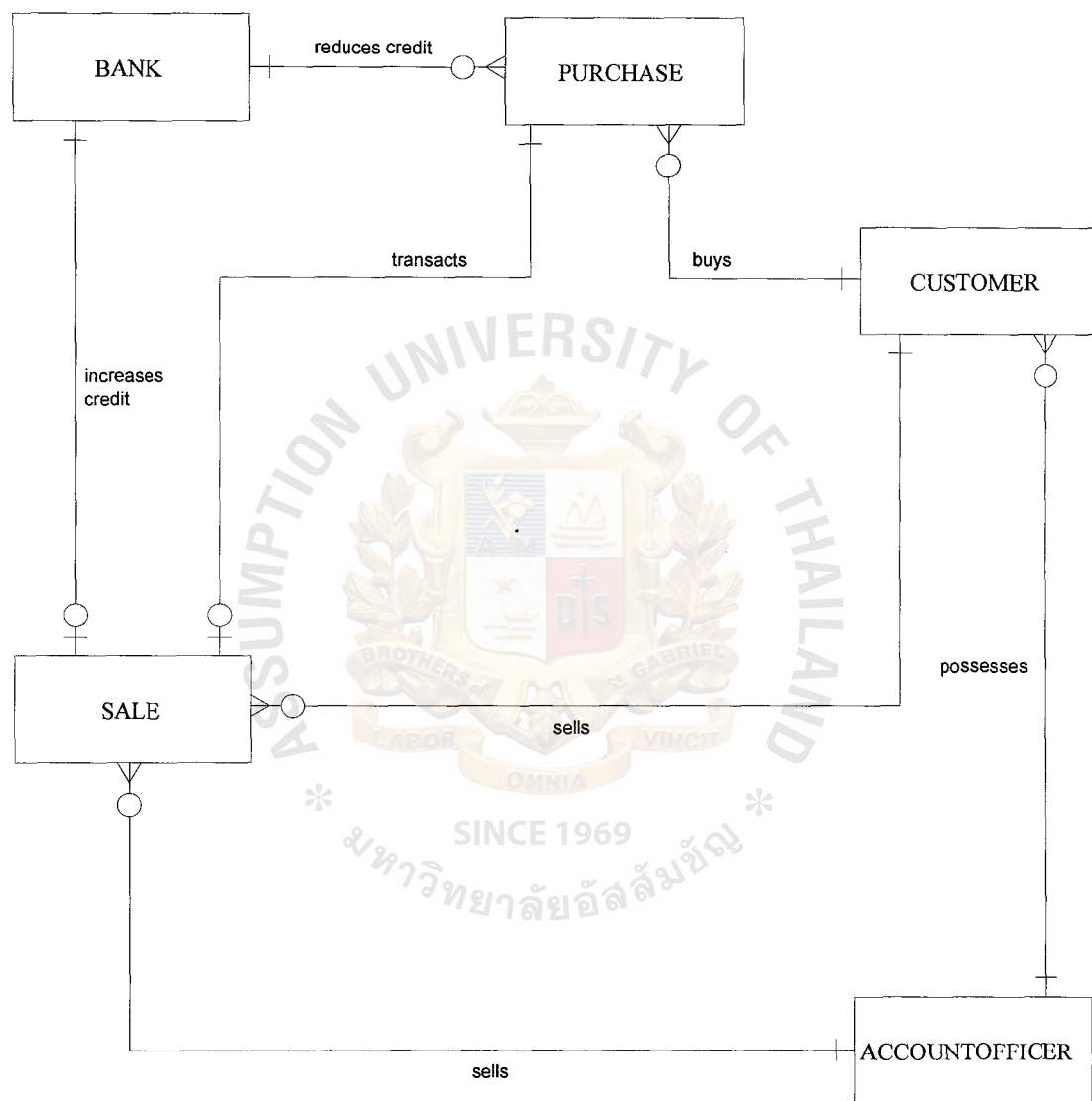


Figure A.1. Context Data Model of the Proposed System.

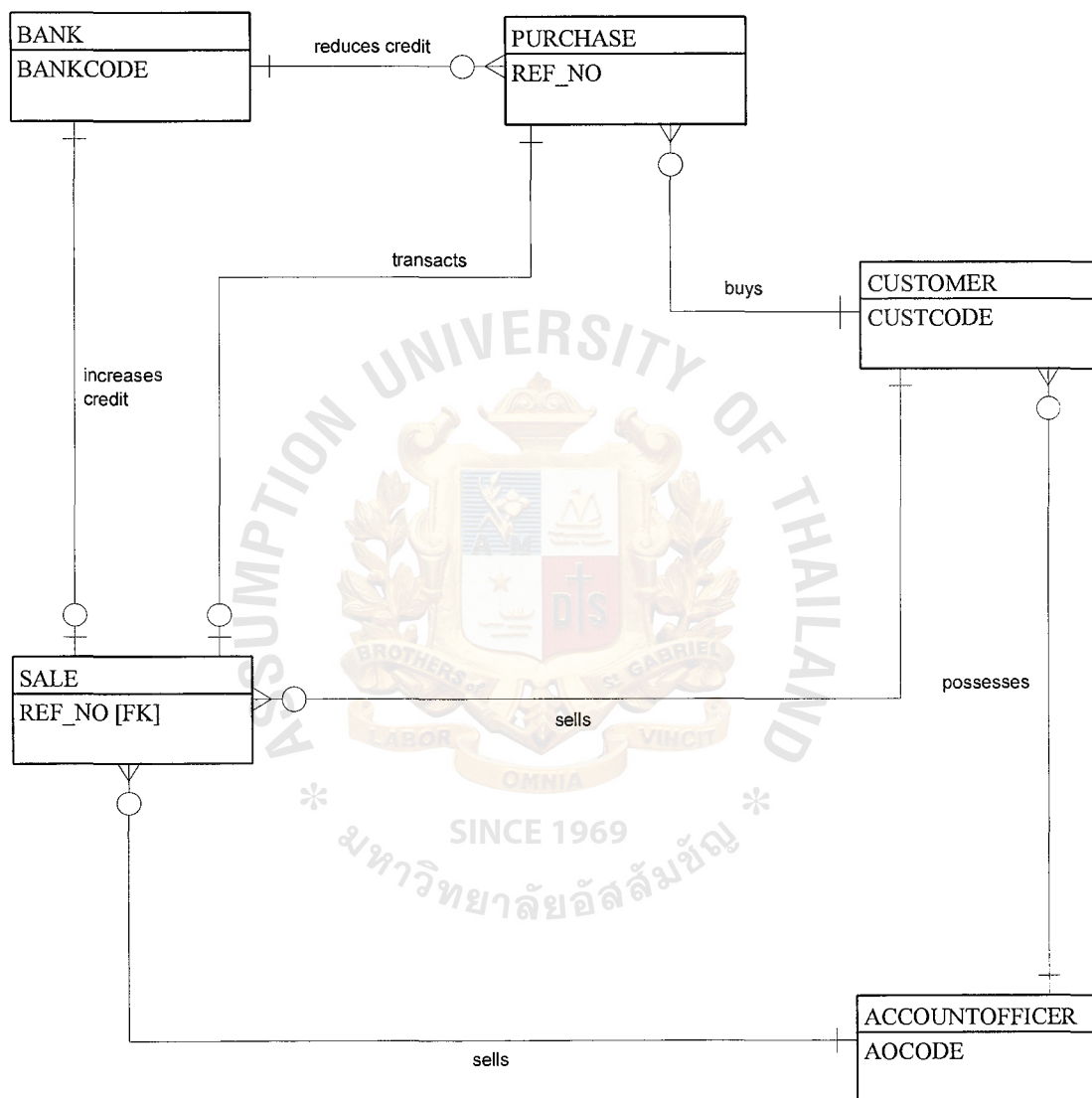


Figure A.2. Key-Based Data Model of the Proposed System.

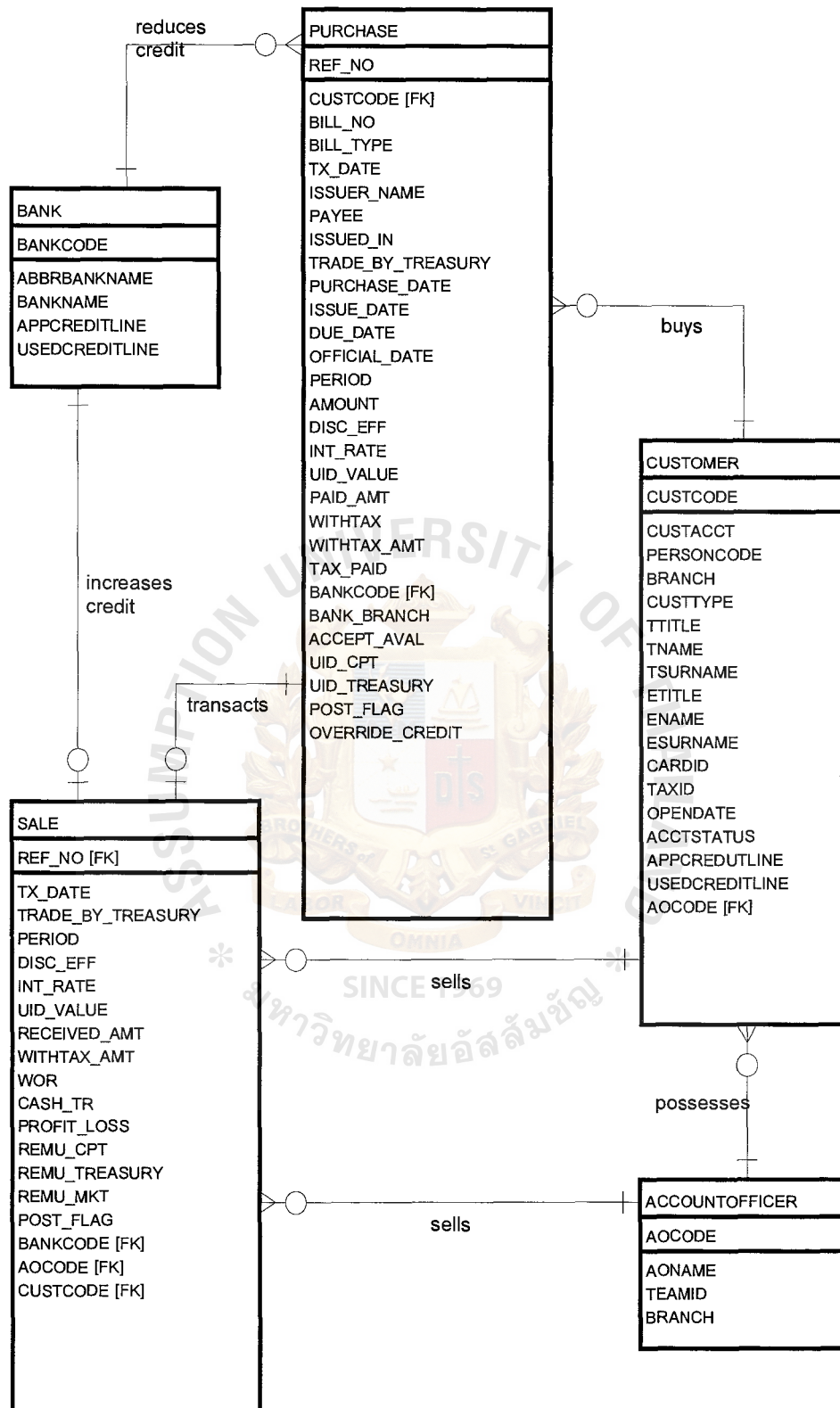
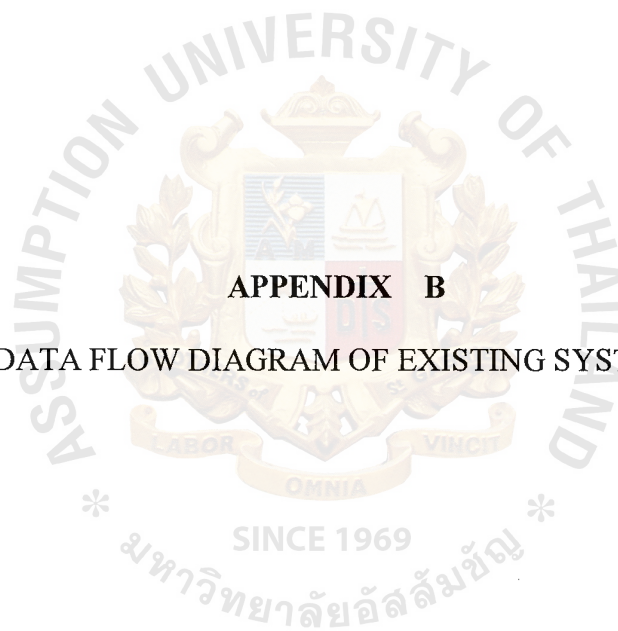


Figure A.3. Fully-Attributed Data Model of the Proposed System.

APPENDIX B
DATA FLOW DIAGRAM OF EXISTING SYSTEM



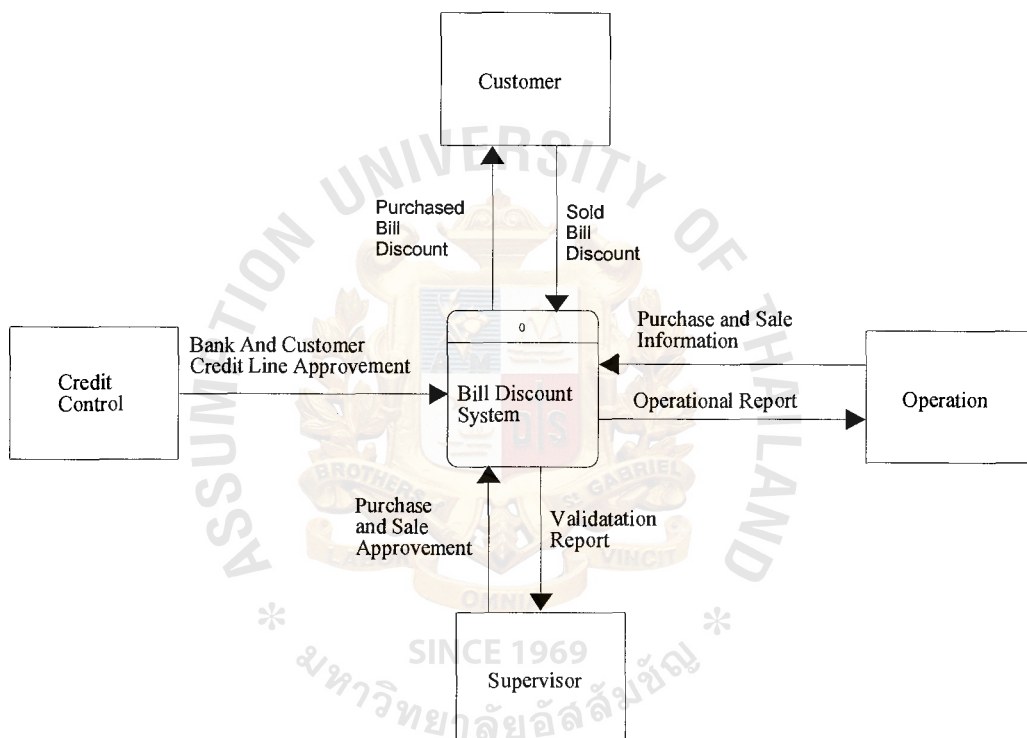


Figure B.1. Context Data Flow Diagram of the Existing System.

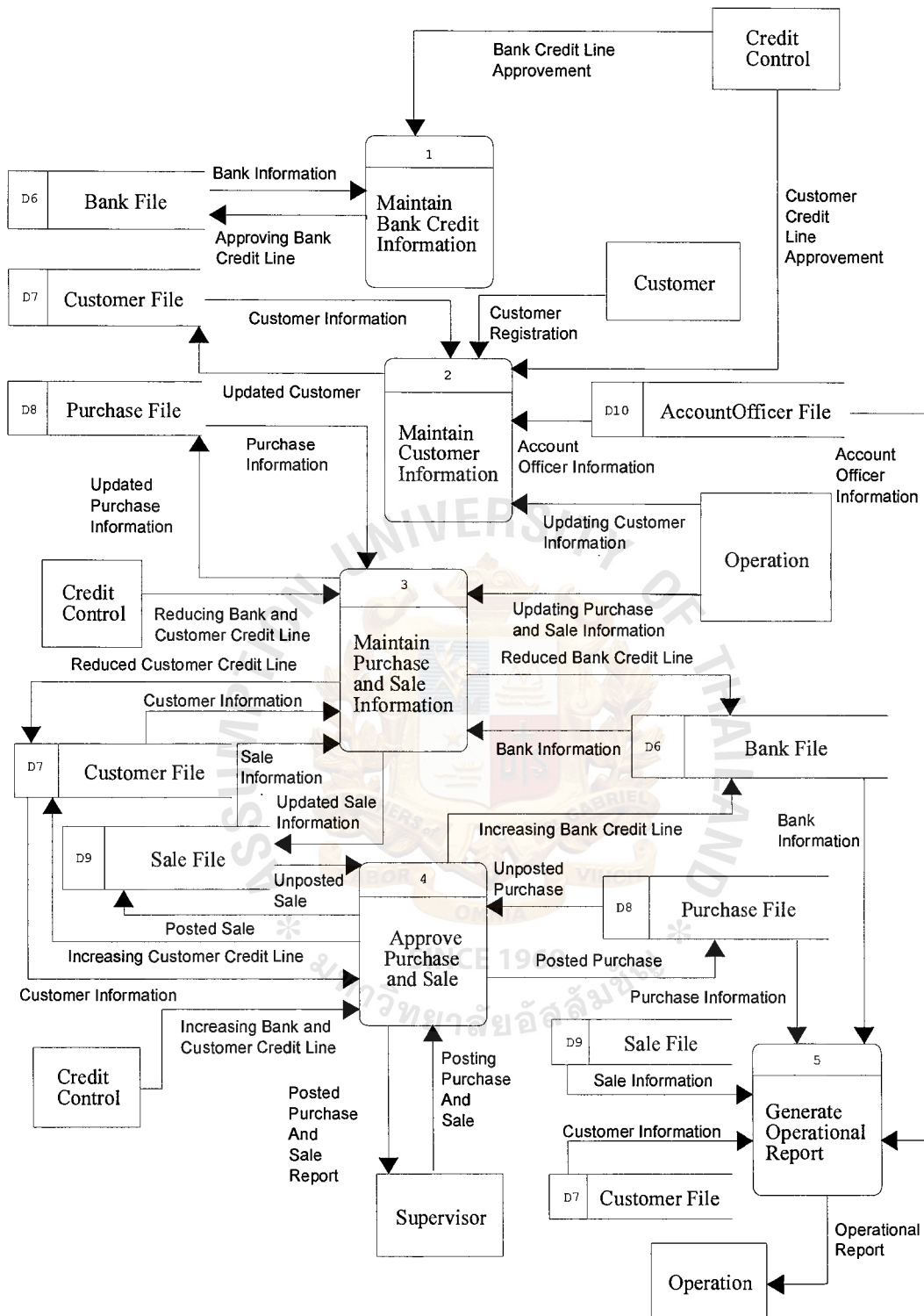


Figure B.2. Data Flow Diagram Level 0 of the Existing System.

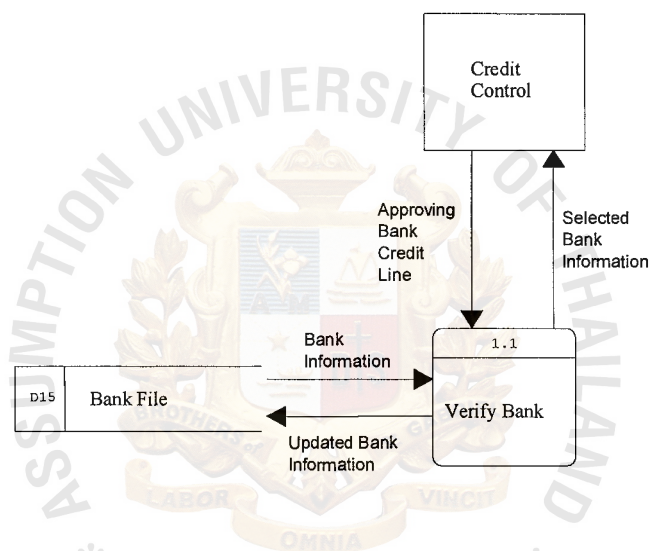


Figure B.3. Data Flow Diagram Level 1 Process 1 of the Existing System.

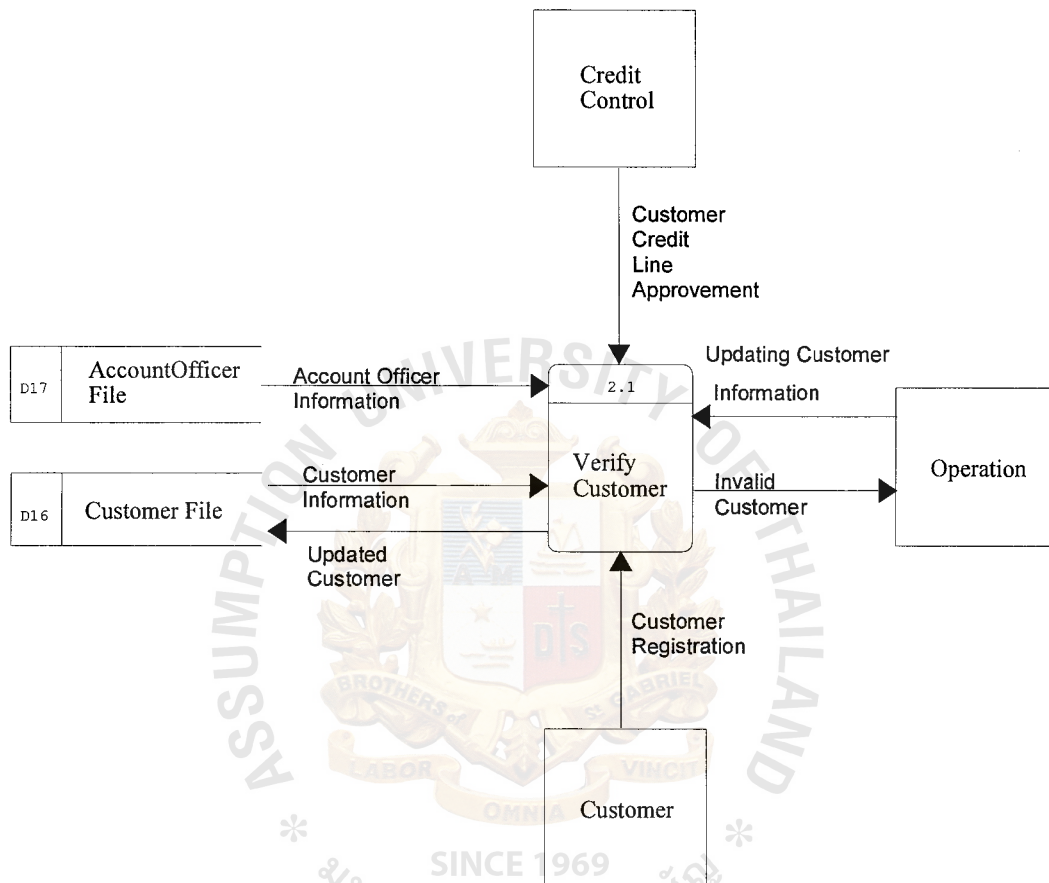


Figure B.4. Data Flow Diagram Level 1 Process 2 of the Existing System.

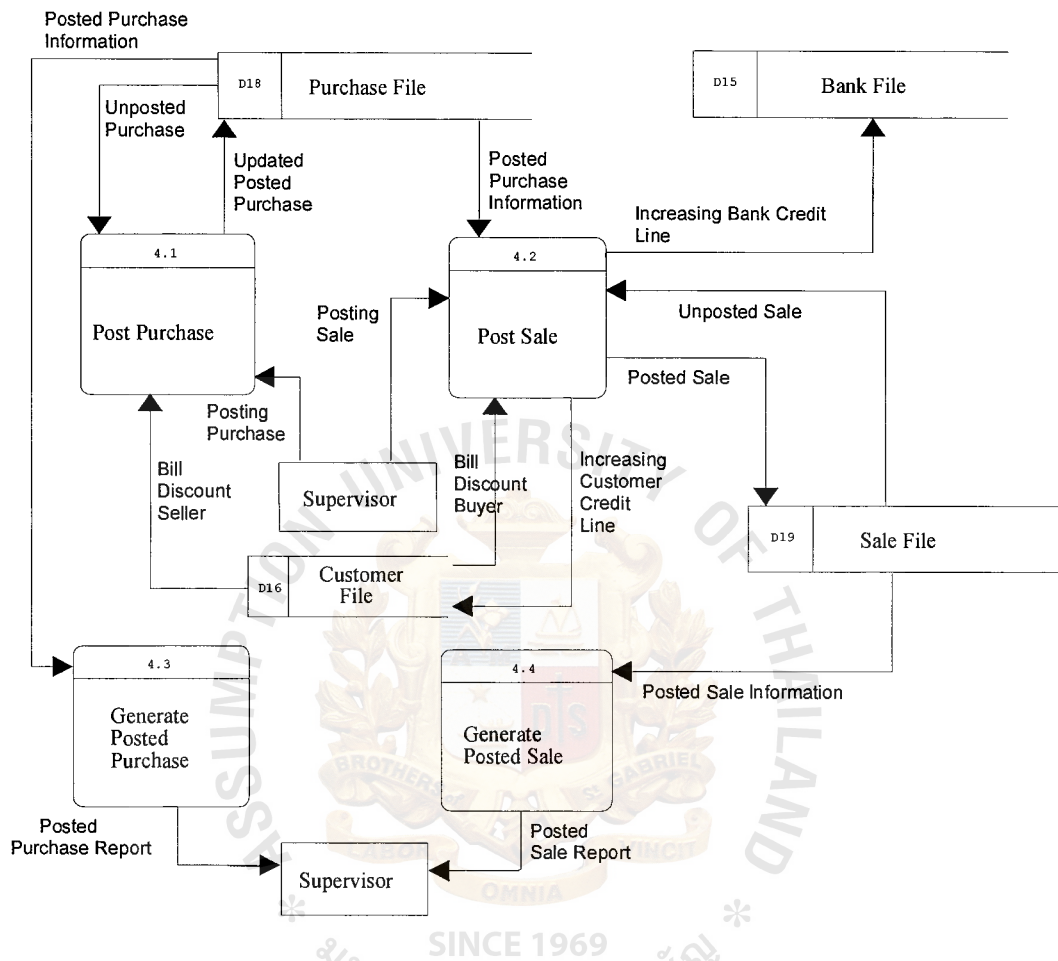


Figure B.6. Data Flow Diagram Level 1 Process 4 of the Existing System.

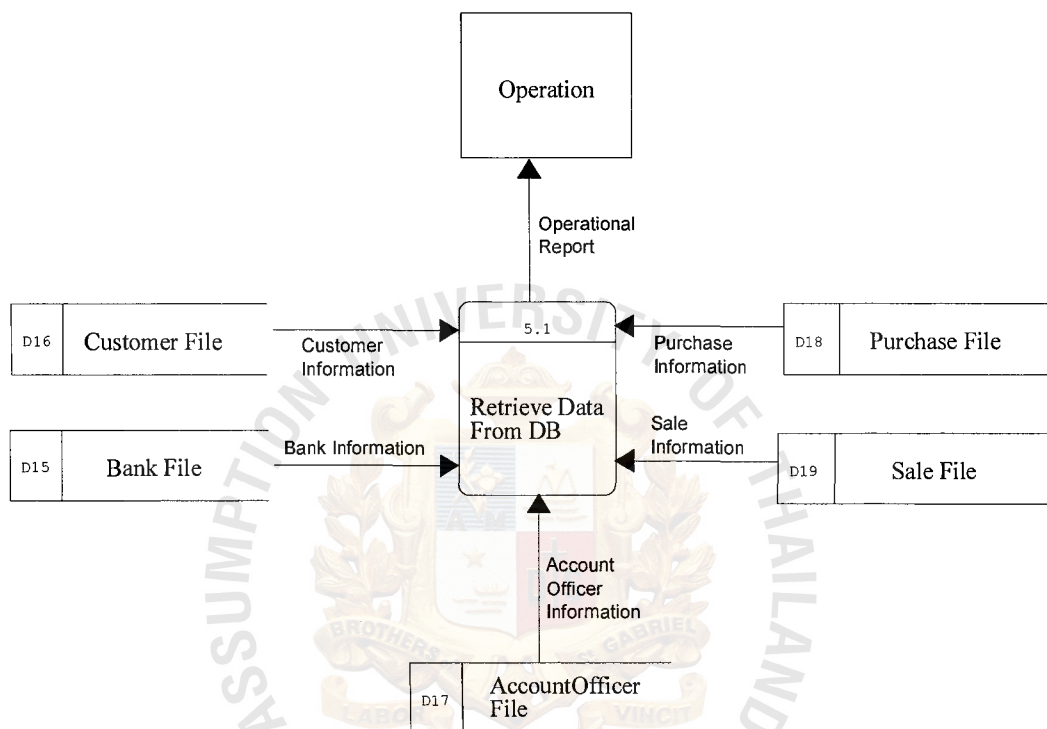


Figure B.7. Data Flow Diagram Level 1 Process 5 of the Existing System.

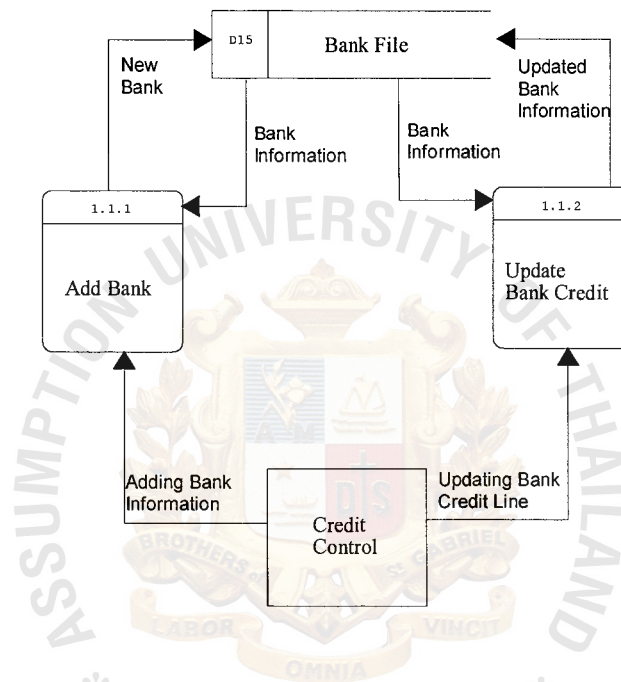


Figure B.8. Data Flow Diagram Level 2 Process 1.1 of the Existing System.

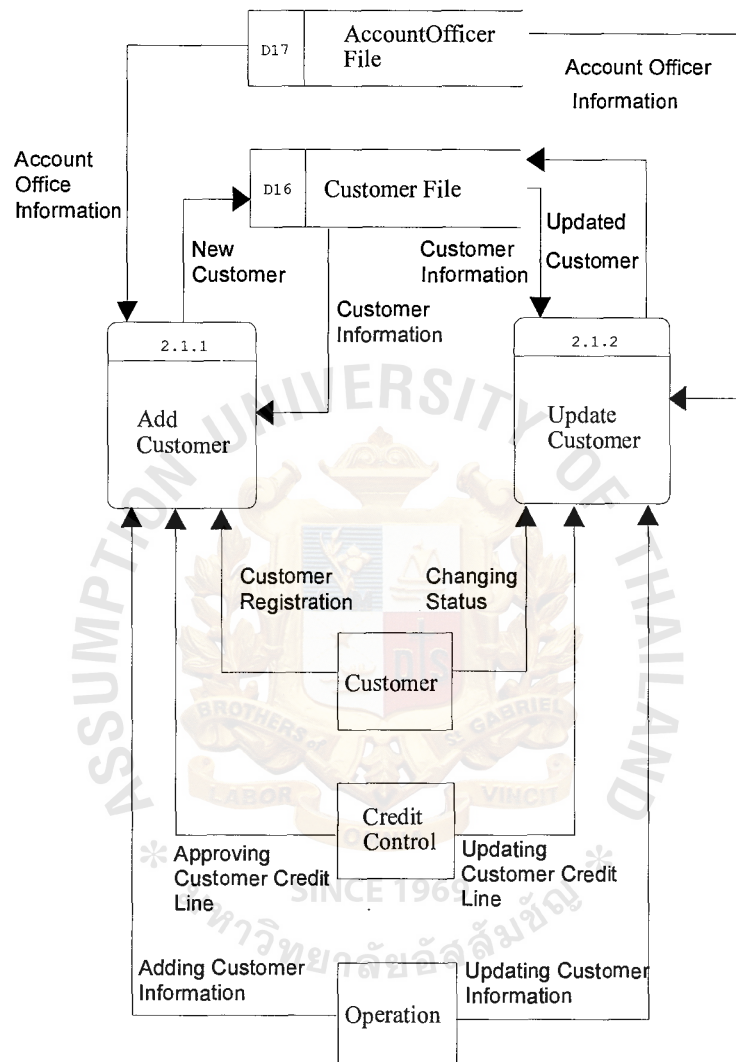


Figure B.9. Data Flow Diagram Level 2 Process 2.1 of the Existing System.

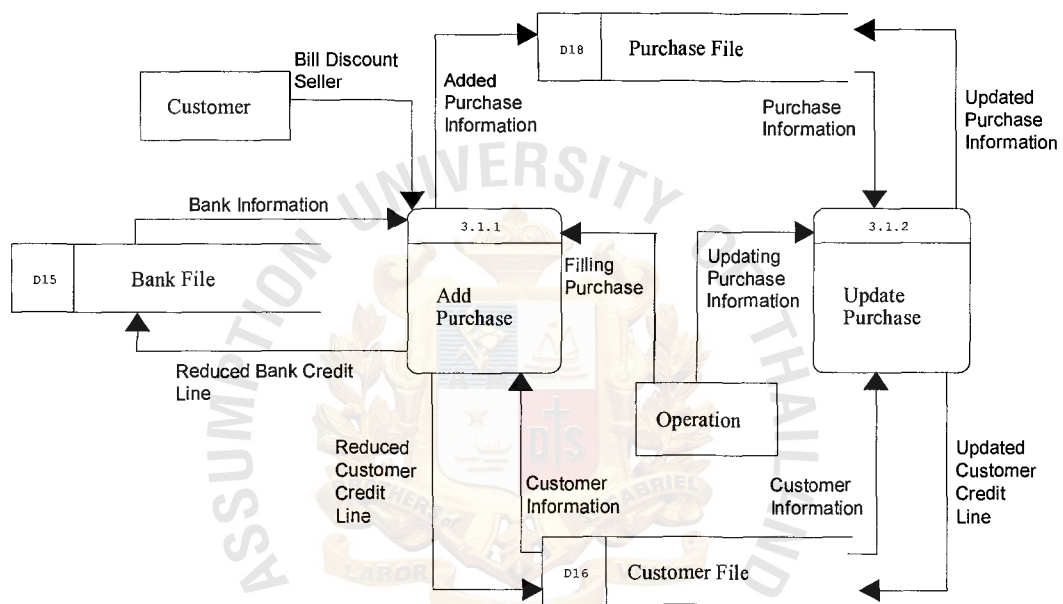


Figure B.10. Data Flow Diagram Level 2 Process 3.1 of the Existing System.

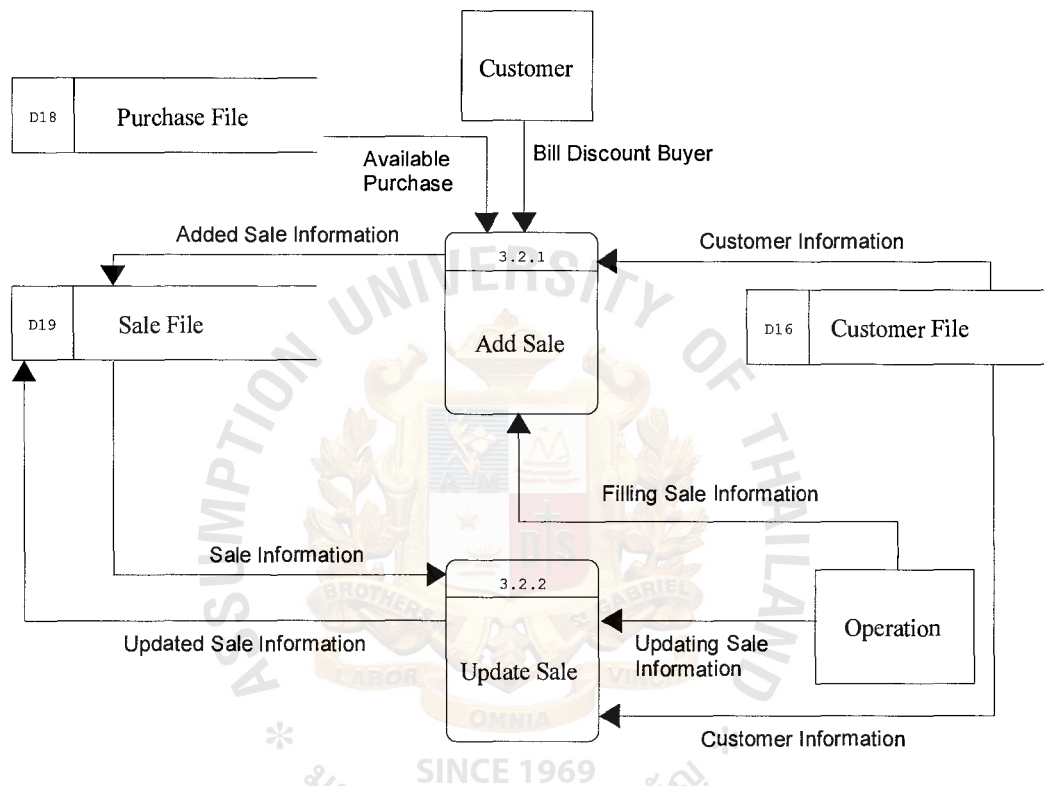
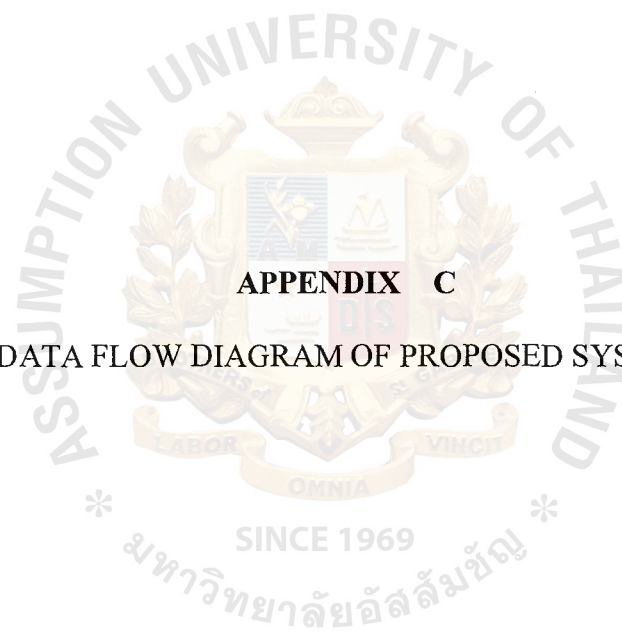


Figure B.11. Data Flow Diagram Level 2 Process 3.2 of the Existing System.

APPENDIX C

DATA FLOW DIAGRAM OF PROPOSED SYSTEM



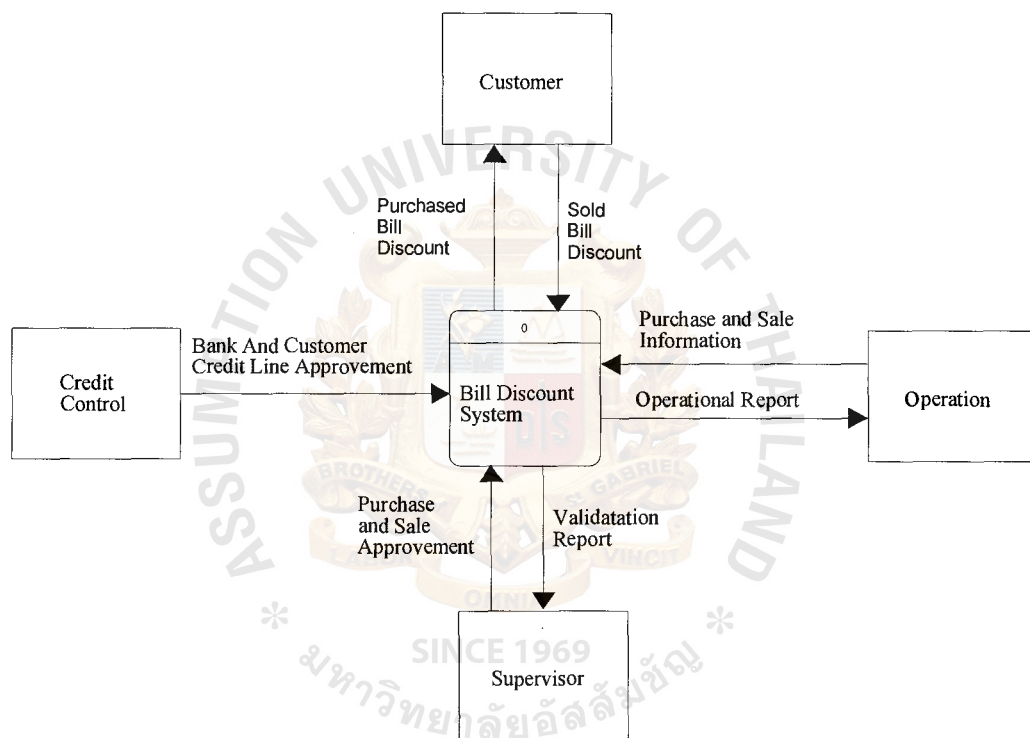


Figure C.1. Context Data Flow Diagram of the Proposed System.

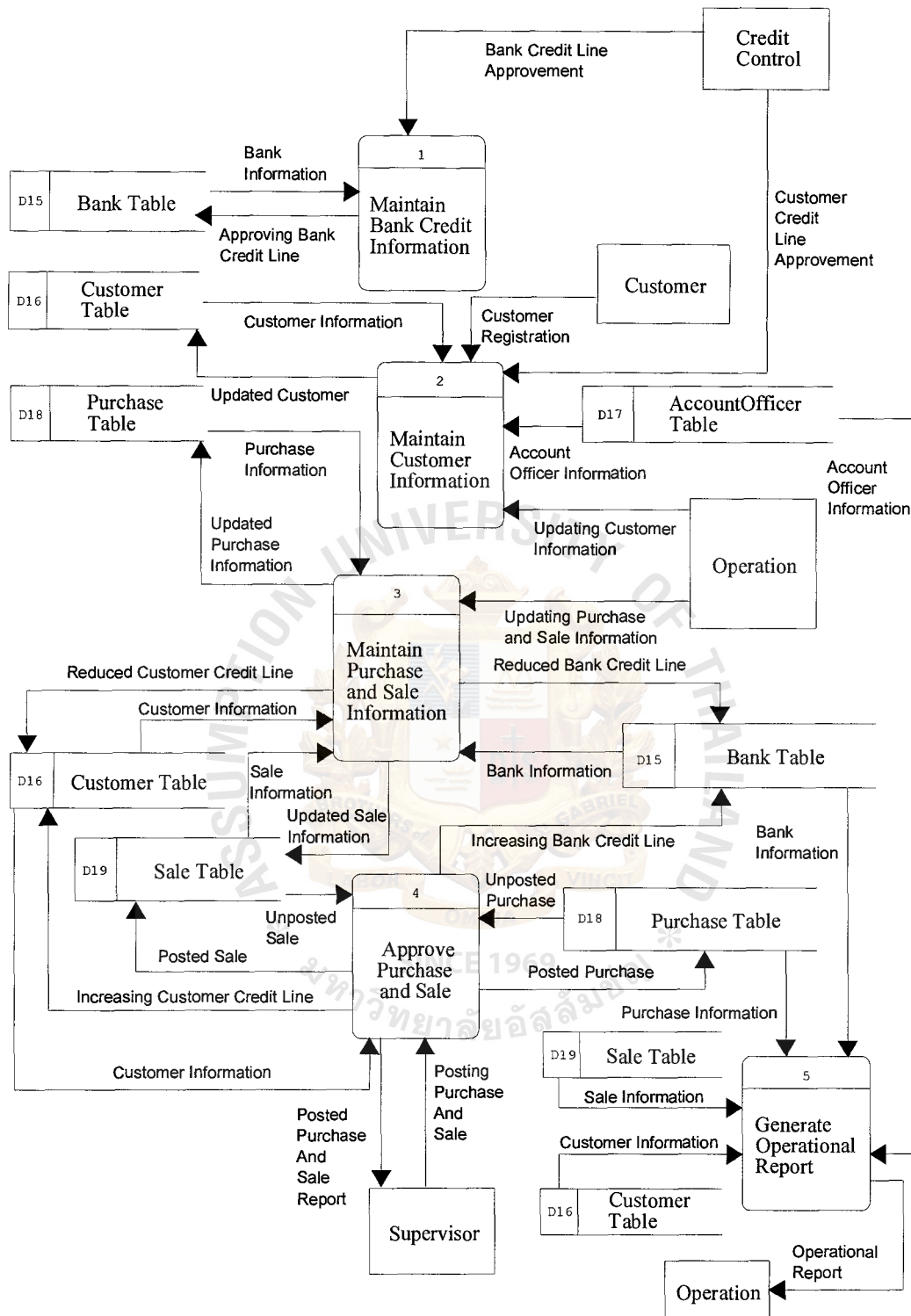


Figure C.2. Data Flow Diagram Level 0 of the Proposed System.

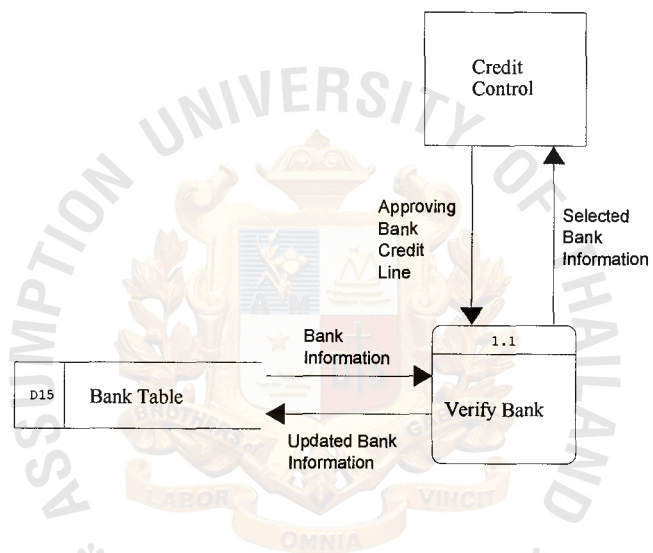


Figure C.3. Data Flow Diagram Level 1 Process 1 of the Proposed System.

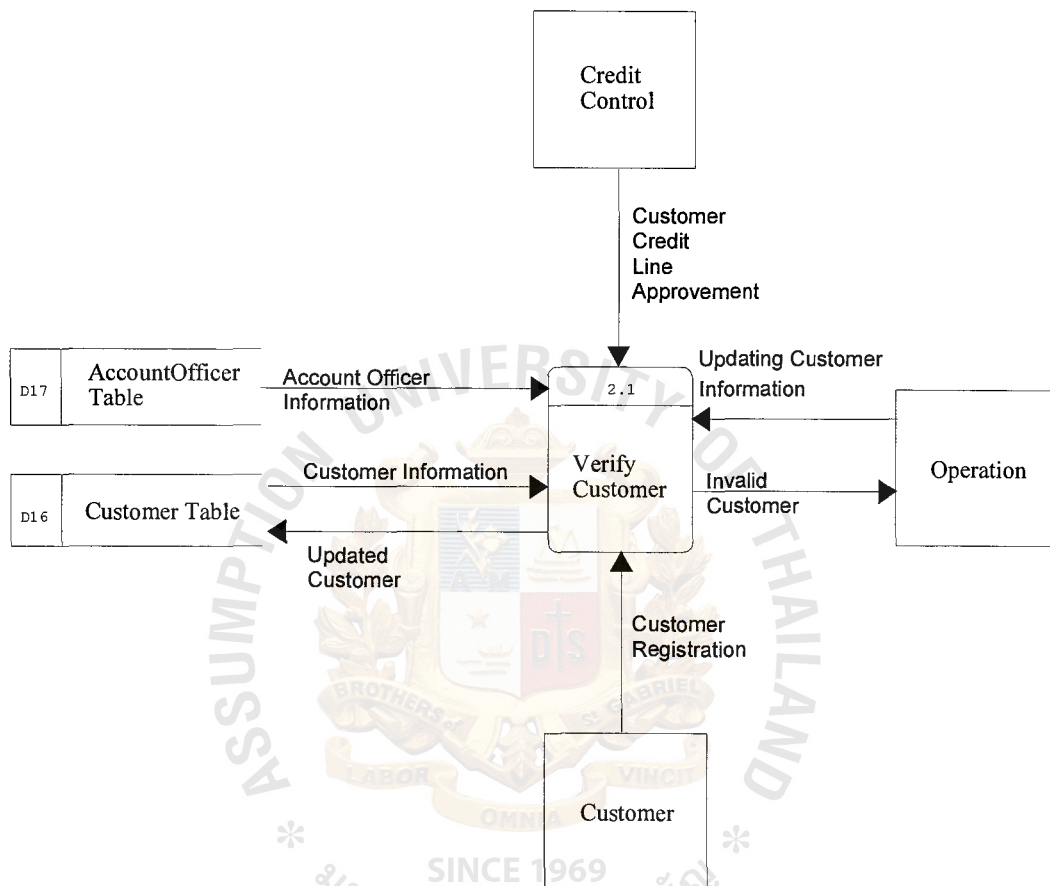


Figure C.4. Data Flow Diagram Level 1 Process 2 of the Proposed System.

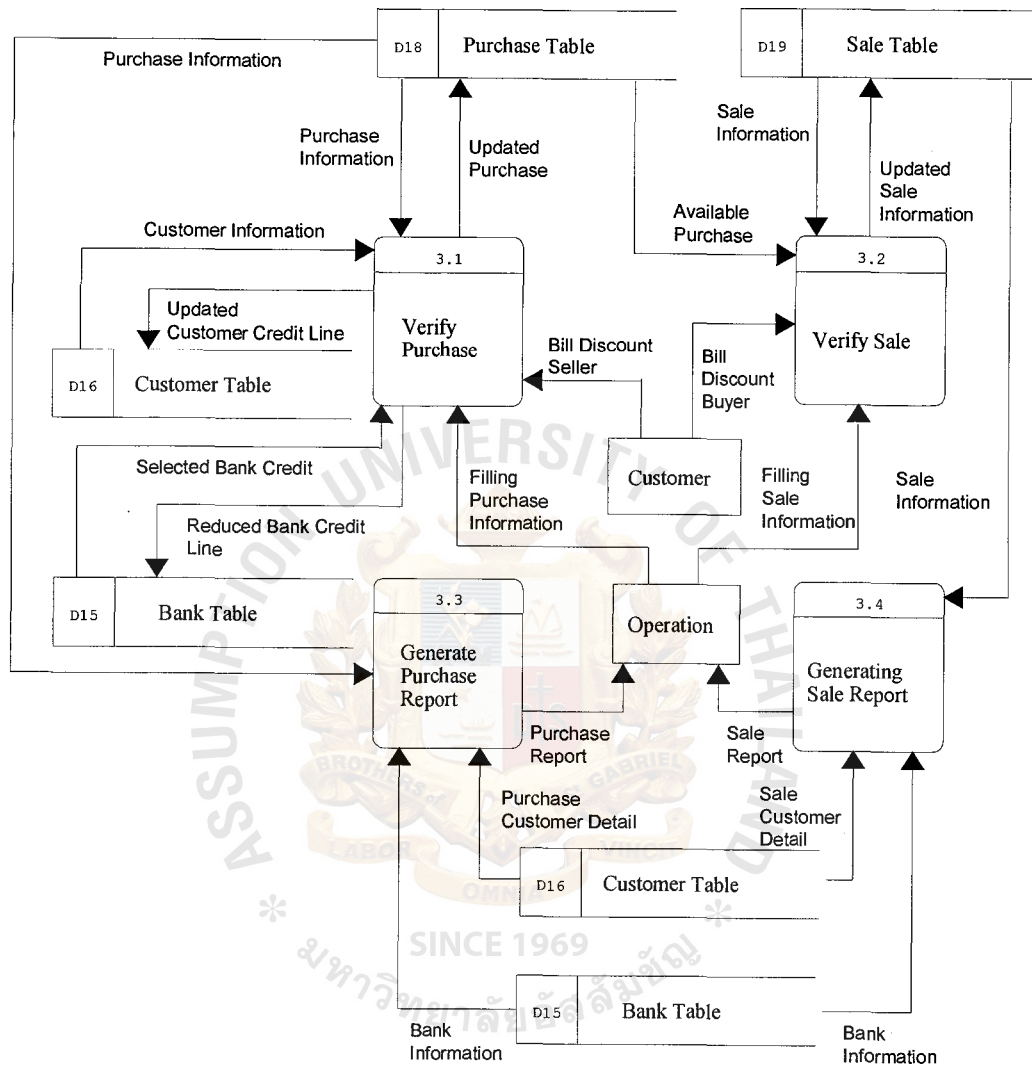


Figure C.5. Data Flow Diagram Level 1 Process 3 of the Proposed System.

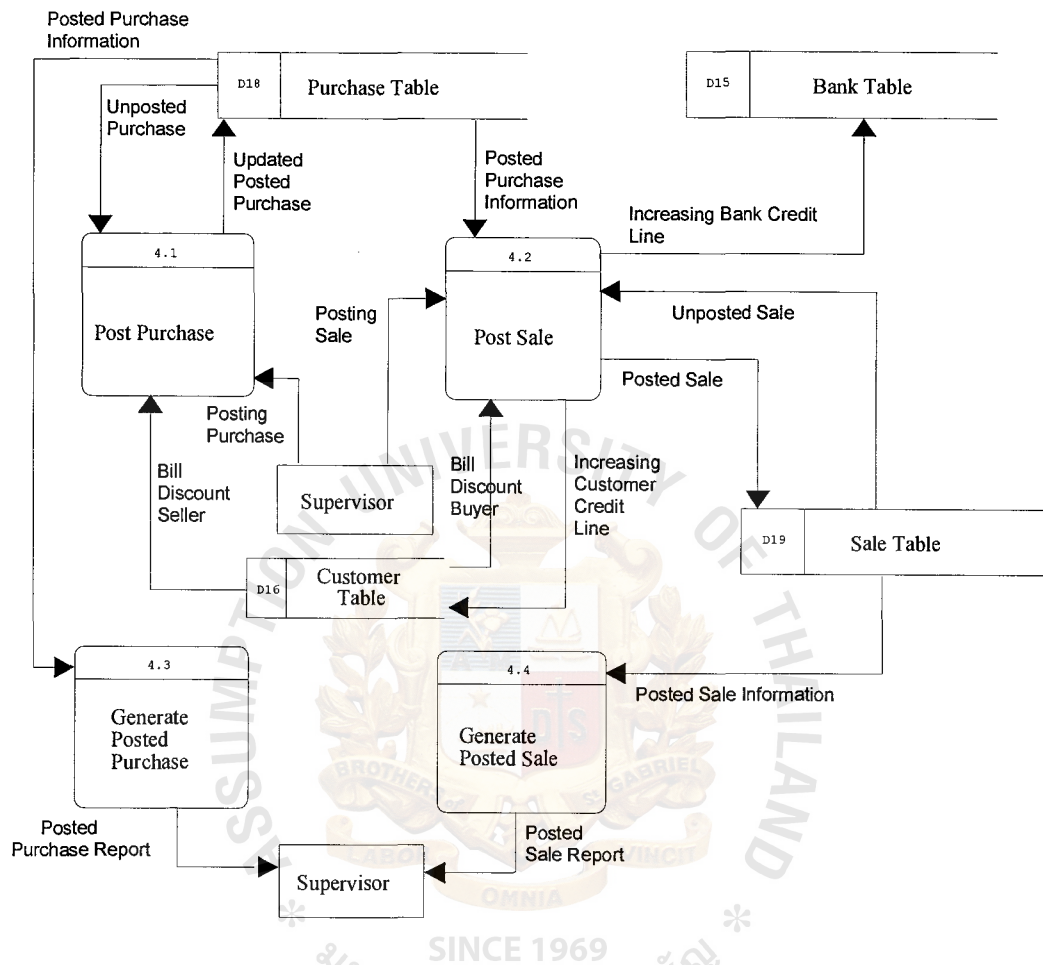


Figure C.6. Data Flow Diagram Level 1 Process 4 of the Proposed System.

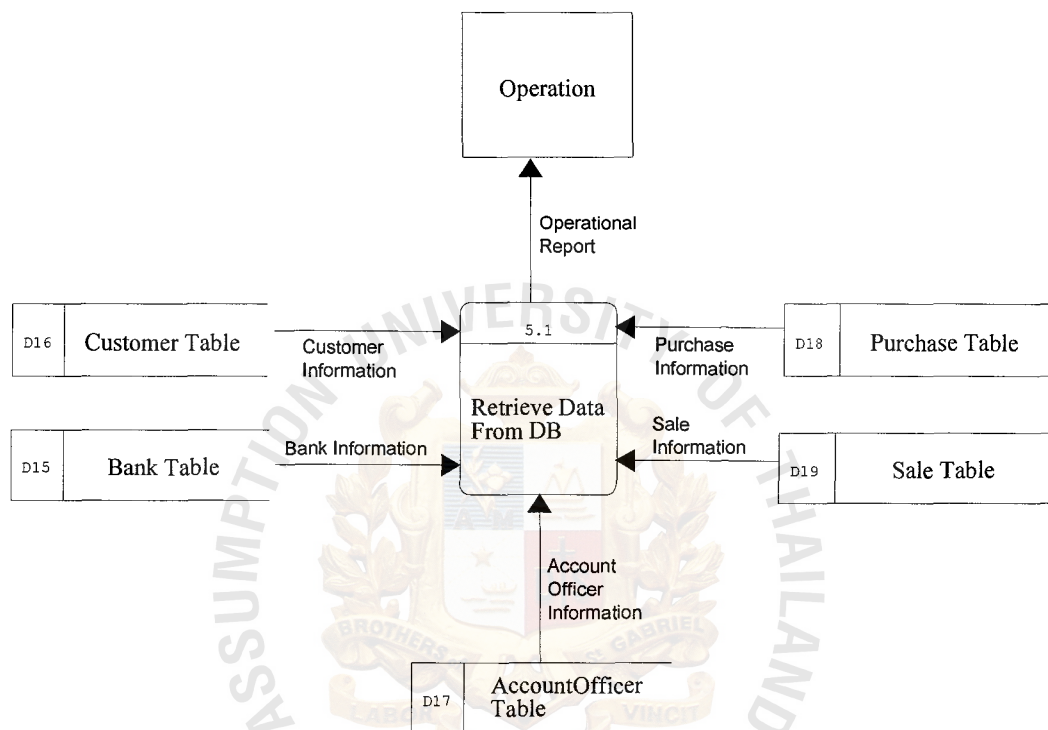


Figure C.7. Data Flow Diagram Level 1 Process 5 of the Proposed System.

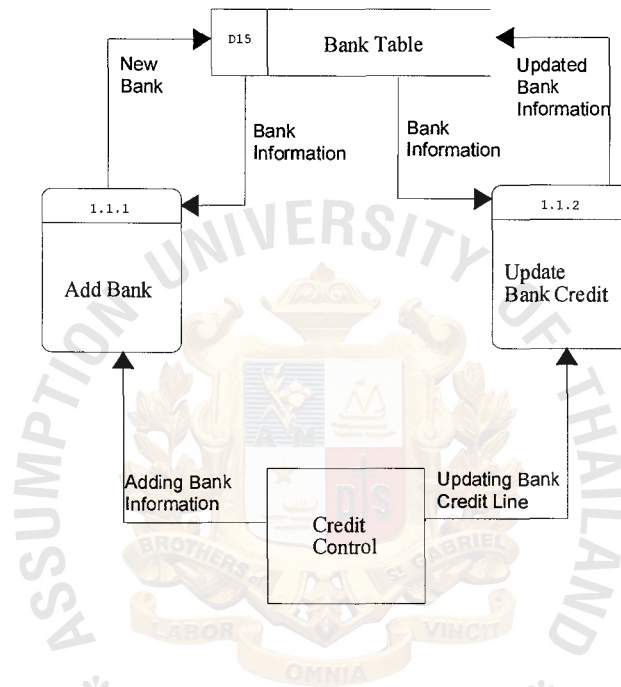


Figure C.8. Data Flow Diagram Level 2 Process 1.1 of the Proposed System.

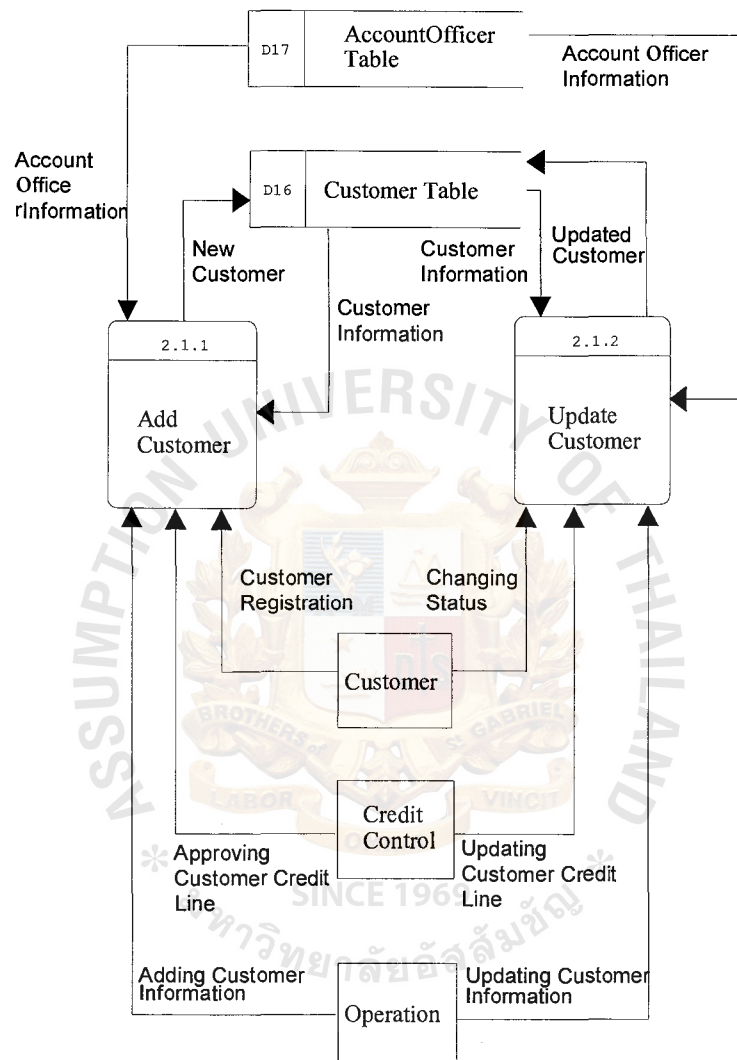


Figure C.9. Data Flow Diagram Level 2 Process 2.1 of the Proposed System.

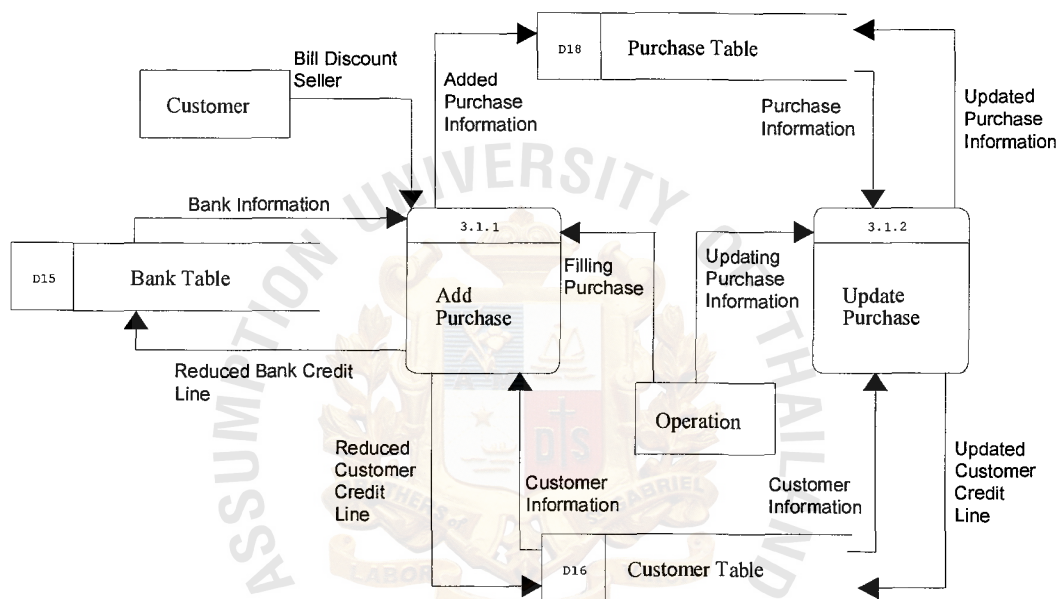


Figure C.10. Data Flow Diagram Level 2 Process 3.1 of the Proposed System.

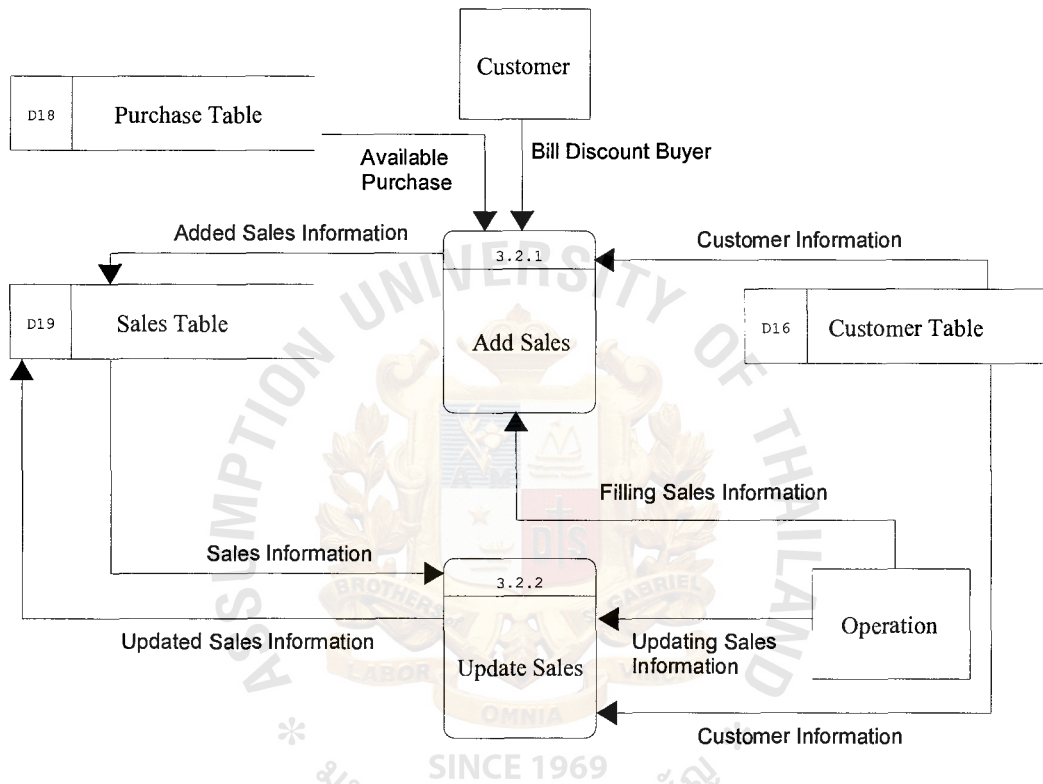


Figure C.11. Data Flow Diagram Level 2 Process 3.2 of the Proposed System.



APPENDIX D
STRUCTURE CHART

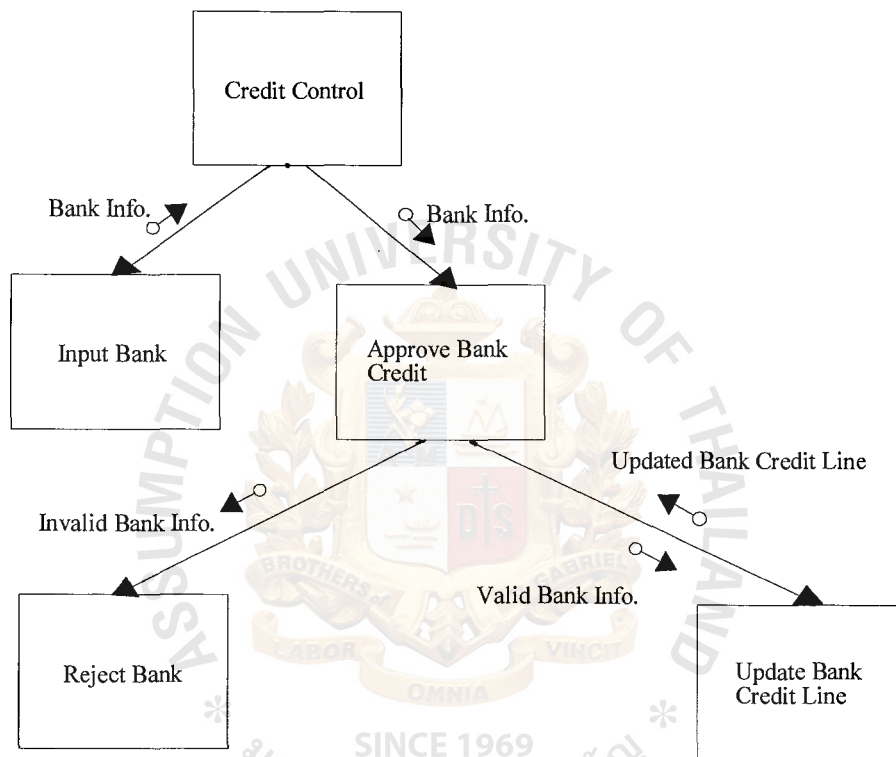


Figure D.1. Structure Chart of Approve Bank Credit Line Process.

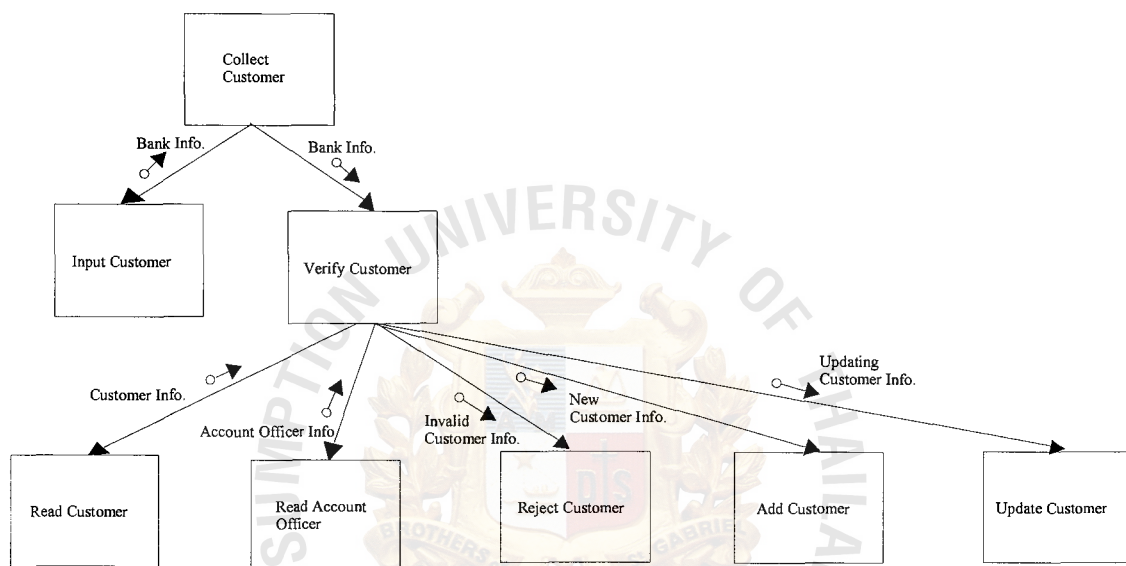


Figure D.2: Structure Chart of Collect Customer Process.

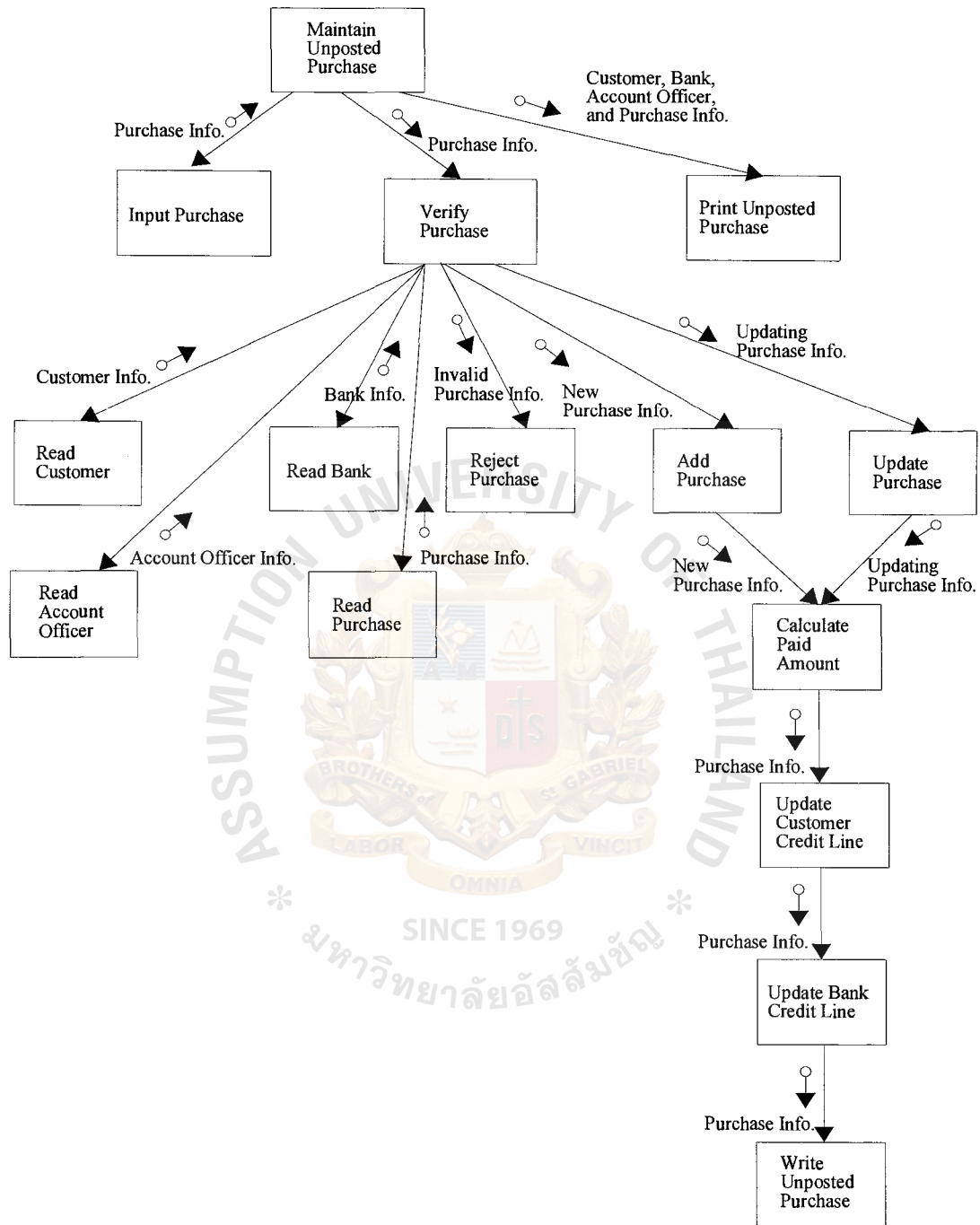


Figure D.3. Structure Chart of Maintain Unposted Purchase Process.

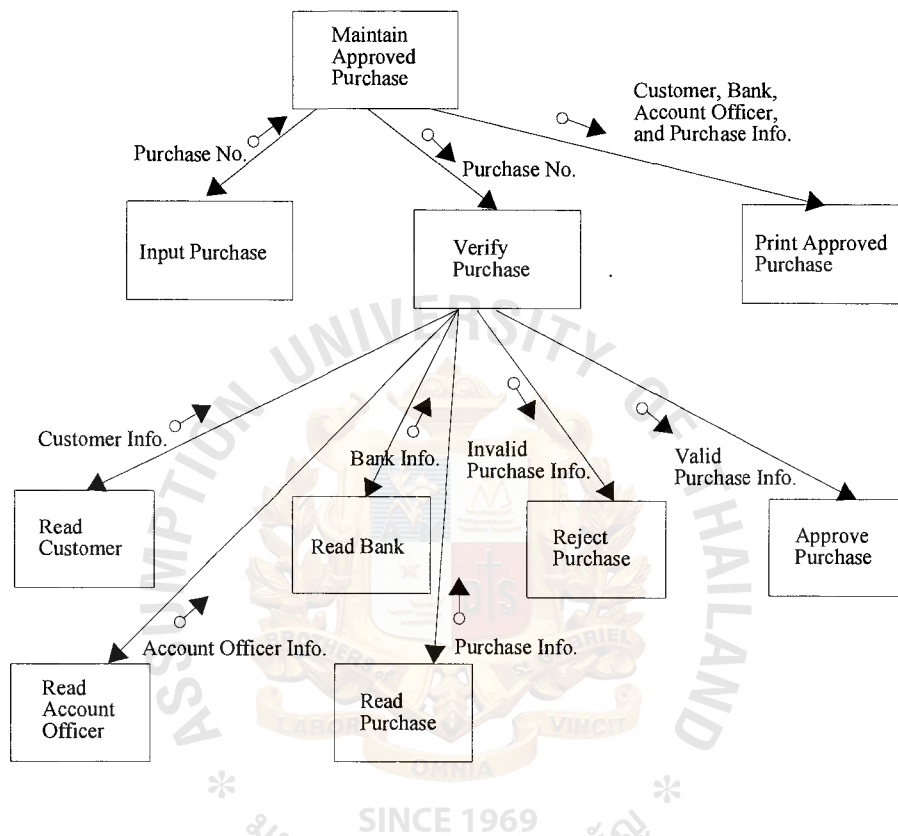


Figure D.4. Structure Chart of Maintain Approved Purchase Process.

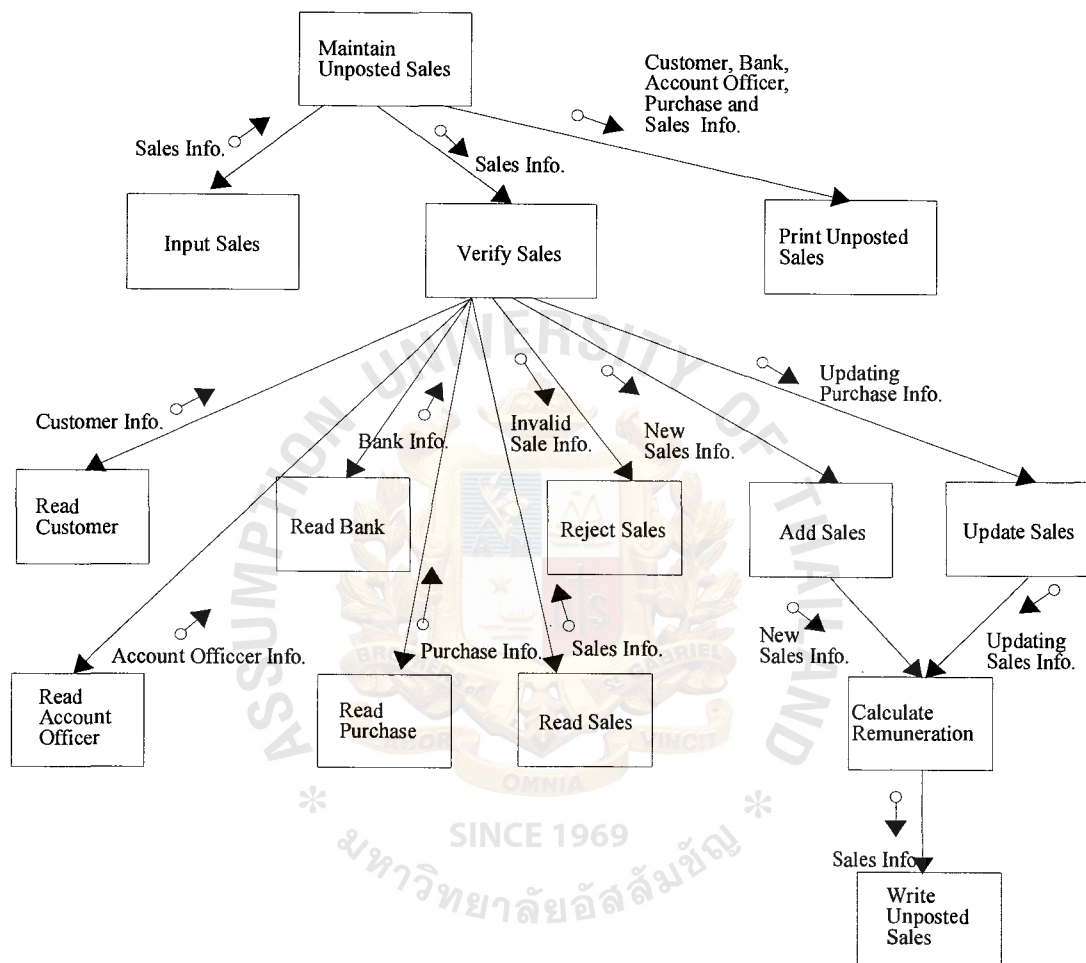


Figure D.5. Structure Chart of Maintain Unposted Sales Process.

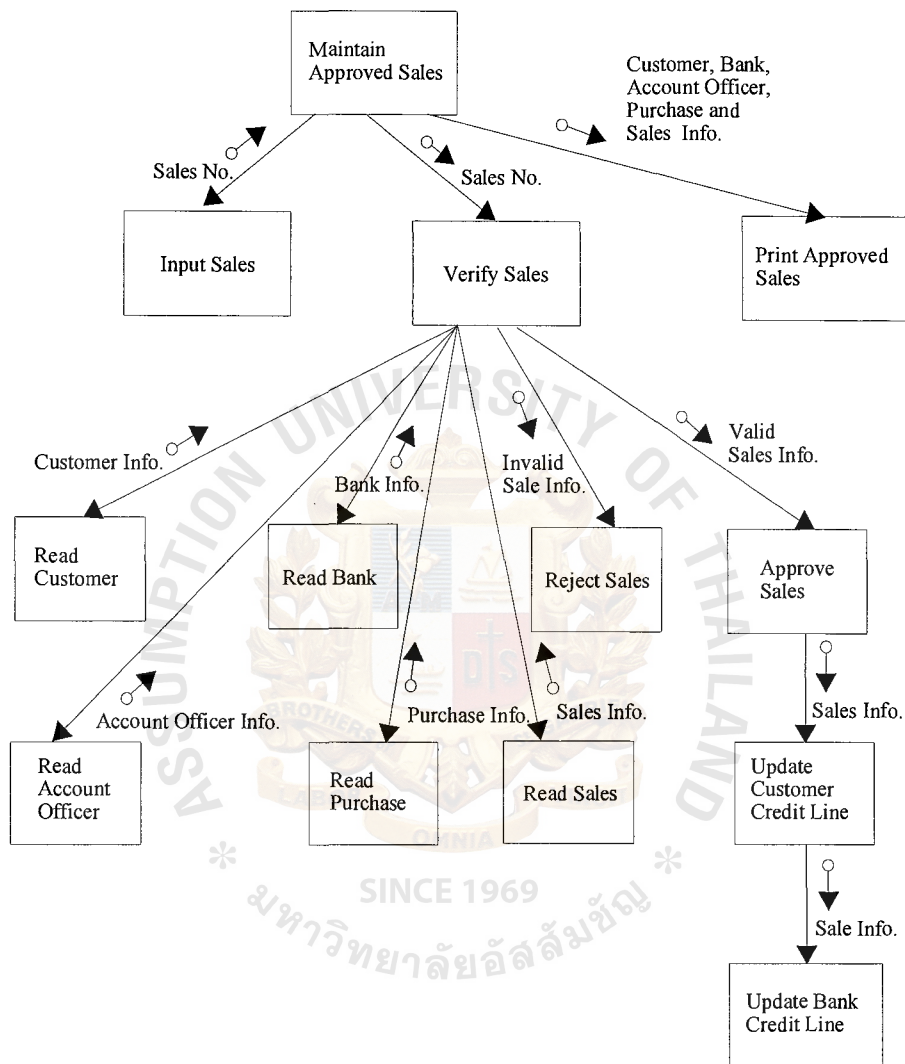


Figure D.6. Structure Chart of Maintain Approved Sales Process.



APPENDIX E
INPUT DESIGN



Figure E.1. Logon Screen.

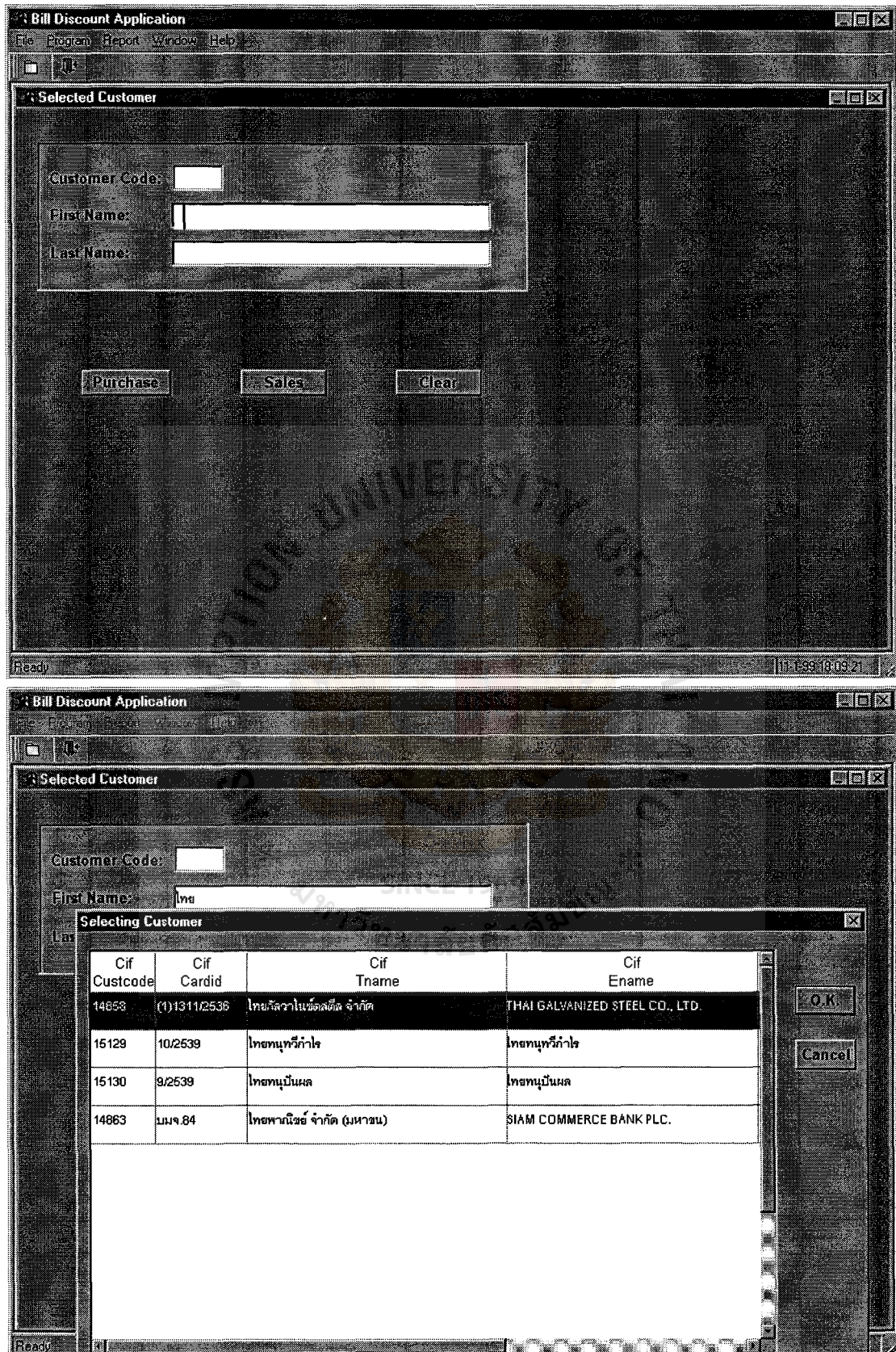


Figure E.2. Selected Customer Screen.

Bill Discount Application

File Program Report Window Help

Insertion of Purchase

Customer Name: ไทยกสิวิวัฒน์ จำกัด	Ref No:	Transaction Date: 00/00/0000
Issuer Name:	Customer Code: 14858	
Issued In: <input checked="" type="radio"/> Bangkok <input type="radio"/> Upcountry	Payee:	
Purchase Date: 00/00/0000	Trade By Treasury: <input type="radio"/> Yes <input checked="" type="radio"/> No	
Due Date: 00/00/0000	Issue Date: 00/00/0000	
Period: Days:	Official Due Date: 00/00/0000	
Tax Paid: <input type="radio"/> Yes <input checked="" type="radio"/> No	Bill No: <input type="radio"/> B/E <input type="radio"/> P/N <input type="radio"/> Bond	
Amount: 0.00	Withholding Tax: <input type="radio"/> Yes <input checked="" type="radio"/> No	
Interest Rate: 0.000 %	Type of Rate: <input checked="" type="radio"/> Discount Rate <input type="radio"/> Effective Rate	
Pay Add: 0.00	OID Value: 0.00	
Guaranteed By: Branch:	With Tax: 0.00	
Cheque Paid By: Branch:	<input checked="" type="radio"/> Accepted <input type="radio"/> Aval <input type="radio"/> None	
Comment:	Cheque No: Cheque Date: 00/00/0000	
	Override Credit Limit: <input type="checkbox"/> Post Flag: 0	

Ready 11:1:33 18/12/23

Figure E.3. Purchase Screen.

Sale File Program Report Window Help

Ref. No. Transaction Date

Customer Name Supplier Name

Customer Address Supplier Address

Customer Code Supplier Code

Trade By Treasury ☐ Yes ☐ No

Sales Date Purchase Date Trade By CPT

Issue Date Due Date

Trade Date Period

Maturity Date Amount

Type of Rate ☐ Discount Rate ☐ Effective Interest Rate

Unit Price Annual Income

Bill No. ☐ EYE ☐ ZR ☐ LTR ☐ WVR ☐ WVC

Quoted By Branch ☐ Account ☐ Name

Type of Paid ☐ Cheque ☐ Cash/ATM

Cheque Paid By Branch Cheque No. Cheque Date

Comment Post Date

Figure E.4. Sales Screen.

Bank Credit Application

File Program Window Help

Bank Credit

Code	Abbr. Name	Bank Name	App. Credit Line	Used Credit Line
1	ABN	ABN-AMRO Bank NV	400,000,000.00	0.00
2	BOA.NT	Bank of America N.T. & S.A.	400,000,000.00	0.00
3	CITI	Citibank, N.A.	400,000,000.00	0.00
4	CAI	Credit Agricole Indosuez	400,000,000.00	0.00
5	DB	Deutsche Bank	400,000,000.00	0.00
6	HSBC	The Hong Kong and Shanghai Banking Cor	400,000,000.00	0.00
7	STCB	Standard Chartered Bank	400,000,000.00	0.00
8	BBL	Bangkok Bank Public Company Limited	400,000,000.00	13,205,350.00
9	KTB	Krung Thai Bank Public Company Limited	400,000,000.00	52,619,195.48
10	TFB	Thai Farmers Bank Public Company Limite	400,000,000.00	7,500,000.00
11	GSB	The Government Savings Bank	400,000,000.00	0.00
12	FIDF	Financial Institutions Development Fund	400,000,000.00	0.00
13	TDB	The Thai Danu Bank Public Company Limit	300,000,000.00	14,200,000.00
14	IFCT	The Industrial Finance Corporation of Thaila	300,000,000.00	40,000,000.00
15	BOA	The Bank of Asia Public Company Limited	300,000,000.00	0.00
16	SCB	The Siam Commercial Bank Public Compa	40,000,000.00	0.00
17	BAY	Bank of Ayudhya Public Company Limited	100,000,000.00	0.00

Login successful

11/1/99 18:49:40

Figure E.6. Bank Credit Maintenance Screen.

Customer Maintenance

Customer Type: ☐ Individual

Title: First Name: Last Name:

Card ID: Tax ID:

Marketing:

Approved Credit Line: Used Credit Line: Account Status:

Figure E.7. Customer Maintenance Screen.



APPENDIX F
OUTPUT DESIGN

Bill Discount Application

File Program Report Window Help

Select Report Condition

Purchase Report

Please specify date and bill type to print.

From: 01/11/1998 To: 31/03/1999

Bill Type: ☒ B/E ☒ P/N ☒ Bond

OK Clear

Bill Discount Application

File Program Report Window Help

Bill Discount Purchase Report

Bill Discount Purchase Report as from 01-Nov-1998 to 31-Mar-1999

Customer	Issuer	Payee	Bill#	Ref#	Purchase Date	Maturity Date	Disc. Rate
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.ชีวิตเอนจินเนียริง	มจก.ที.เอส.พี. บีโตร์เลียม	1311/41	243/41	20/NOV/98	01/FEB/99	11.250
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.ชีวิตเอนจินเนียริง	มจก.ที.เอส.พี. บีโตร์เลียม	1354/41	242/41	20/NOV/98	01/FEB/99	11.250
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.ชีวิตเอนจินเนียริง	มจก.ที.เอส.พี. บีโตร์เลียม	1388/41	250/41	27/NOV/98	03/FEB/99	11.250
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.ชีวิตเอนจินเนียริง	มจก.ที.เอส.พี. บีโตร์เลียม	1372/41	249/41	27/NOV/98	09/FEB/99	11.250
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.ชีวิตเอนจินเนียริง	มจก.ที.เอส.พี. บีโตร์เลียม	1473/41	19981203-006	04/DEC/98	15/FEB/99	11.000
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.บุญชัยพาณิชย์ (1979)	มจก.ที.เอส.พี. บีโตร์เลียม	1551/41	19981214-001	14/DEC/98	24/FEB/99	10.000
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.บุญชัยพาณิชย์ (1979)	มจก.อี.อี.ซี. (1993)	1633/41	19981230-004	30/DEC/98	26/FEB/99	7.750
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.บุญชัยพาณิชย์ (1979)	นายสำราญ ล้าเลิศ	1631/41	19981230-005	30/DEC/98	26/FEB/99	7.750
ที.เอส.พี. บีโตร์เลียม จำกัด	มจก.ชีวิตเอนจินเนียริง	มจก.อาร์.เอ.คอน	1600/41	19981229-009	29/DEC/98	26/FEB/99	8.750

Ready 11/2/99 15:01:14

Figure F.1. Purchase Report.

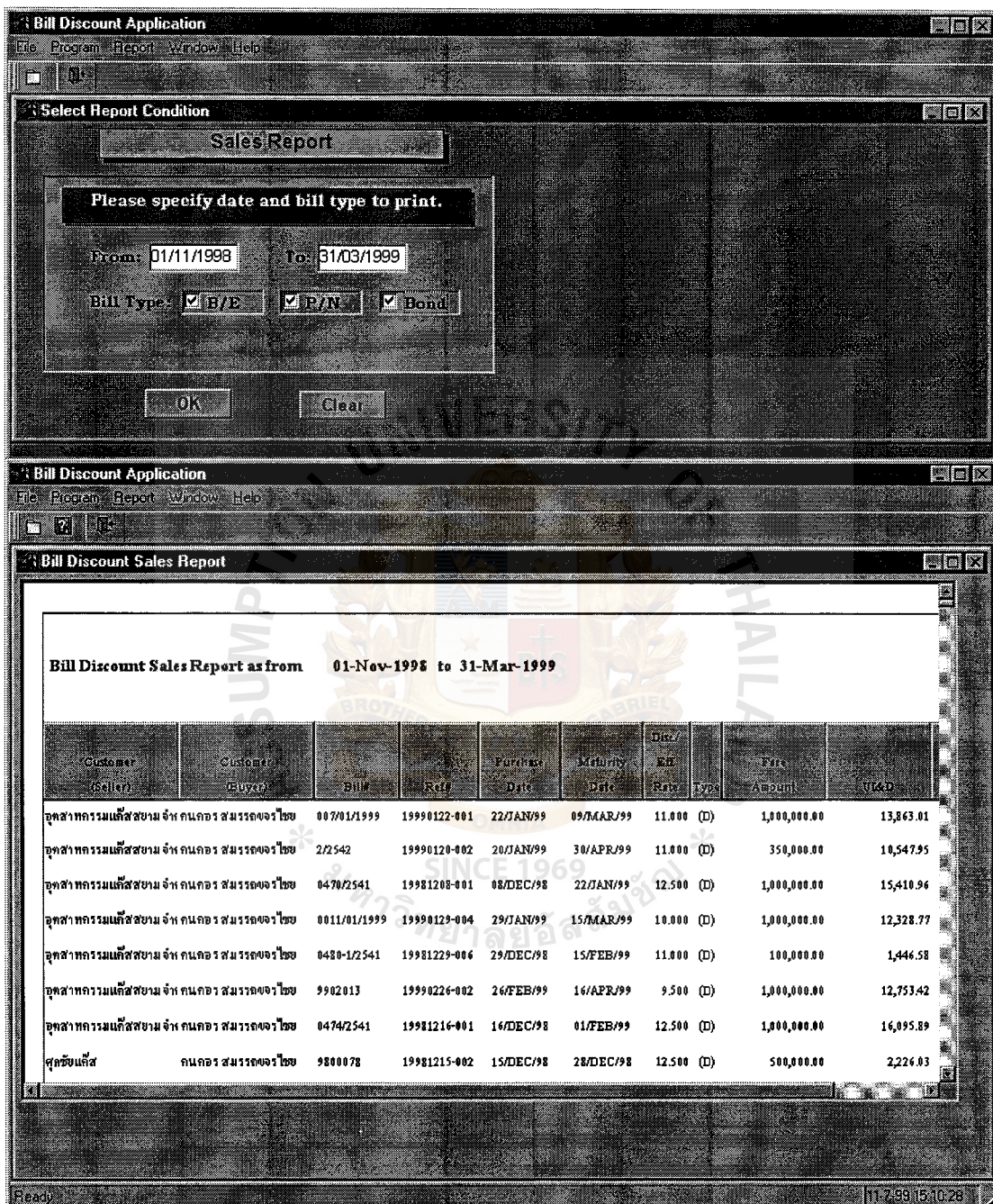


Figure F.2. Sales Report.

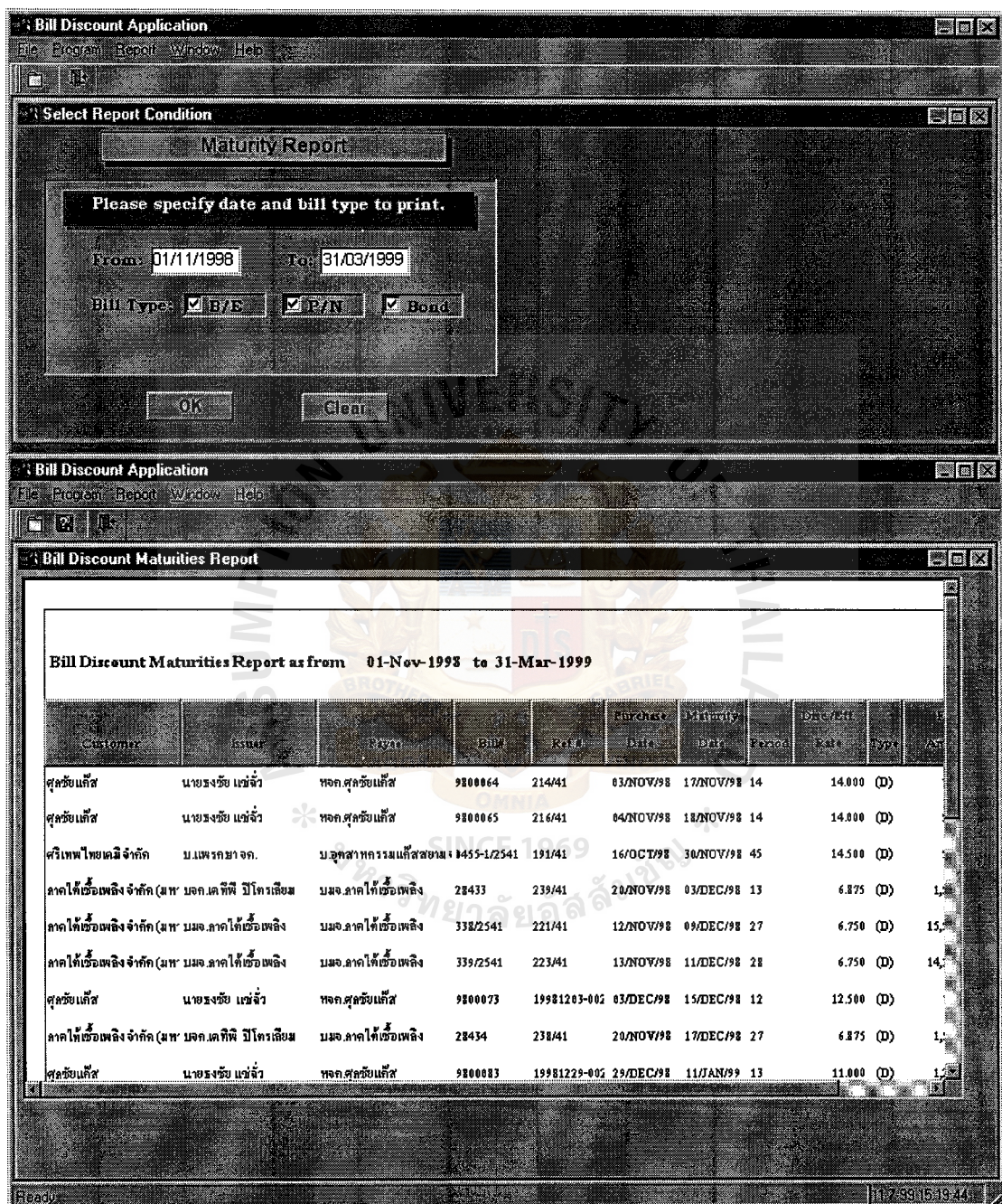


Figure F.3. Maturity Report.

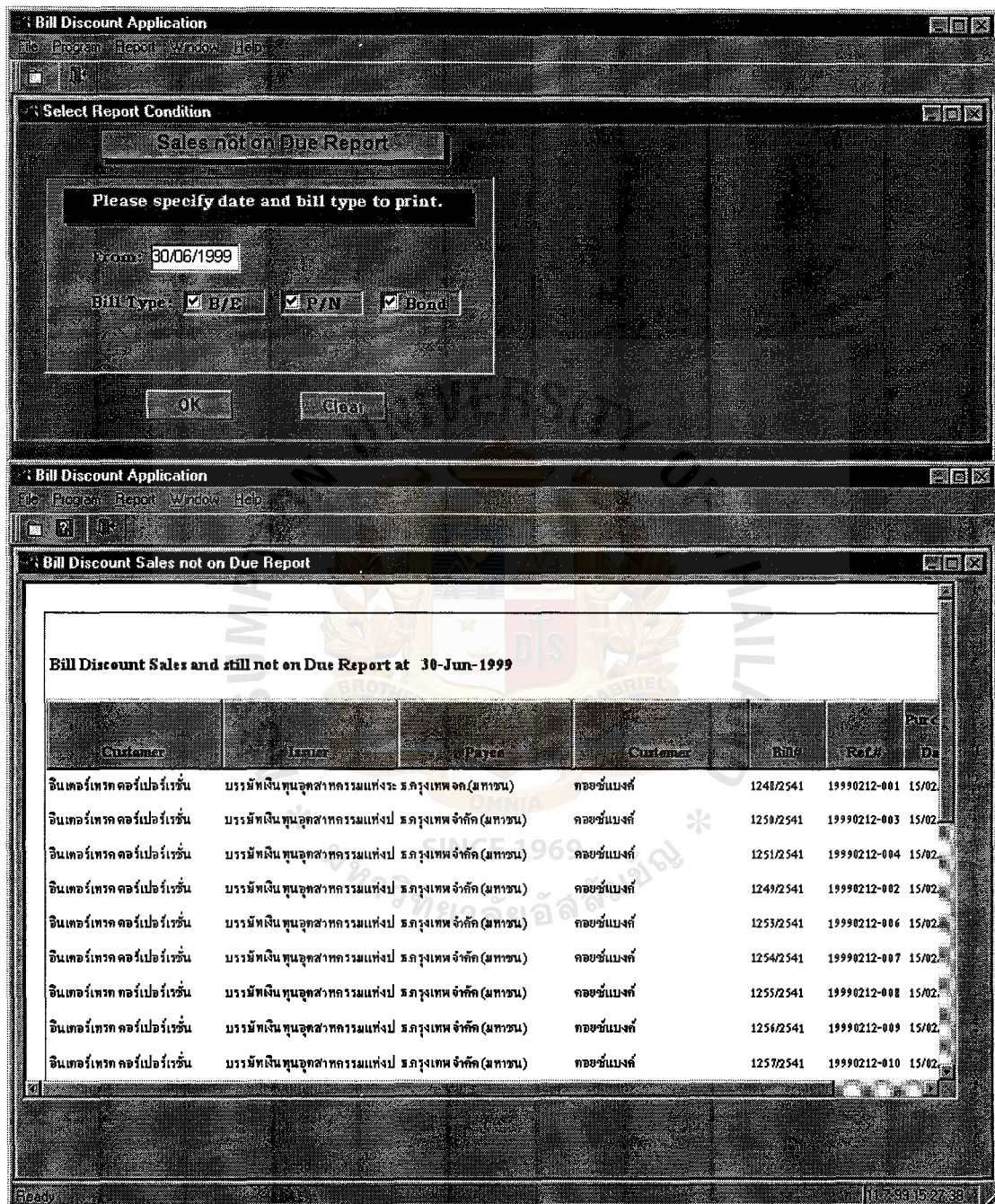


Figure F.4. Sales Not on Due Report.

Bill Discount Application

File Program Report Window Help

Select Report Condition

Month-End Outstanding Report

Please specify date and bill type to print.

From: 31/05/1999 To: 31/05/1999

Bill Type: ☒ B/E ☐ P/N ☐ Bond

OK Clear

Bill Discount Application

File Program Report Window Help

Bill Discount Sales not on Due Report

Bill Discount Sales and still not on Due Report at 30-Jun-1999

Customer	Supplier	Payee	Customer	Bill#	Ref#	Due
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1248/2541	19990212-001	15/02
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1250/2541	19990212-003	15/02
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1251/2541	19990212-004	15/02
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1249/2541	19990212-002	15/02
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1253/2541	19990212-006	15/02
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1254/2541	19990212-007	15/02
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1255/2541	19990212-008	15/02
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1256/2541	19990212-009	15/02
อินเตอร์เทรด คอร์ปอเรชั่น	บริษัทเงินทุนอุตสาหกรรมแห่งประเทศไทย (มหาชน)	คชช.แม่จัน		1257/2541	19990212-010	15/02

Ready 11:27:39 15/07/99

Figure F.5. Month-End Outstanding Report.

Bill Discount Application

File Program Report Window Help

Select Report Condition

Taxation Report

Please specify date and bill type to print.

From: 01/01/1999 To: 31/03/1999

Bill Type: ☒ H/E ☒ P/N ☒ Bond

OK Clear

Bill Discount Application

File Program Report Window Help

Taxation Statement

ใบส่ง ภ.ง.ด. 2

NITHIPAT CAPITAL AND SECURITIES COMPANY LIMITED

TAXATION STATEMENT

เลขประจำตัวผู้เสียภาษีอากร 3011708903

ชื่อใบขอรับหักภาษี

(ของผู้นำนำเข้าหักภาษี ณ ที่จ่าย)

ลำดับที่	ชื่อผู้มีเงินได้	วันเดือนปี ที่จ่าย	ประเภทเงินได้	อัตรา หักภาษี
1	คุณหญิง	04/01/1999	ดอกเบี้ยเงินฝาก	15%
2	คุณหญิง	04/01/1999	ดอกเบี้ยเงินฝาก	15%
3	คุณหญิง	04/01/1999	ดอกเบี้ยเงินฝาก	15%
4	คุณหญิง	04/01/1999	ดอกเบี้ยเงินฝาก	15%

รวมยอดเงินได้และภาษีที่นำส่ง ณ วันที่ 04/01/1999

Ready

Page 1 of 1

Figure F.6. Taxation Report.

APPENDIX G

ESTIMATED COSTS FOR CANDIDATE 1



Table G.1. Estimated Implementation Costs of Candidate 1, Baht.

Cost items	Quantity	Unit Price	Amount
Hardware & Software			
Server	1	50,000	50,000
Clients	3	30,000	90,000
Laser Printer	1	15,000	15,000
Dot Matrix Printer	1	10,000	10,000
Hub	1	3,000	3,000
Cable and Network Interface	5	1,000	5,000
Grand Total			173,000

Table G.2. Estimated Annual Operation Costs of Candidate 1, Baht.

Cost items	Amount
1. Staff Cost	
Credit Control Manager	240,000
Operation Supervisor	120,000
Operation Staff	60,000
Sub Total	420,000
2. Operation Cost	100,000
3. Utility Cost	90,000
4. Maintenance Cost	15,000
Grand Total	625,000

Table G.3. Payback Period Matrix of Candidate 1, Baht.

Cost items	Years					
	0	1	2	3	4	5
Development cost	-173,000					
Operation maintain cost		-625,000	-687,500	-756,250	-831,875	-915,063
Discount factor for 12 %	1	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs -adjusted to present value	-173,000	-558,125	-547,938	-538,450	-529,073	-518,840
Cumulative time-adjusted cost over lifetime	-173,000	-731,125	-1,279,063	-1,817,513	-2,346,585	-2,865,425
Benefits derived from operation of new system	0	272,000	299,200	329,120	362,032	398,235
Discount factors for 12 %	1	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits – adjusted to present value	0	242,896	238,462	234,333	230,252	225,799
Cumulative time-adjusted benefits over lifetime	0	242,896	481,358	715,692	945,944	1,171,744
Cumulative lifetime time-adjusted -costs + benefits	-173,000	-488,299	-797,704	-1,101,821	-1,400,641	-1,693,682

We can not measure the payback period of candidate 1.

Net Present Value = -1,693,682 Baht



APPENDIX H

ESTIMATED COSTS FOR CANDIDATE 2

Table H.1. Estimated Implementation Costs of Candidate 2, Baht.

Cost items	Quantity	Unit Price	Amount
Hardware & Software			
Server	1	50,000	50,000
Clients	3	30,000	90,000
Laser Printer	1	15,000	15,000
Dot Matrix Printer	1	10,000	10,000
Hub	1	3,000	3,000
Cable and Network Interface	5	1,000	5,000
ORACLE RDBMS	1	300,000	300,000
Developer/2000	1	100,000	100,000
Sub Total			573,000
Development & Implementation			
System Analysis			100,000
System Design			100,000
Programming			150,000
Testing			5,000
Training			3,000
Implementation			5,000
Sub Total			363,000
Grand Total			936,000

Table H.2. Estimated Annual Operation Costs of Candidate 2, Baht.

Cost items	Amount
1. Staff Cost	
Credit Control Manager	80,000
Operation Supervisor	40,000
Operation Staff	20,000
Sub Total	140,000
2. Operation Cost	35,000
3. Utility Cost	20,000
4. Maintenance Cost	35,000
Grand Total	230,000

Table H.3. Payback Period Matrix of Candidate 2, Baht.

Cost items	Years					
	0	1	2	3	4	5
Development cost	-936,000					
Operation maintain cost		-230,000	-253,000	-278,300	-306,130	-336,743
Discount factor for 12 %	1	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs -adjusted to present value	-936,000	-205,390	-201,641	-198,150	-194,699	-190,933
Cumulative time-adjusted cost over lifetime	-936,000	-1,141,390	-1,343,031	-1,541,181	-1,735,879	-1,926,813
Benefits derived from operation of new system	0	485,000	533,500	586,850	645,535	710,089
Discount factors for 12 %	1	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits – adjusted to present value	0	433,105	425,200	417,837	410,560	402,620
Cumulative time-adjusted benefits over lifetime	0	433,105	858,305	1,276,142	1,686,702	2,089,322
Cumulative lifetime time-adjusted -costs + benefits	-936,000	-708,285	-484,727	-265,039	-49,177	162,510

$$\begin{aligned}
 \text{Payback Period} &= \text{Last year of negative} + \frac{\text{Cumulative difference last negative year}}{\text{Absolute value of cumulative difference}} \\
 &= 4 + \frac{49,177}{(49,177 + 162,510)} \\
 &= 4.23 \text{ Years}
 \end{aligned}$$

Net Present Value = 162,510 Baht



APPENDIX I

ESTIMATED COSTS FOR CANDIDATE 3

Table I.1. Estimated Implementation Costs of Candidate 3, Baht.

Cost items	Quantity	Unit Price	Amount
Hardware & Software			
Server	1	45,000	45,000
Clients	3	30,000	90,000
Laser Printer	1	12,000	12,000
Dot Matrix Printer	1	8,000	8,000
Hub	1	3,000	3,000
UPS	5	2,000	10,000
Cable and Network Interface	5	1,000	5,000
SQLServer 7.0 RDBMS	1	100,000	100,000
PowerBuilder 6.0	1	40,000	40,000
Sub Total			313,000
Development & Implementation			
System Analysis			20,000
System Design			20,000
Programming			30,000
Testing			5,000
Training			3,000
Implementation			5,000
Sub Total			83,000
Grand Total			396,000

Table I.2. Estimated Annual Operation Costs of Candidate 3, Baht.

Cost items	Amount
1. Staff Cost	
Credit Control Manager	80,000
Operation Supervisor	40,000
Operation Staff	20,000
Sub Total	140,000
2. Operation Cost	35,000
3. Utility Cost	20,000
4. Maintenance Cost	35,000
Grand Total	230,000

Table I.3. Payback Period Matrix of Candidate 3, Baht.

Cost items	Years					
	0	1	2	3	4	5
Development cost	-396,000					
Operation maintain cost		-230,000	-253,000	-278,300	-306,130	-336,743
Discount factor for 12 %	1	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs –adjusted to present value	-396,000	-205,390	-201,641	-198,150	-194,699	-190,933
Cumulative time-adjusted cost over lifetime	-396,000	-601,390	-803,031	-1,001,181	-1,195,879	-1,386,813
Benefits derived from operation of new system	0	485,000	533,500	586,850	645,535	710,089
Discount factors for 12 %	1	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits -adjusted to present value	0	433,105	425,200	417,837	410,560	402,620
Cumulative time-adjusted benefits over lifetime	0	433,105	858,305	1,276,142	1,686,702	2,089,322
Cumulative lifetime time-adjusted -costs + benefits	-396,000	-168,285	55,274	274,961	490,823	702,510

$$\begin{aligned}
 \text{Payback Period} &= \frac{\text{Last year of negative} + \text{Cumulative difference last negative year}}{\text{Absolute value of cumulative difference}} \\
 &= 1 + \frac{168,285}{(168,285 + 55,274)} \\
 &= 1.75 \text{ Years}
 \end{aligned}$$

Net Present Value = 702,510 Baht



APPENDIX J

DATA DICTIONARY

Table J.1. Data Dictionary of Bill Payment System.

Field Name	Meaning
Abbreviate Bank Name	The abbreviation name of bank i.e., BBL ,TFB ,TMB
Acceptance	The Flag of accept bank guaranteed
Aval	The Flag of aval bank guaranteed
Account Officer Information	The information of account officer i.e, code, name,
Account Officer Table	The table that stores the data of account officer
Add Bank	The process that used to add bank information into the bill discount system.
Add Customer	The process that used to add customer information into the Bill discount system.
Add Purchase	The process that used to add transaction of purchase order information into the Bill discount system.
Add Sales	The process that used to add transaction of sales order information into the Bill discount system.
Added Purchase Information	The system added purchase information.
Added Sales Information	The system added sales information.
Added Bank Information	The system added bank information.
Added Customer Information	The system added customer information.
Amount	The face value of bill of exchange
AOCODE	The code of Account Officer
AONAME	The name of Account Officer
APPCREDITLINE	The amount of approved bank credit line
APPCREDUTLINE	The amount of approved customer credit line
Approved Purchase And Sales	The process of approved for purchase and sales of bill
Approved Bank Credit Line	The credit control approved credit line of bank into the bank table.
Approved Customer Credit Line	The credit control approved credit line of bank into the bank table.
Available Purchase	The posted and unsold bill discount which can be sold
Bank	The table of Bank.
Bank and Customer Credit - Line Approvement	The credit control approves bank and customer credit line.
Bank Credit Approvement	The function that used to approved bank credit line.
Bank Credit Line Approvement	The credit control approved bank credit line.
Bank Information	The information of bank i.e. bank code, bank name
Bank Table	The table of bank information
Bank Branch	The branch of bank that guaranteed the bill discount.
Bank Code	The code of bank
Bank Name	The full name of bank
Bill Discount Buyer	The information of customer who buys the bill discount.
Bill Discount Seller	The information of customer who sells the bill discount.
Bill Discount System	The process of Bill Discount System.
Bill No.	The number of bill discount
Bill Type	The type of bill discount

Table J.1. Data Dictionary of Bill Payment System (continued).

Field Name	Meaning
Branch	The branch of account officer
Card I.D.	The identified card which include population and passport number
Cash TR	The flag of customer who paid money by cashing or Transferring
Changing Status	The customer who changes some status after the operation which update corresponding information into customer table.
Credit Control	The credit control staff
CUSTACCT	The type of customer account
CUSTCODE	The customer code
Customer Credit Approvement	The credit control who approved customer credit line
Customer Information	The information of customer such as code, name, tax i.d., approved credit line, used credit line, etc.
Customer Registration	The process that added the information of customer
Customer Table	The table that keeps the information of customer
Customer Verification	The process that used to verify the customer
CUSTTYPE	The type of Customer
DISC EFF	The flag of methodology of interest
DUE DATE	The due date on the bill
ENAME	The English first name
ESURNAME	The English surname
ETITLE	The English prename
Filling Purchase Information	The operation enters purchase information via add purchase process after that store into purchase table.
Fill Sales Information	The operation enters sales information via add sales process after that store into sales table.
Generate Operation Report	The process is used to generate reports to operations
Generate Posted Purchase	The process is used to generate posted purchase reports
Generate Posted Sale	The process is used to generate posted sale reports
Generate Purchase Report	The process is used to generate purchase reports
Generating Sale Report	The process is used to generate sale reports
Increasing Bank Credit Line	The system increased the bank credit line when the bill is sold
Increasing Customer Credit Line	The system increases customer credit line when the bill is sold
INT RATE	The interest rate
Invalid Customer	The customer who has been rejected
ISSUE DATE	The date of issue
ISSUED IN	The bill is issued in
ISSUER NAME	The issuer name of the bill
Maintain Bank Credit Information	The process is used to maintain bank information
Maintain Customer Information	The process is used to maintain customer information

Table J.1. Data Dictionary of Bill Payment System (continued).

Field Name	Meaning
Maintain Purchase and Sales Information	The process is used to maintain purchase and sales information
New Bank	The system adds a new bank into bank table
New Customer	The system adds a new customer into customer table
OFFICIAL DATE	The official due date is the due date on working day
OPENDATE	The date of open account
Operational Report	The system generates operational reports to operations
OVERRIDE CREDIT	The override credit flag
PAID_AMT	The total amount was included the purchased with tax and excluded the purchase discount value.
PAYEE	The payee name
PERIOD	The number of days counted as from Sale Date to Official Due Date
PERSONCODE	The flag which identifies the type of person
Post Sale	The process is used when the supervisor operation approves the sale transaction.
POST_FLAG	Post flag is used to identify that the supervisor operation approved the transaction.
Posted Purchase And Sales Report	The system generates posted purchase and sale reports
Posted Purchase Information	The purchase information that is approved by the supervisor operation
Posted Purchase Report	The system generates posted purchase reports
Posted Sales	The sale information after being approved by the supervisor operation
Posting Purchase	The supervisor operation approves purchase transaction of the bill
Posting Purchase And Sales	The supervisor approves purchase and sales transaction
Posting Sales	The supervisor operation approves sales transaction of the bill
PROFIT LOSS	The amount of profit or loss of transaction
Purchase and Sale Approvement	The information of purchase and sale transaction
Purchase Customer Detail	The information of customer, who sells bill discount, which is used to generate purchase report
Purchase Information	The information of purchase such as reference no., customer code, bill no, guaranteed bank, etc.
Purchase Report	The system generates purchase reports
Purchase Table	The table of purchase information
PURCHASE DATE	The date of purchase
Purchased Bill Discount	The bill discount that is purchased by customers
RECEIVED_AMT	The total amount was included the sales with tax and excluded the sales discount value.
Reduced Bank Credit Line	The system reduces bank credit line.

Table J.1. Data Dictionary of Bill Payment System (continued).

Field Name	Meaning
Reduced Customer Credit Line	The system reduces customer credit line.
REF_NO	The reference number of bill discount
REMU_CPT	The amount of remuneration of Commercial Paper Trading (CPT)
REMU_MKT	The amount of remuneration of marketing
REMU_TREASURY	The amount of remuneration of treasury
Retrieve Data From DB	The process is used to retrieve purchase and sale information to generate the reports
SALE	The table of sale information
Sale Customer Detail	The information of customer who buys bill discount
Sale Information	The information of sale such as reference no., customer code, sale date, etc.
Sale Report	The system generates sale reports
Sale Table	The table of sale information
Selected Bank Information	The credit control selects bank information to maintain.
Sold Bill Discount	The bill discount that is sold by customers.
Supervisor	The supervisor operation staffs
TAX_PAID	The flag of tax of sale
TAXID	The tax identification number
TEAMID	The team of account officer
TNAME	The Thai first name of customer
TRADE_BY_TREASURY	The flag of trade by treasury
TSURNAME	The Thai surname of customer
TTITLE	The Thai prename of customer
TX_DATE	The date of transaction
UID_CPT	The remuneration of Commercial Paper Trading (CPT)
UID_TREASURY	The remuneration of treasury
UID_VALUE	The unearned interest value
Unposted Purchase	The supervisor selects only the unposted purchase to approve.
Unposted Sale	The supervisor selects only the unposted sale to approve.
Update Bank Credit	The process is used to update bank information.
Update Customer	The process is used to update customer information.
Update Purchase	The process is used to update purchase information.
Update Sales	The process is used to update sales information.
Updated Bank Information	The system updates bank information.
Updated Customer	The system updates customer information.
Updated Customer Credit Line	The system updates customer credit line.
Updated Purchase Information	The system updates purchase information.
Updated Sales Information	The system updates sales information.
Updating Bank Credit Line	The credit control updates bank credit line.
Updating Customer Information	The operation updates customer information.

Table J.1. Data Dictionary of Bill Payment System (continued).

Field Name	Meaning
Updating Purchase and Sales Information	The operation updates purchase and sales information.
Updating Purchase Information	The operation updates purchase information.
USED CREDITLINE	The amount of used credit line
Validation Report	The system generates report to validate purchase and sales information.
Verify Bank	The process is used to verify bank information.
Verify Customer	The process is used to verify customer information.
Verify Purchase	The process is used to verify purchase information.
Verify Sales	The process is used to verify sales information.
WITH TAX	The flag of including tax
WITH TAX AMT	The amount of tax purchase
WOR	The flag without recourse



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