



Analysis and Design of
a Currency Exchange Transaction

by

Mr. Wutichai Napasakulku

A Final Report of the Three-Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
Assumption University

November 2004

St. Gabriel's Library, Assumption University

**Analysis and Design of
a Currency Exchange Transaction**

by
Mr. Wutichai Napasakulku

A Final Report of the Three-credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
Assumption University

November 2004

Project Title Analysis and Design of a Currency Exchange
Transaction


Name Mr. Wutichai Napasakulku

Project Advisor Dr. Chamnong Jungthirapanich


Academic Year November 2004

The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management

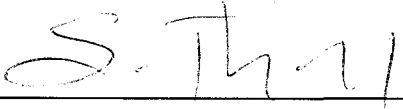
Approval Committee:



(Dr. Chamnong Jungthirapanich)
Dean and Advisor



(Prof. Dr. Srisakdi Charmonman)
Chairman



(Assoc. Prof. Somchai Thayarnyong)
CHE Representative

November 2004

ABSTRACT

ABC Petrochemical Co.,Ltd. is a fictitious company to study the possible problem and see the outcome of the problem solving. ABC Petrochemical Co.,Ltd. is a company that produces products from oil. Refined & Lubricant Products are distributed wholesale to major traders, industrial plants, transportation companies, and companies within ABC Petrochemical Group. The company has one Headquarter and 68 service stations that distribute to the metropolitans and the big provinces.

When the products are distributed to the service station, that station must generate the exchange transaction back to the distributor and the headquarters. Sometimes if the transaction is sent or received too late, the distributor or even the headquarters will get into trouble. So, the station will communicate to the distributor or the related station via telephone for most of the transactions. This problem generates the annual cost of about 18 million baht.

To reduce the major cost of communication transactions and reduce transaction transfer time, the New Currency Exchange Transaction System is implemented. The new system will change all the ways of transacting communication from mail and telephone to email and web based. The new system can save the cost of about 13 million baht a year less than the current system.

From the replacement analysis and break-even analysis, if the current system is replaced by the new system, the company will meet the break-even within 1.09 years. It can be concluded that the company should replace the current system and it is recommended that the company should expand the system to gain more benefit from the new system.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to the following people who gave me the guidance and information to do this project. They were very kind and willing to help me finish this project with their knowledge and patience.

First of all, I would like to express my special thanks to Dr. Chamnong Jungthirapanich, my project advisor and the Dean of the Master of Science in Computer and Engineering Management. He always encouraged me to proceed with the project continuously and his true knowledge could help me find the solutions to problems of the project. So, I could complete this pre-implementation study smoothly.

I would like to express my sincere appreciation to my colleagues, Ms. Dussanee Inthawadee who always gave me the information of how to run the project, the date of project checking, and project submission date and also warned me every step while the project was running. Next, Mr. Tul Viratsilp who gave me many of old sample projects.

Last but not the least, I give the special thanks to my family for their encouragement to study in the Master Degree program and who cheered me to complete this project.

TABLE OF CONTENTS

<u>Chapter</u>	<u>Page</u>
ABSTRACT	i
ACKNOWLEDGEMENTS	ii
LIST OF FIGURES	v
LIST OG TABLES	vii
I. INTRODUCTION	1
1.1 Background of the Project	1
1.2 Objective of the Projects	2
1.3 Scopes of the Project	2
II. THE EXISTING SYSTEM	4
2.1 Background of the Organization	4
2.2 The Existing Computer System	7
2.3 Current Problems and Areas for Improvement	12
III. THE PROPOSED SYSTEM	13
3.1 System Specification	13
3.2 System Design	13
3.3 Hardware and Software Requirements	47
3.4 Security and Control	48
3.5 System Cost Analysis	49
3.6 Intangible Benefit	66
IV. PROJECT IMPLEMENTATION	67
4.1 Overview of Project Implementation	67
4.2 The Construction and Testing Phase	67
4.3 Installation	68

<u>Chapter</u>	<u>Page</u>
4.4 Training	69
V. CONCLUSIONS AND RECOMMENDATIONS	70
5.1 Conclusions	70
5.2 Recommendations	73
BIBLIOGRAPHY	75



LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
2.1. Organization Chart of ABC Petrochemical Co.,Ltd.	6
2.2. Organization Chart of Station Office.	7
2.3. Context Diagram of the Current Exchange Transaction.	9
2.4. Data Flow of the Current Exchange Transaction.	11
3.1. The Context Diagram of Currency Exchange Transaction System.	14
3.2. Level 0 Data Flow Diagram of The Currency Exchange System.	15
3.3. Level 1 Data Flow of The Authorized User Access.	16
3.4. Level 1 Data Flow Diagram of Exchange Transaction Activities.	18
3.5. Level 1 Data Flow Diagram of Check Stock.	19
3.6. Level 1 Data Flow Diagram of Store All Rates and Fees.	20
3.7. Level 1 Data Flow Diagram of Generate Report.	21
3.8. Entities Relationship Diagram of the Currency Exchange Transaction System.	31
3.9. Login Page Screen.	34
3.10. Main Menu Screen.	35
3.11. Pre-Invoice Generation Screen.	35
3.12. Pending Transaction List Screen.	36
3.13. Approved Transaction List Screen.	36
3.14. Add New Transaction Screen.	37
3.15. Approved Transaction Detail Screen.	37
3.16. Rejected Transaction List Screen.	38
3.17. Re-Charge the Rejected Transaction Screen.	38

<u>Figure</u>	<u>Page</u>
3.18. Invoice Generation List Screen.	39
3.19. Billing Round Code Screen.	39
3.20. User Access Right Screen.	40
3.21. Invoice Report Format.	41
3.22. Income/Expense Report Format.	42
3.23. Computer Layout of the Currency Exchange Transaction System.	48
3.24. The Cash Flow of the Annual Cost.	51
3.25. The Cash Flow of the Current System.	63
3.26. The Cash Flow of the New System.	63
3.17. Break-even Analysis of the Currency Exchange Transaction System.	65

LIST OF TABLES

<u>Table</u>	<u>Page</u>
3.1. Process Specification of Process 1.1.	22
3.2. Process Specification of Process 1.2.	22
3.3. Process Specification of Process 2.1.	22
3.4. Process Specification of Process 2.2.	23
3.5. Process Specification of Process 2.3.	23
3.6. Process Specification of Process 2.4.	24
3.7. Process Specification of Process 2.5.	24
3.8. Process Specification of Process 2.6.	25
3.9. Process Specification of Process 2.7.	25
3.10. Process Specification of Process 2.8.	25
3.11. Process Specification of Process 3.1.	26
3.12. Process Specification of Process 3.2.	26
3.13. Process Specification of Process 4.1.	26
3.14. Process Specification of Process 4.2.	27
3.15. Process Specification of Process 4.3.	27
3.16. Process Specification of Process 5.1.	28
3.17. Process Specification of Process 5.2.	28
3.18. Process Specification of Process 5.3.	29
3.19. Process Specification of Process 5.4.	29
3.20. Data Dictionary of User.	32
3.21. Data Dictionary of User_Menu.	32
3.22. Data Dictionary of Menu_Item.	32

<u>Table</u>	<u>Page</u>
3.23. Data Dictionary of User_Transaction.	33
3.24. Data Dictionary of Transaction.	33
3.25. Data Dictionary of Fee Rate.	33
3.26. Data Dictionary of Transaction_Stock.	33
3.27. Data Dictionary of Stock.	34
3.28. Structure of User.	43
3.29. Structure of User_Menu.	43
3.30. Structure of Menu_Item.	44
3.31. Structure of User_Transaction.	44
3.32. Structure of Transaction.	45
3.33. Structure of Fee_Rate.	45
3.34. Structure of Transaction_Stock.	46
3.35. Structure of Stock.	46
3.36. The Specification of the Web Server and Database Server (Datacenter Machine).	47
3.37. The Specification of the Client Computer (Station Office Computer).	47
3.38. Software Specification on the Datacenter Machine.	47
3.39. Software Specification on the Client Computer (Station Office Computer).	48
3.40. The Hardware Cost of the current system of ABC Petrochemical Co.,Ltd.	52
3.41. The Software Cost of the Current System of ABC Petrochemical Co.,Ltd.	52
3.42. Summary of Annual Documentation Cost of the Current System.	54

<u>Table</u>	<u>Page</u>
3.43. Summary of Annual Communication Cost of the Current System.	55
3.44. The Annual Cost of the Current System.	56
3.45. The Hardware Cost of the New System of ABC Petrochemical Co.,Ltd.	56
3.46. The Software Cost of the New System of ABC Petrochemical Co.,Ltd.	57
3.47. Project Planning - Estimation (Process Base)	58
3.48. Total of All Initiative Cost of the New System.	59
3.49. Total cost of Annual Cost of the New System.	59
3.50. The Cost of the Current System and the New System.	60
3.51. Flow of The Current System.	61
3.52. Cash Flow of The New System.	61
5.1. The Degree of Achievement of the Proposed System.	71

I. INTRODUCTION

1.1 Background of the Project

Internet is perhaps the most well-known, and the largest, implementation of internetworking, linking hundreds of thousands of individual network all over the world. The Internet has a range of capabilities that organizations are using to exchange information internally or to communicate externally with other organizations.

Internet is based on client/server technology. Individuals using the Internet control what they do through client applications, such as Web browser software. All data, including e-mail message and Web pages, are stored on servers. A client uses the Internet to request information from a particular Web server on a distant computer and the server sends the requested information back to the client via the Internet.

Currently, the Currency Exchange Transaction used by ABC Petrochemical Co.,Ltd. Office and station office, is totally a manual system. There are two ways for the transactions' flow. First, transactions are sent by mail by using EMS service. Another flow is direct contact by using the telephone. These create a large amount of paperwork and inefficiencies. The annual cost of this system is also high. The company has to spend a lot each year especially on the communication via telephone cost.

There is one policy of the old system, that is, each station has to send an Excel file that contains all exchange transaction records to the headquarters (HQ) office every six months to generate invoice for each station and make analysis of exchange flow. It is more inefficient for both the station office and the HQ office because not all transaction records are recorded.

To make it more effective, all exchange transaction records problems and the solutions, using the information collected to allocate resources and to develop a collection of standard solutions to common problems.

This project has been implemented to replace the existing system in order to increase the productivity and efficiency of the Currency Exchange Transaction system, meet the user requirement to keep track of the transaction status, and also reduce the annual cost. The worthiness of the new Currency Exchange Transaction system is reflected by the satisfactory results obtained from the cost analysis.

1.2 Objectives of the Project

The Objectives of this project are to analyze the existing problem of the current exchange transaction system as well as design the new system which is more effective and attractive to users in the HQ office and each station. The objectives of the project are:

- (1) To analyze the nature of the current system's problems.
- (2) To determine the solutions of the problems.
- (3) To design a new Currency Exchange Transaction system.
- (4) To compare the new system with the old system.
- (5) To analyze Feasibility and develop an appropriate software prototype and system document.

1.3 Scopes of the Project

This project focuses on the analysis of the old Exchange Transaction System and Designing the new system with more efficiency and effectiveness. The scopes of the project are:

- (1) Analyzing and understanding the problems of the existing system.
- (2) Analyzing Feasibility

- (3) Evaluating the problems and determining the solutions
- (4) Designing the Data Flow Diagram of the new system
- (5) Designing Database structure of the new system
- (6) Designing a user interface and report
- (7) Developing a Currency Exchange Transaction application prototype base on Web infrastructure



II. THE EXISTING SYSTEM

2.1 Background of the Organization

ABC Petrochemical Co.,Ltd. was established in December 1990 with the current registered and paid-up capital of Baht 900 million with ABC Petrochemical Co.,Ltd. holding 100 percent of the shares. The company distributes refined products with a full capacity of 115,000 BPD such as Butane, LPG, Cracked Reformat, Unleaded Gasoline, Automotive Diesel Oil, Fuel Oil, and Lubricants which are produced from Lube Base Oil as a raw material from ABC Petrochemical whereby Lubricants of all types are blended at Lube Oil Blending Plant (LOBP) at Chonburi Terminal and marketed under ABC Petrochemical brand. ABC Petrochemical also blends Lubricants as per request by a third party customer or repacker.

Refined & Lubricant Products are distributed wholesale to major traders, industrial plants, transportation companies, and companies within ABC Petrochemical Group. At present, ABC Petrochemical Co.,Ltd. retails its products through 68 ABC Petrochemical service stations nationwide of which 19 stations are situated in Bangkok & the Metropolitan area and 49 stations are situated in the provinces. These are either clients or ABC Petrochemical Co.,Ltd. operates with strategy focusing on product quality, competitive prices, and offers full line of services including minimart and car care.

As Thailand's first locally-owned oil firm, ABC Petrochemical Co.,Ltd. is committed to continue developing for the ultimate advantage of the consumers, quality products at reasonable prices. These include quality control, reasonable pricing policies, appropriate and effective promotion campaigns, increasing competitiveness in the

marketplace, and integrated services like minimart, car care service and automatic car wash facilities.

ABC Petrochemical Co.,Ltd. always recognizes the significance of operating its business and production with maximum efficiency. To make this possible requires not only teamwork among ABC Petrochemical Co.,Ltd.'s staffs but also understanding of the needs of customers and end users alike.

In order to achieve its goals of meeting customer's demands and being responsible for the public and the environment, the company implemented ISO 9000 quality system at every level of its administration.



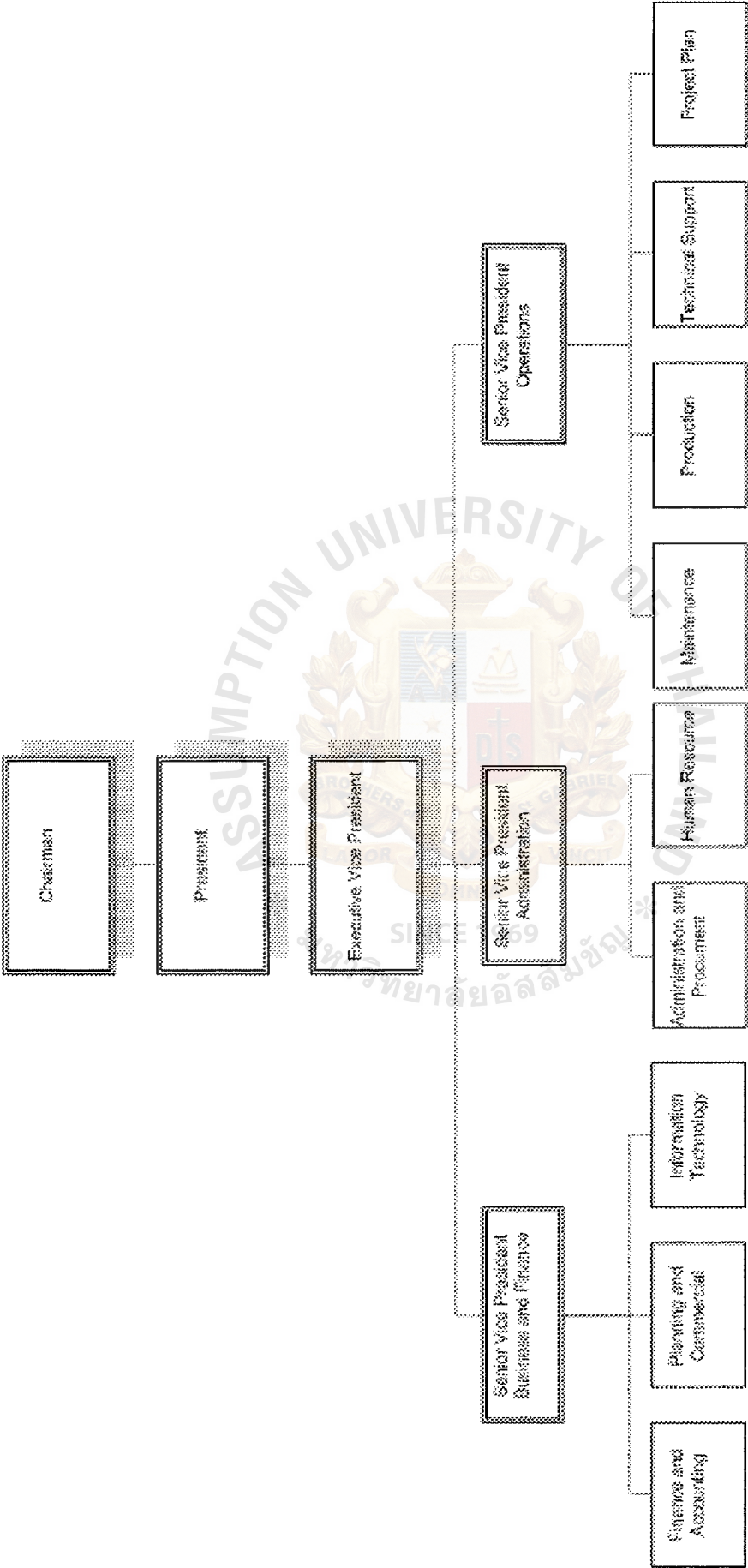


Figure 2.1.1. Organization Chart of ABC Petrochemical Co.,Ltd.

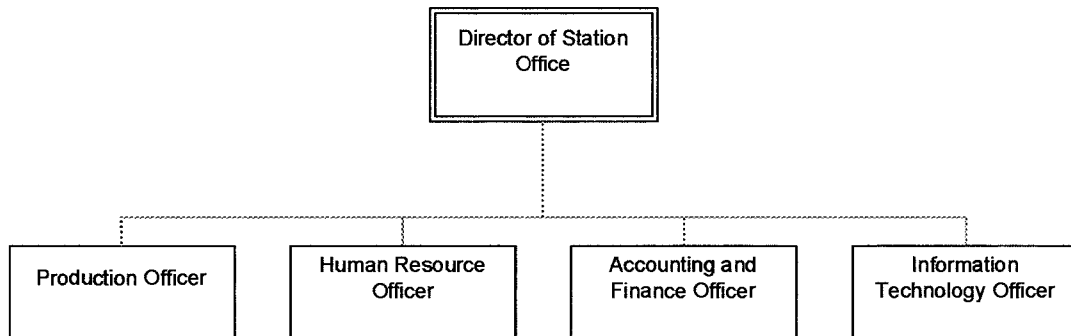


Figure 2.2. Organization Chart of Station Office.

2.2 The Existing Computer System

The existing Currency Exchange Transaction relies on the manual system. All the transactions have to be printed into transaction form and sent to the related station office and one soft copy is kept on the record file for sending to the HQ office every six months. Most of the transactions are the immediate transactions which are communicated via telephone and also have to keep records. This practice is time consuming and uses up a large amount of printed-form cost, communication cost, and postal cost.

The transactions are created from any station office and header quarter office. The transactions have to be sent to the related office via mail or asked by telephone. The related office can approve, reject, recharge, or cancel those transactions. Before each transaction is approved, it has to be checked for availability of the product in the stock. If the product is out of stock, mail notification will be sent out to the related office.

The transaction records have to be recorded into the computer and send the recorded transaction in the form of an Excel file to the header quarter office to generate invoice and make analysis of the purchased product every six months.

Figure 2.3. is a context diagram of the current exchange transaction system. The system has interaction between HQ officer and service station officer. Transaction records have bi-direction flow from/to the system and HQ officer and/or service station officer. HQ officer can generate invoice by requesting from the service station officers and send to them.



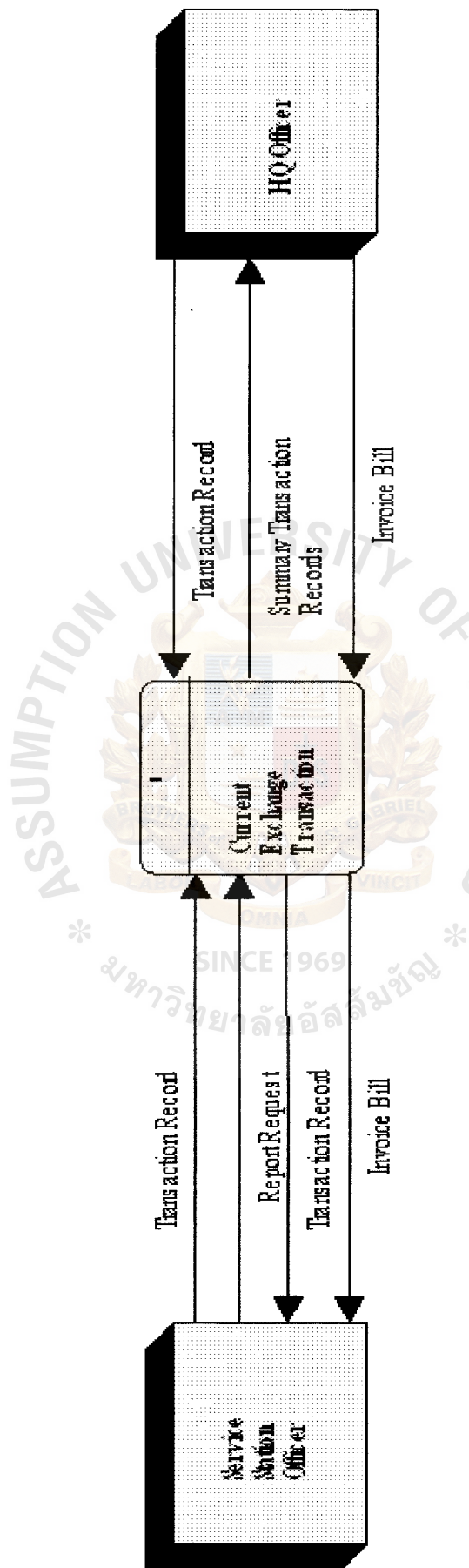


Figure2.3. Context Diagram of Current Exchange Transaction.

Figure 2.4. shows the data flow diagram of the current exchange transaction system. There are three main data flow processes which are Action Transaction, Generate Transaction Bill, and Report Generation.

The Action Transaction process takes all transaction activities – add new transaction, approve transaction, reject transaction, and cancel transaction. All activities are created by manual input, print out transaction, and then sent via mail to the related office. Most of the transactions will be communicated via telephone instead of mail because of the emergency of the transaction.

The Generate Transaction Bill process will happen every time a transaction activity occurs. The generated transaction bill will be sent to either the HQ or the service station office.

The Report Generation process will be active when the service station office makes a request for an invoice, stock report, transaction record, etc. HQ will create a request report and send via mail to the requested office.

3001 3.4

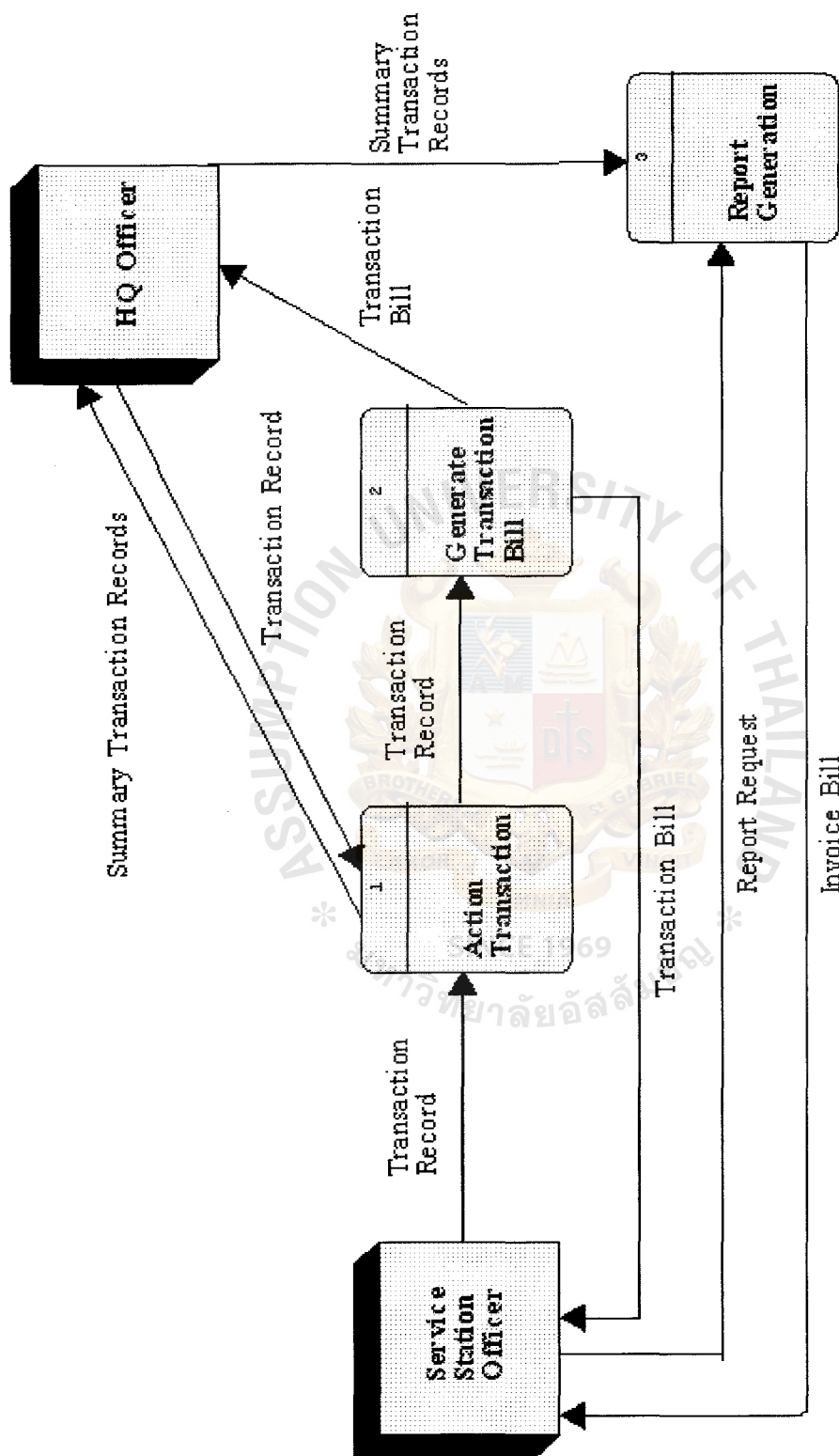


Figure2.4. Data Flow of the Current Exchange Transaction System.

2.3 Current Problems and Areas for Improvement

There are two stated problems which come from, first, the station office report that the printed-transaction sent via mail is time consuming, it has to be sent back and forth until it is approved or cancelled. So the station office prefers to use the telephone to negotiate transaction. Transaction has to be verified on the availability of production in stock, then this step is time consuming and sometimes it is too late.

Second, the HQ office reports that the communication cost via telephone is very high each month. Sometimes the HQ received sensitive transactions or critical transactions very late. These also created an extra cost. There are some duplicate exchange transactions.

To solve these problems, all exchange transactions have to be collected into the same common term and same place to keep record. By using the centralization concept, all transactions will be recorded in the central machine or also called the datacenter.

III. THE PROPOSED SYSTEM

3.1 System Specification

The specification of the project is based on the user requirement. In this project the user is the ABC Petrochemical Co.,Ltd. The user requires an effective Currency Exchange Transaction via Internet which can solve the problem of the current system.

In order to achieve the target, the requirements of the new Currency Exchange Transaction System are as follows:

- (1) Only authorized users can have access to the system
- (2) Alert new coming transactions
- (3) Send an email to related office when there is a transaction activity automatically: create new transaction, modify transaction, reject transaction, approve transaction, and cancel transaction
- (4) Record all transactions activities.
- (5) Specify the fee rate of transaction (only HQ officer)
- (6) Able to view the transaction status any time
- (7) Able to view detail of specific transaction
- (8) Verify the correct data type of transaction entered into the database
- (9) Provide the summary report, invoice report, zero balance report

3.2 System Design

3.2.1 Context Diagram

The boundaries of the proposed system can be shown in the form of a context diagram and external entities that interact with the system. There are 2 concerned within this system and they are the station officer and the HQ officer. These two officers have to transfer transaction to each other.

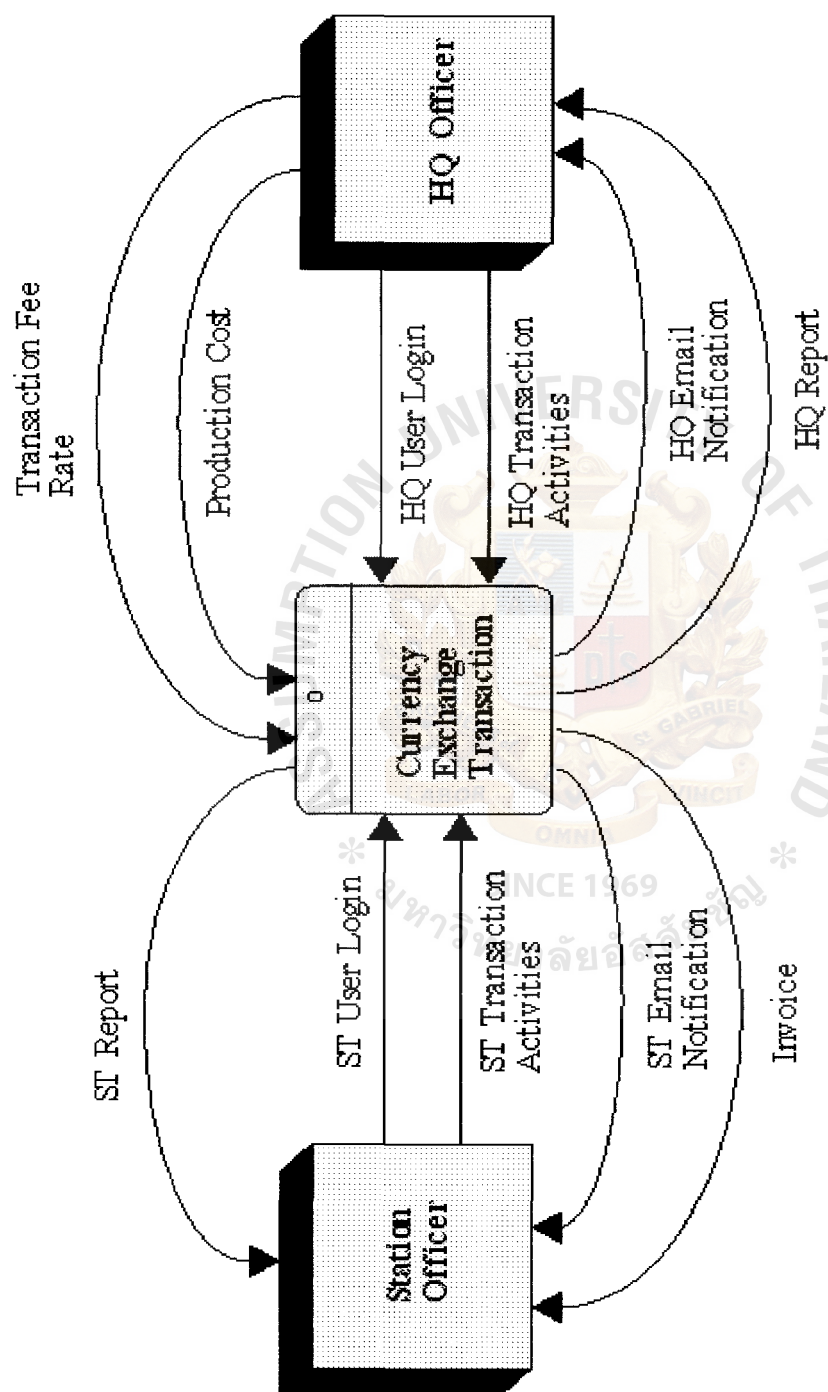


Figure 3.1. The Context Diagram of Currency Exchange Transaction System.

3.2.2 Data Flow Diagram

The data flow diagram is the analytical context diagram. It can be thoroughly analyzed into Level-0 data flow diagram that represents the major system's processes flow and data store. Data flow diagram detail is shown in the Figure 3.1.

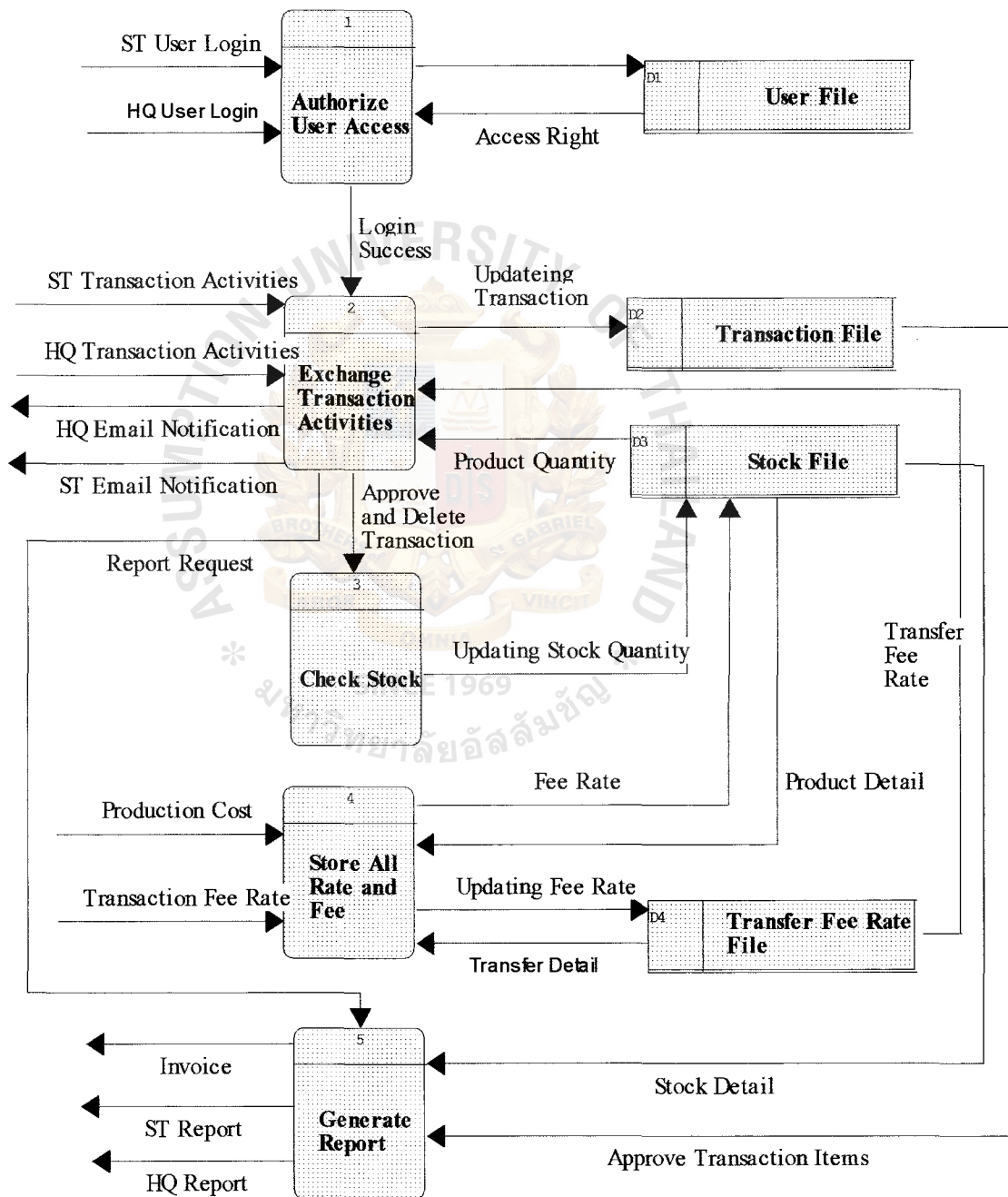


Figure 3.2. Level 0 Data Flow Diagram of The Currency Exchange System.

The proposed system is designed into 5 major processes as follows:

(1) Process 1: Authorized User Access

This process will identify the user login account. Only an authorized person can gain access to the system or access is denied and vice versa. The user login account will be verified in the User File that stores all user accounts and access rights. After the user account is verified that account will map with the access right to get the menu function.

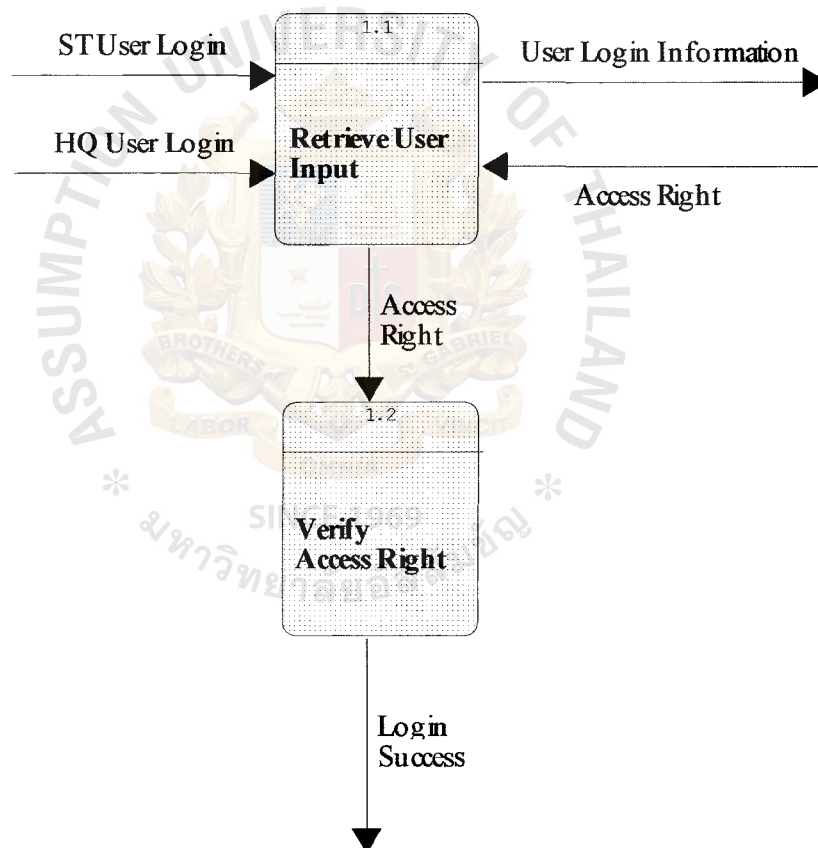


Figure 3.3. Level 1 Data Flow of The Authorized User Access.

(2) Process 2: Exchange Transaction Activities

Exchange Transaction Activities is a process after the user account has an authorized access to the system. This process will process all activities of the transaction which are to create a new transaction, modify transaction, approve transaction, reject transaction, or cancel transaction. Each activity will automatically send an email to the related office when the activity is finished. All transactions will be stored into the Transaction File.



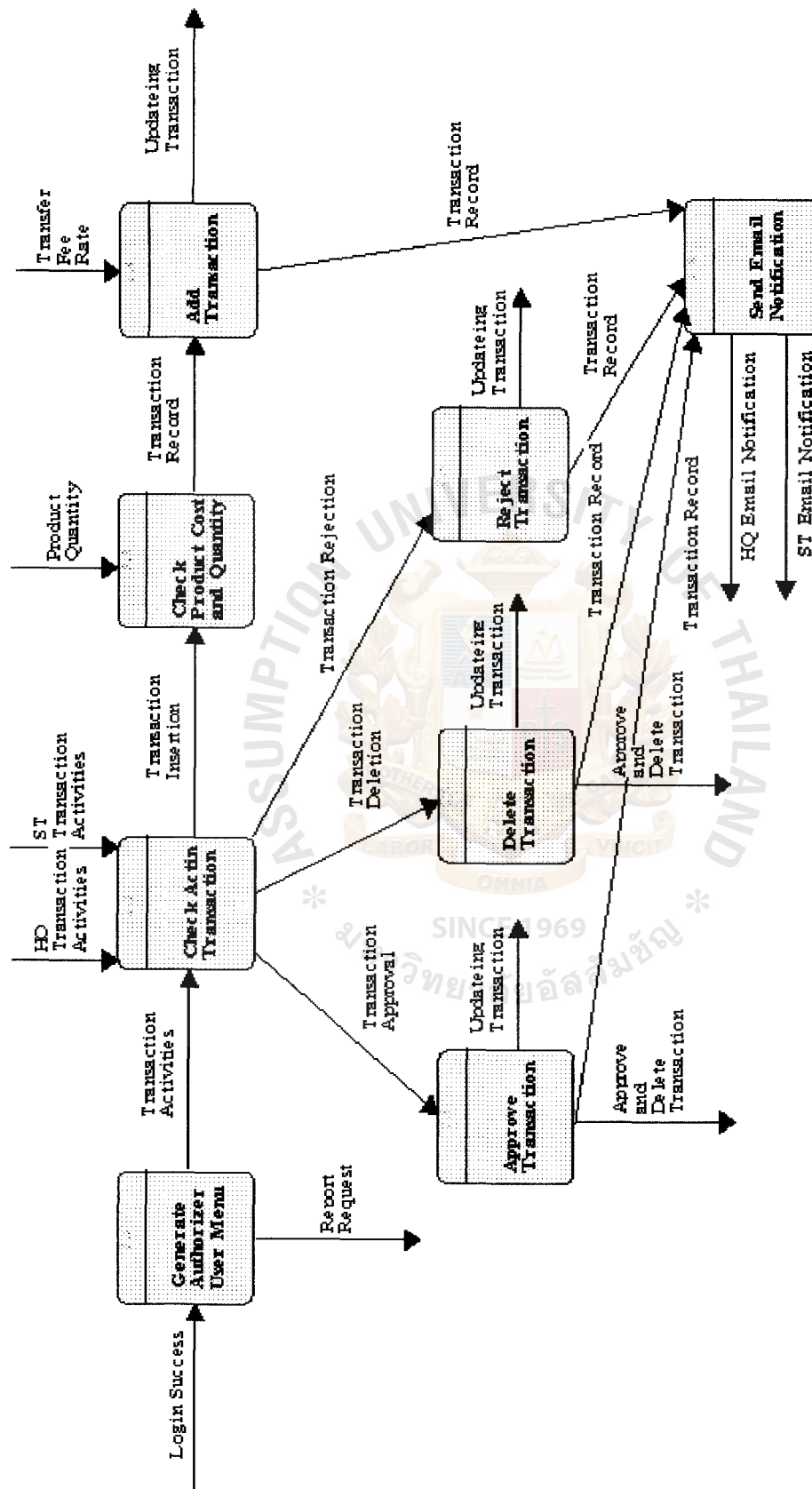


Figure 3.4. Level 1 Data Flow Diagram of Exchange Transaction Activities.

(3) Process 3: Check Stock

This process will do the task of checking the availability of the product in the warehouse. The stock number will cut only when the transaction is approved. When the production is out of stock the latest transaction will be automatically rejected and an email sent to the related office. All stock will be stored into the Stock File.

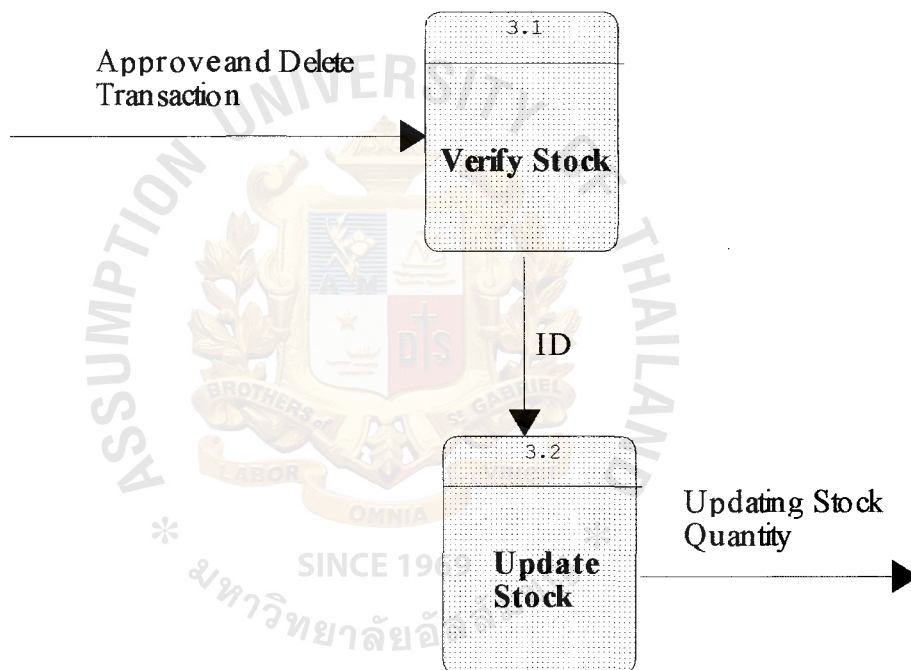


Figure 3.5. Level 1 Data Flow Diagram of Check Stock.

(4) Process 4: Store All Rates and Fees

This process can be accessed by the HQ officer only. This process will store all the input transfer rates and transfer fees and store into the Transfer Fee Rate File.

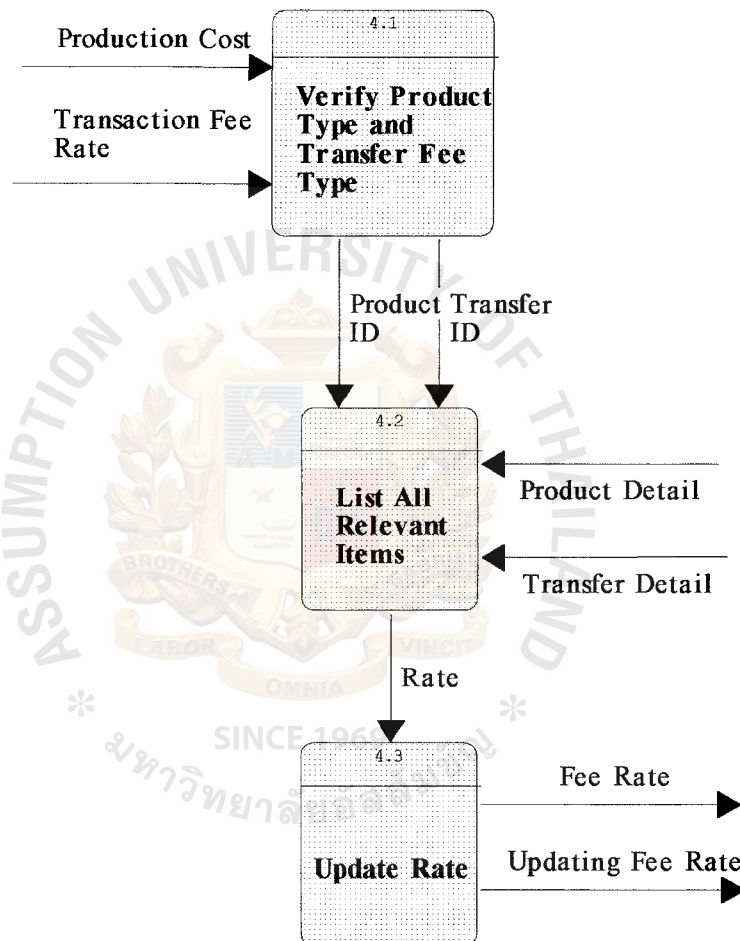


Figure 3.6. Level 1 Data Flow Diagram of Store All Rates and Fees.

(5) Process 5: Generate Report

The Generation Report process will generate on-demand report format provided by the HQ office. There are several types of report format which are invoice report, zero balance report, transaction status report, and

treasury report. Only the approved transaction will be taken to the invoice report, treasury report, and zero balance report.

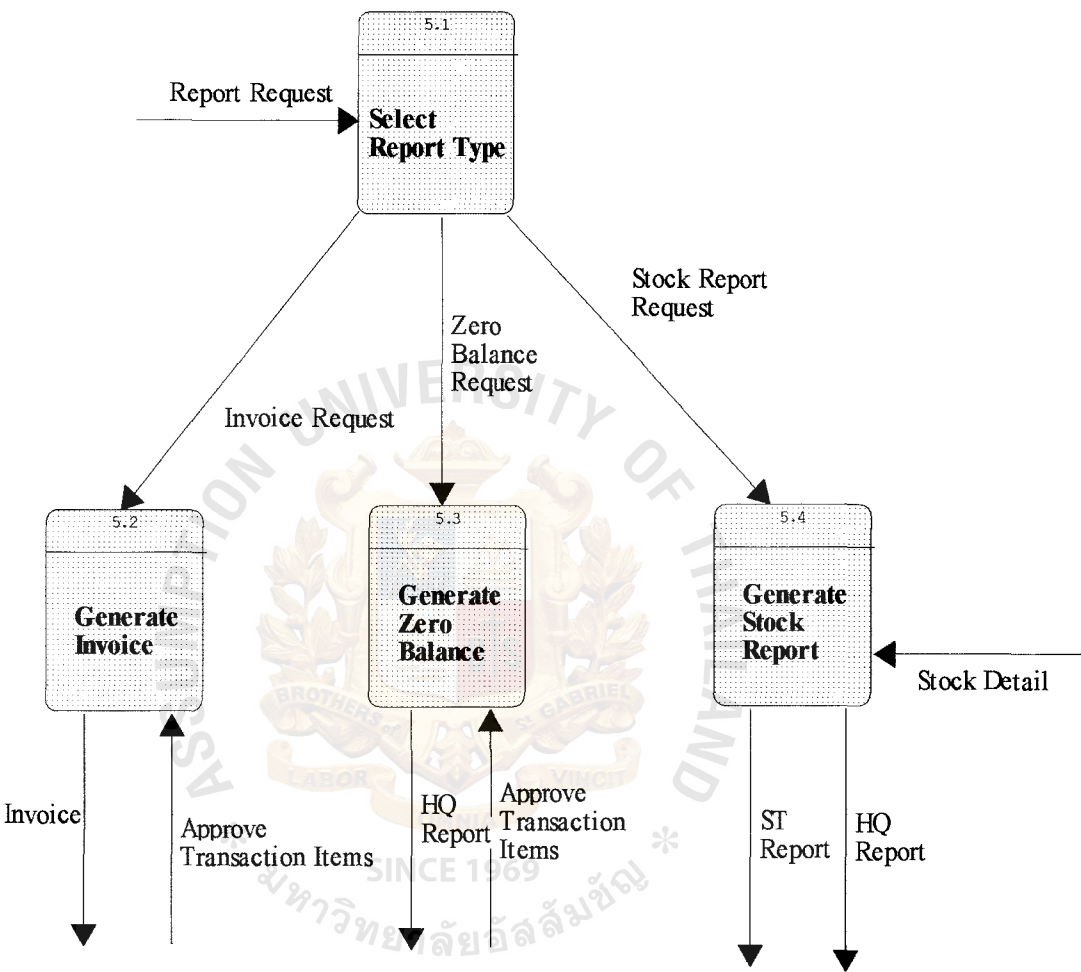


Figure 3.7. Level 1 Data Flow Diagram of Generate Report.

3.2.3 Process Specification

The process specification provides further description of element-level processes as shown in the following table.

Table 3.1. Process Specification of Process 1.1.

Items	Descriptions
Process Name:	Retrieve User Input
Data In:	a. ST User Login b. HQ User Login
Data Out:	a) Access Right
Process:	(1) Retrieve User Name and Password (2) Check User Name and Password from User File (3) Get Access Right from User File
Attachment:	(1) HQ Officer (2) ST Officer (3) User File

Table 3.2. Process Specification of Process 1.2.

Items	Descriptions
Process Name:	Verify Access Right
Data In:	Access Right
Data Out:	Login Success
Process:	(1) Verify Access Right (2) Send Login Succeed or Deny
Attachment:	-

Table 3.3. Process Specification of Process 2.1.

Items	Descriptions
Process Name:	Generate Authorize User Menu
Data In:	Login Success
Data Out:	(1) Transaction Activities (2) Report Request
Process:	(1) Use Access Right to Build an Appropriate Menu Structure for User (2) Get Menu Request Access From User
Attachment:	-

Table 3.4. Process Specification of Process 2.2.

Items	Descriptions
Process Name:	Check Action Transaction
Data In:	(1) HQ Transaction Activities (2) ST Transaction Activities (3) Transaction Activities
Data Out:	(1) Transaction Insertion (2) Transaction Approval (3) Transaction Rejection (4) Transaction Deletion
Process:	(1) Get Action on Transaction From User (2) Select An Action Process – Insert, Approve, Reject, Delete
Attachment:	(1) HQ Officer (2) Station Officer

Table 3.5. Process Specification of Process 2.3.

Items	Descriptions
Process Name:	Check Production and Quantity
Data In:	(1) Transaction Insertion (2) Product Quantity
Data Out:	Transaction Record
Process:	(1) Get the Transaction Insertion Request (2) Find and Retrieve Production Quantity before allow Insert (3) If Product quantity is not exceeding the limit, insertion will be allowed. (4) Transaction Record is Sent Out
Attachment:	Stock File

Table 3.6. Process Specification of Process 2.4.

Items	Descriptions
Process Name:	Add Transaction
Data In:	(1) Transaction Record (2) Transfer Fee Rate
Data Out:	(1) Updating Transaction (2) Transaction Record
Process:	(1) Get the Transfer Fee Rate and Transaction Record (2) Insert the Aggregate Transaction Record into Transaction File
Attachment:	(1) Transaction File (2) Transfer Fee Rate File

Table 3.7. Process Specification of Process 2.5.

Items	Descriptions
Process Name:	Approve Transaction
Data In:	Transaction Approve
Data Out:	(1) Updating Transaction (2) Transaction Record (3) Approve and Delete Transaction
Process:	(1) Get the Approval Request (2) Proceed the Approval Transaction and then Update into Transaction File (3) Send out the Transaction Record
Attachment:	Transaction File

Table 3.8. Process Specification of Process 2.6.

Items	Descriptions
Process Name:	Reject Transaction
Data In:	Transaction Rejection
Data Out:	(1) Updating Transaction (2) Transaction Record
Process:	(1) Get the Rejection Request (2) Proceed the Rejection Transaction and then Update into Transaction File (3) Send out the Transaction Record
Attachment:	Transaction File

Table 3.9. Process Specification of Process 2.7.

Items	Descriptions
Process Name:	Delete Transaction
Data In:	Transaction Deletion
Data Out:	(1) Updating Transaction (2) Transaction Record (3) Approve and Delete Transaction
Process:	(1) Get the Deletion Request (2) Proceed the Deletion Transaction and then Update into Transaction File (3) Send out the Transaction Record
Attachment:	Transaction File

Table 3.10. Process Specification of Process 2.8.

Items	Descriptions
Process Name:	Send Email Notification
Data In:	Transaction Record
Data Out:	(1) HQ Email Notification (2) ST Email Notification
Process:	(1) Get the Transaction Record From Previous Process (2) Generate an Email Form (3) Send an Email to the Related Office
Attachment:	(1) HQ Officer (2) Station Officer

Table 3.11. Process Specification of Process 3.1.

Items	Descriptions
Process Name:	Verify Stock
Data In:	Approve and Delete Transaction
Data Out:	ID
Process:	(1) Verify the Product Quantity in the Stock by Using Transaction Record (2) Pass through the Product ID
Attachment:	-

Table 3.12. Process Specification of Process 3.2.

Items	Descriptions
Process Name:	Update Stock
Data In:	ID
Data Out:	Updating Stock Quantity
Process:	(1) Retrieve Product ID and Search into the Stock File. (2) If approve transaction, product quantity will be cut from file. (3) If delete transaction, product quantity will be added to file.
Attachment:	Stock File

Table 3.13. Process Specification of Process 4.1.

Items	Descriptions
Process Name:	Verify Product Type and Transfer Fee Type
Data In:	(1) Production Cost (2) Transfer Fee Rate
Data Out:	(1) Product ID (2) Transfer ID
Process:	(1) Verify the Product Input Type and Cost and Transaction Transfer Fee Rate From File (2) Retrieve the Transaction Fee Rate ID and Product ID from File
Attachment:	HQ Officer

Table 3.14. Process Specification of Process 4.2.

Items	Descriptions
Process Name:	List All Relevant Item
Data In:	(1) Product ID (2) Transfer ID (3) Product Detail (4) Transfer Detail
Data Out:	Rate
Process:	(1) Use the Product Id and Transfer ID to Search in the File. (2) List All Relevant Items and Put the New Rate
Attachment:	(1) Stock File (2) Transfer Fee Rate File

Table 3.15. Process Specification of Process 4.3.

Items	Descriptions
Process Name:	Update Rate
Data In:	Rate
Data Out:	(1) Fee Rate (2) Updating Fee Rate
Process:	(1) Update the New Rate into the Transfer Rate File (2) Send the New Rate to Update the Transaction File
Attachment:	(1) Stock File (2) Transfer Fee Rate File

Table 3.16. Process Specification of Process 5.1.

Items	Descriptions
Process Name:	Select Report Type
Data In:	Report Request
Data Out:	(1) Invoice Request (2) Zero Balance Request (3) Stock Report Request
Process:	(1) Receive the Report Request Type (2) Send the Request to the Report Generation
Attachment:	-

Table 3.17. Process Specification of Process 5.2.

Items	Descriptions
Process Name:	Generate Invoice
Data In:	(1) Invoice Request (2) Approve Transaction Items
Data Out:	Invoice
Process:	(1) Verify the Request And Send the Request to the Transaction File to Get All Approved Transactions in the Selected Bill Round (2) Generate Invoice Report and Send out to the Requester
Attachment:	(1) Transaction File (2) HQ Officer (3) Station Officer

Table 3.18. Process Specification of Process 5.3.

Items	Descriptions
Process Name:	Generate Zero Balance
Data In:	(1) Zero Balance Request (2) Approve Transaction Items
Data Out:	HQ Report
Process:	(1) Verify the Request and Send the Request to the Transaction File to Get All Approve Transactions in the Selected Bill Round (2) Generate Zero Balance Report and Send out to the HQ Officer
Attachment:	(1) Transaction File (2) HQ Officer

Table 3.19. Process Specification of Process 5.4.

Items	Descriptions
Process Name:	Generate Stock Report
Data In:	(1) Stock Report Request (2) Stock Detail
Data Out:	(1) HQ Report (2) ST Report
Process:	(1) Verify the Request and Send to Request to the Stock File to Get All Selected Stock List (2) Generate Stock Report to the Requester
Attachment:	(1) Stock File (2) HQ Officer (3) Station Officer

3.2.4 Entity Relationship Diagram (E-RD)

E-RD is a detailed, logical representation of the data for an organization or for a business area. E-RD is expressed in terms of entities in the business environment, the relationships or associations among those entities, and the attributes or properties of both the entities and their relationship. The E-RD of the Currency Exchange Transaction System is shown in Figure 3.8.



3.2.5 Data Dictionary

To make the common understanding between the system analyst, the programmer and the user, the Data Dictionary has to be implemented. Data dictionary is an organized listing of all data definitions that are pertinent to the system, with precise, rigorous definitions. All components will be shown in the following tables.

Table 3.20. Data Dictionary of User.

Field Name	Meaning
UserID	User Identification
Password	Password
OfficeCode	Office Code Number
FirstName	User First Name
LastName	User Last Name
Address	User Address

Table 3.21. Data Dictionary of User_Menu.

Field Name	Meaning
UserID	User Identification
MenuID	Menu Identification

Table 3.22. Data Dictionary of Menu_Item.

Field Name	Meaning
MenuID	Menu Identification
MenuName	Menu Name
LinkAccess	Link To Access Feature

Table 3.23. Data Dictionary of User_Transaction.

Field Name	Meaning
UserID	User Identification
TransactionID	Transaction Identification

Table 3.24. Data Dictionary of Transaction.

Field Name	Meaning
TransactionID	Transaction Identification
FeeRateID	Fee Rate Identification
TransactionType	Transaction Type
TransactionDescription	Description of the Transaction
ChargeFrom	Who Charge the Transaction
ChargeTo	Who is Charged the Transaction
CostPerUnit	Unit Cost
Quantity	Product Quantity in one Transaction
CreatedBy	Transaction is created by whom
TransactionFlag	Transaction Stage
PaymentRound	(Insert,Approve,Reject) Payment Round of the Transaction

Table 3.25. Data Dictionary of Fee Rate.

Field Name	Meaning
FeeRateID	Fee Rate Identification
FeeRateName	Fee Rate Name
FeeRateType	Fee Rate Type
FeeRate	Rate Fee of Transaction

Table 3.26. Data Dictionary of Transaction_Stock.

Field Name	Meaning
TransactionID	Transaction Identification
StockItemID	Stock Item Identification
TransactionQuantity	Product Quantity in the Transaction

Table 3.27. Data Dictionary of Stock.

Field Name	Meaning
StockItemID	Stock Identification
ProductName	Product Name
ProductCost	Cost of Product
ProductRemaining	Product Remains in the Stock
NextComing	Date of Product Refill

3.2.6 User Interface Design

This is the interface design of the overall proposed project based on the user-friendly interface. So users can do their job through the user interface. The user interface design is represented in the following figures.

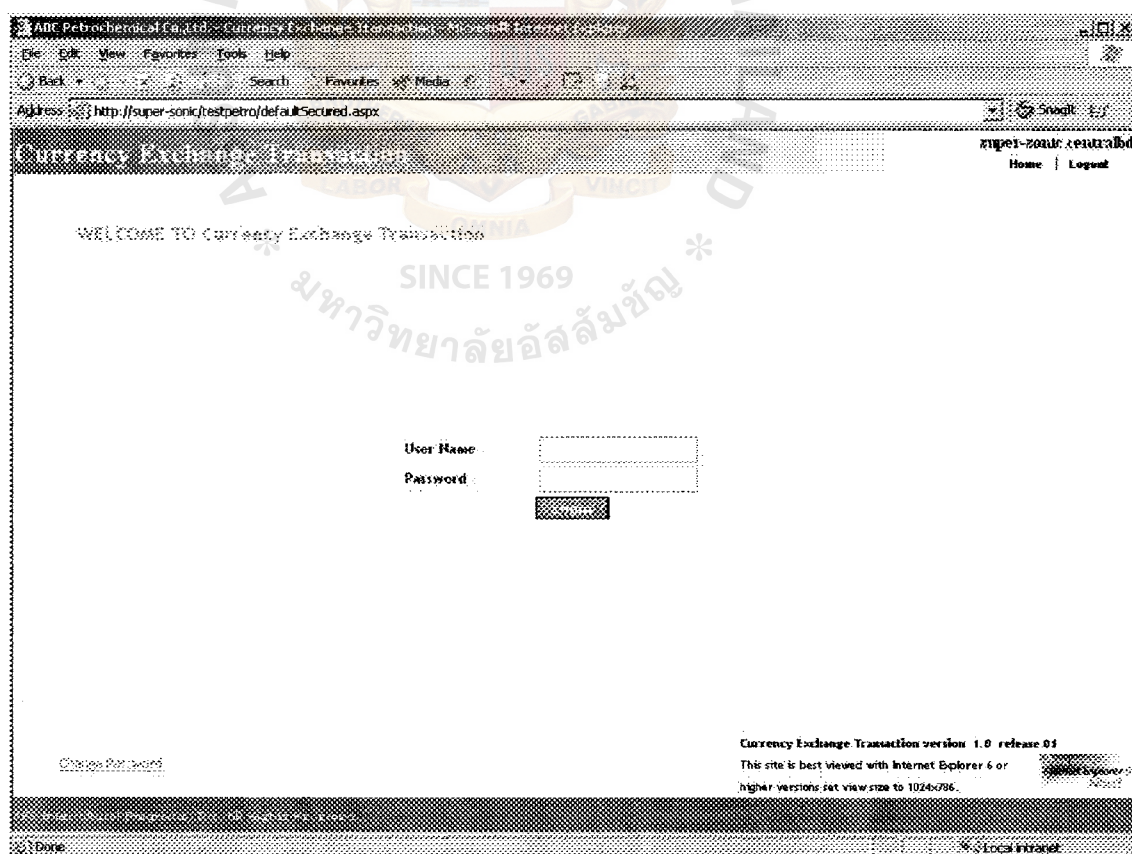


Figure3.9. Login Page.

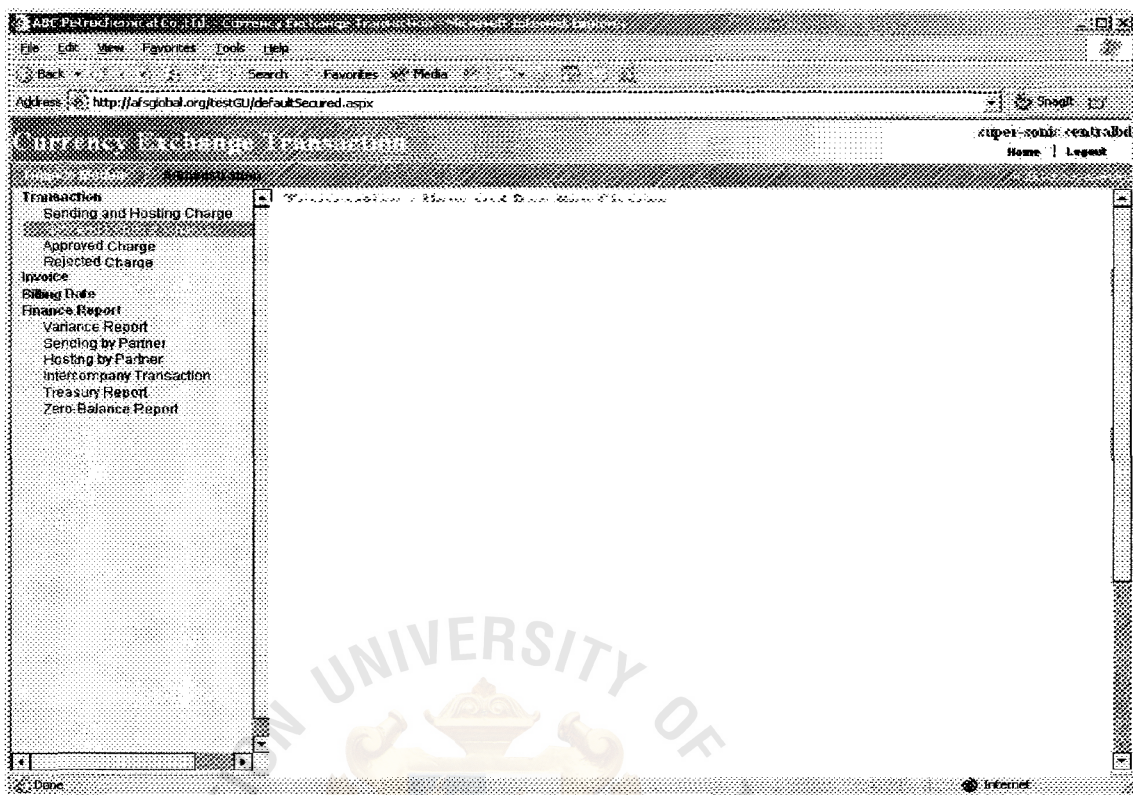


Figure3.10. Main Menu Screen.

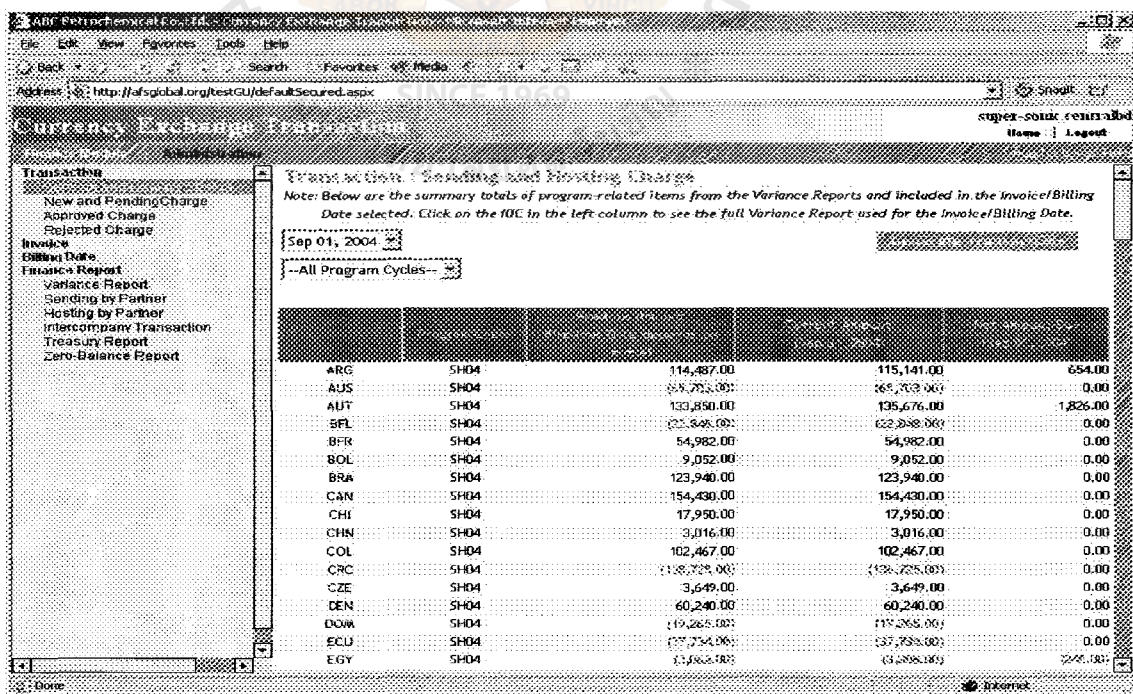


Figure3.11. Pre-Invoice Generation Screen.

ABC Petrochemical Co. Ltd. - Currency Exchange Transaction

Transaction: New and Pending Charge

CRC

Transaction Ref No	Category	Charge From	Charge To	Description	Unit	Exchange Rate	Amount	Approved Status
17/04/04	Inter-company Charge - Other	CRC	EUR	ER - Martine Corbier	1	203.00	203.00	Pending
Total Amount							203.00	

Transaction Ref No	Category	Charge From	Charge To	Description	Unit	Exchange Rate	Amount	Approved Status
RC 02	Inter-company Charge - Other	COL	CRC	3 PAX Regional Caribe COL 2004	1	1,050.00	1,050.00	Pending
US8740304	Inter-company Charge - Other	USA	CRC	Reimb for payment made to student while on program USAYPSCCRCSH03	1	84.50	84.50	Pending
12/17ER	Inter-company Charge - Other	INT	CRC	2002 year end reconciliation adjustment	1	10,850.00	10,850.00	Pending
12/125	Inter-company Charge - Other	INT	CRC	(2002) Year-end program reconciliation	1	3,253.00	3,253.00	Pending
CRC10101	Inter-company Charge - Other	USA	CRC	Wides sold	1	128.00	128.00	Pending

Figure 3.12. Pending Transaction List Screen.

ABC Petrochemical Co. Ltd. - Currency Exchange Transaction

Transaction: Approved Charge

Aug 01, 2004

ARG

Transaction Ref No	Category	Charge From	Charge To	Description	Unit	Exchange Rate	Amount	Approved Status
AP5ARS160254	Inter-company Charge - Other	ARG	PAR	Visa CAN Stus YPscNH04 Ariel Vallejos	1	368.00	368.00	PARJRI 7/27/2004
Total Amount							368.00	

Transaction Ref No	Category	Charge From	Charge To	Description	Unit	Exchange Rate	Amount	Approved Status
Per Inbox message 14 Jul 04	Inter-company Charge - Other	PAP	ARG	YPscNH04 Federico Barbagallo's visa cost	1	55.00	55.00	t 9/23/2004
Total Amount							55.00	

Figure 3.13. Approved Transaction List Screen.

Transaction
 Sending and Hosting Charge
 New and Pending Charge
 Rejected Charge
Invoice
 Billing Date
Finance Report
 Variance Report
 Sending by Partner
 Hosting by Partner
 Intercompany Transaction
 Treasury Report
 Zero-Balance Report

Transaction : Add New

Transaction Type : --Select Transaction Category--
 Charge From : INT
 Charge To : INT
 Program Code : (Only applied for program related category) (Only applied for program related category)
 Description :
 Charging Partners Ref. No. :
 Partner Ref. Date : 10/10/2004 (mm/dd/yyyy) Date in which the charge occurred.
 Unit : 1
 Cost per Unit : 0 \$
 Total Amount : 0 \$
 Counter Party Approval : ☒ Yes ☐ No
 Needed ? :

Figure 3.14. Add New Transaction Screen.

Transaction
 Sending and Hosting Charge
 New and Pending Charge
 Rejected Charge
Invoice
 Billing Date
Finance Report
 Variance Report
 Sending by Partner
 Hosting by Partner
 Intercompany Transaction
 Treasury Report
 Zero-Balance Report

Transaction : Edit

Billing Date : Oct 01, 2004
 Transaction Type : 0310
 Charge From : ISL
 Charge To : INT
 Program Code : (Only applied for program related category)
 Description : This is Aug's testing
 Charging Partners Ref. No. : 01-10000
 Partner Ref. Date : 9/28/2004
 Unit : 21
 Cost per Unit : 12
 Total Amount : 252 \$
 Counter Party Approval : No
 Needed ? :

Account : 12115L
 Service Area : ACC00
 Fund : 2
 Authorizer : ABConteh

Figure 3.15. Approved Transaction Detail Screen.

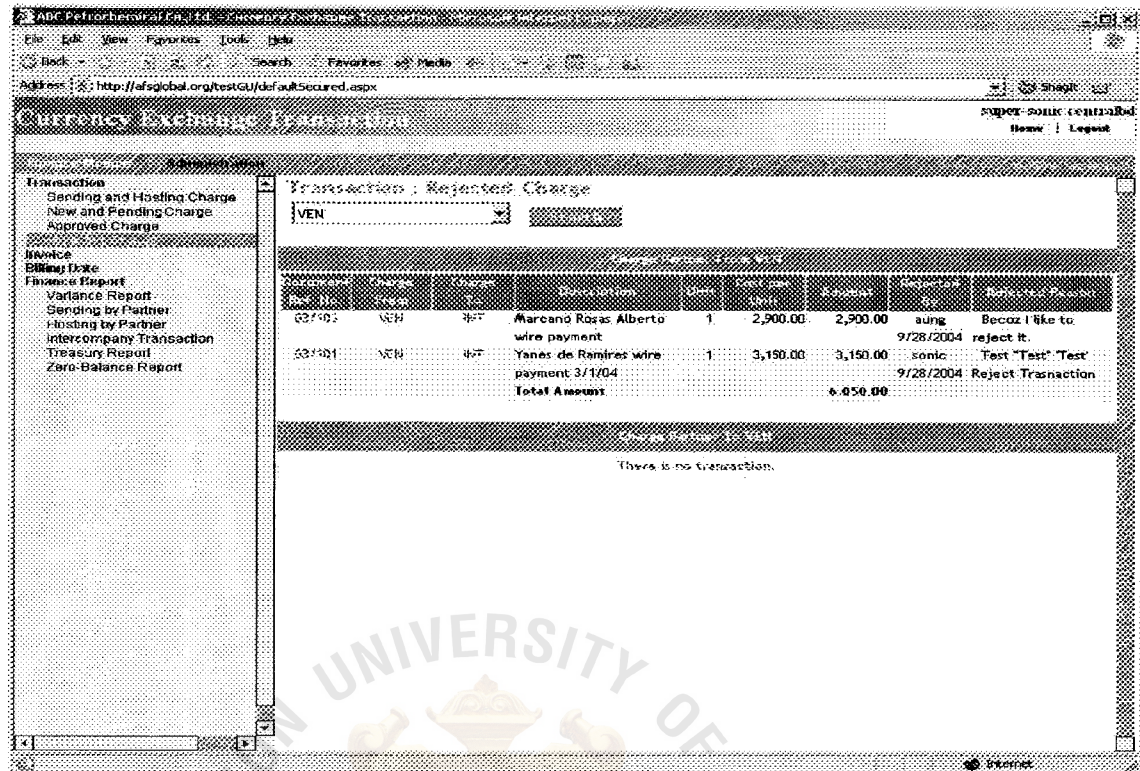


Figure 3.16. Rejected Transaction List Screen.

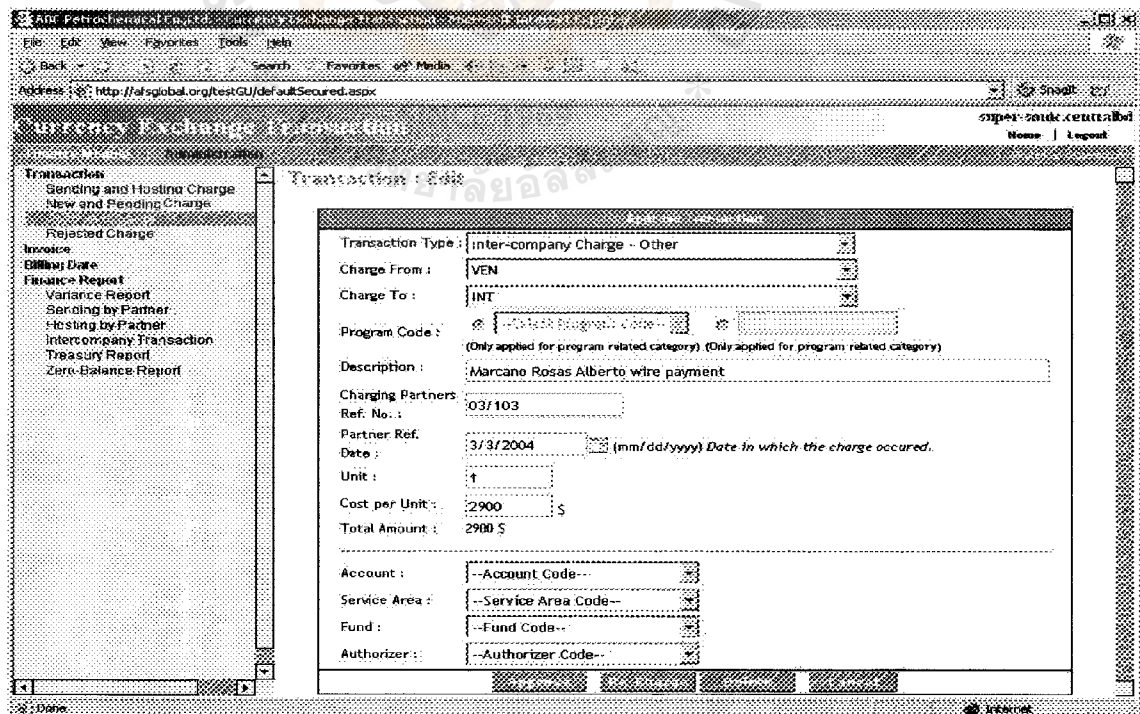


Figure 3.17. Re-Charge the Rejected Transaction Screen.

ABC Petrochemicals Ltd. Currency: US Dollar

Address: http://afsglobal.org/testGU/defaultSecured.aspx

Transaction: **Transaction : \$ 499.**

Transaction List:

Transaction	Date	Code	Description	Amount	Status
Sending and Hosting Charge	Sep 01, 2004	ARG	ARG20040901	152,245.90	Final
New and Pending Charge	Sep 01, 2004	AUS	AUS20040901	12,573.31	Final
Rejected Charge	Sep 01, 2004	AUT	AUT20040901	299,941.22	Final
Invoice	Sep 01, 2004	BFL	BFL20040901	503,077.99	Final
Billing Date	Sep 01, 2004	BFR	BFR20040901	65,340.30	Final
Finance Report	Sep 01, 2004	BOL	BOL20040901	71,225.06	Final
Variance Report	Sep 01, 2004	BRA	BRA20040901	494,394.67	Final
Sending by Partner	Sep 01, 2004	CAN	CAN20040901	135,894.60	Final
Hosting by Partner	Sep 01, 2004	CHI	CHI20040901	612,279.00	Final
Intercompany Transaction	Sep 01, 2004	CHN	CHN20040901	365,700.00	Final
Treasury Report	Sep 01, 2004	COL	COL20040901	175,886.97	Final
Zero-Balance Report	Sep 01, 2004	CRC	CRC20040901	211,865.90	Final
	Sep 01, 2004	CZE	CZE20040901	52,237.00	Final
	Sep 01, 2004	DEN	DEN20040901	275,002.18	Final
	Sep 01, 2004	DOM	DOM20040901	125,548.00	Final
	Sep 01, 2004	ECU	ECU20040901	55,442.66	Final
	Sep 01, 2004	EFL	EFL20040901	15,943.70	Final
	Sep 01, 2004	EGY	EGY20040901	9,078.00	Final
	Sep 01, 2004	ESP	ESP20040901	150,459.31	Final
	Sep 01, 2004	FIN	FIN20040901	180,710.20	Final
	Sep 01, 2004	FRA	FRA20040901	393,669.72	Final
	Sep 01, 2004	GBR	GBR20040901	21,233.70	Final
	Sep 01, 2004	GER	GER20040901	2,464,803.07	Final
	Sep 01, 2004	GHA	GHA20040901	60,399.56	Final
	Sep 01, 2004	GUA	GUA20040901	141,892.00	Final

Figure 3.18. Invoice Generation List Screen.

ABC Petrochemicals Ltd. Currency: US Dollar

Address: http://afsglobal.org/testGU/defaultSecured.aspx

Transaction: **Billing Round Code**

Transaction List:

Transaction	Date	Code	Description	Amount	Status	Created By	Created Date	Modified By	Modified Date
Sending and Hosting Charge	Nov 01, 2004	Draft		0			11/5/2004		11/5/2004
New and Pending Charge	Oct 01, 2004	Draft		0			10/10/2004		10/10/2004
Rejected Charge	Sep 01, 2004	Final		5	9		9/13/2004		9/3/2004
Invoice	Aug 01, 2004	Final		0	0		8/10/2004		8/1/2004
Billing Date	Jul 01, 2004	Final		0	0		7/10/2004		7/1/2004
Finance Report	Jun 01, 2004	Final		0	0		6/10/2004		6/1/2004
Variance Report	May 01, 2004	Final		0	0		5/10/2004		5/1/2004
Sending by Partner	Apr 01, 2004	Final		0	0		4/10/2004		4/1/2004
Hosting by Partner	Mar 01, 2004	Final		5	9		3/10/2004		3/1/2004
Intercompany Transaction	Feb 01, 2004	Final		0	0		2/10/2004		2/1/2004
Treasury Report	Jan 01, 2004	Final		0	0		1/1/2004		1/1/2004
Zero-Balance Report	Dec 15, 2003	Final		5	9		1/6/2004		12/31/2003
	Sep 01, 2003	Final		5	9		9/10/2003		9/1/2003
	Mar 01, 2003	Final		5.25	9.25		3/10/2003		3/1/2003

Figure 3.19. Billing Round Code Screen.

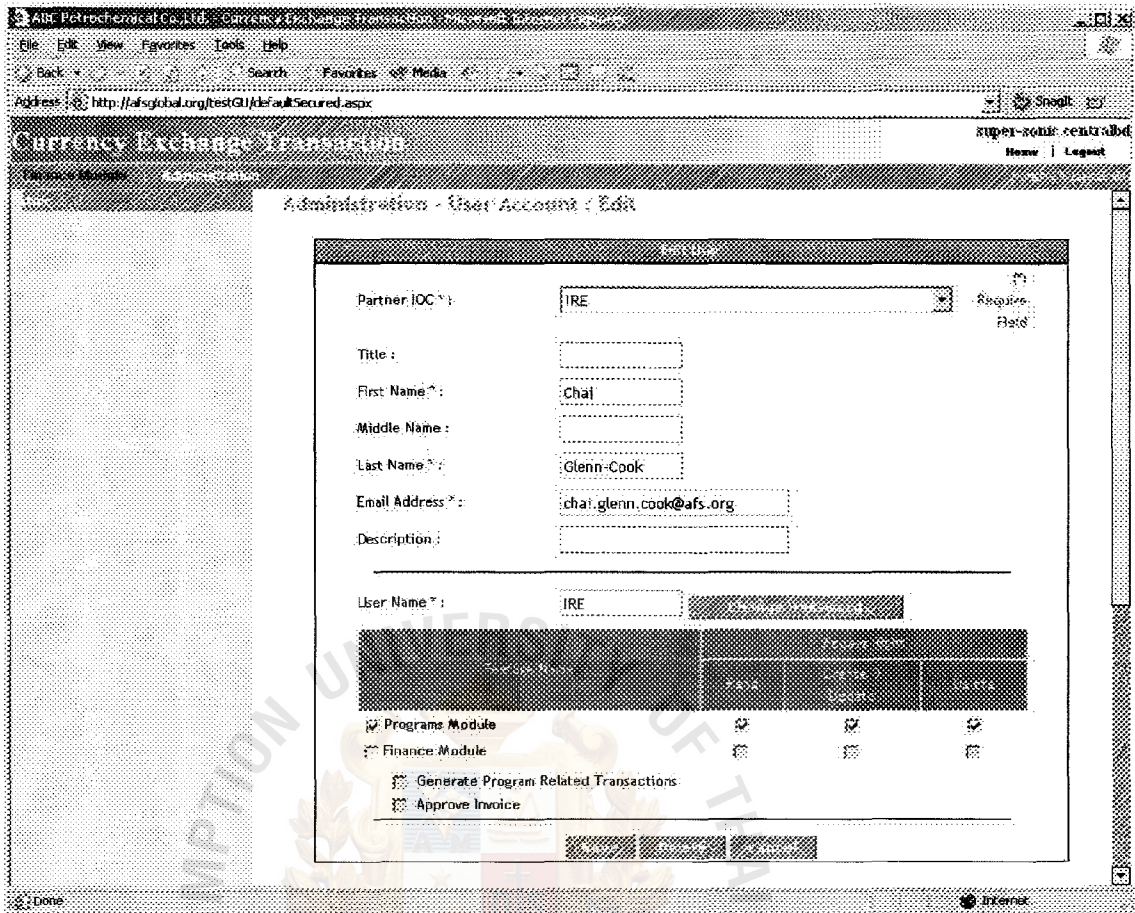


Figure 3.20. User Access Right Screen.

3.2.7 Report Designs

Report designs are the designs of the report formats that are generated by the proposed system. The report formats are created by the HQ office. The report designs are represented in the following figures.

ABC Petrochemical Co., Ltd. - Currency Exchange Transaction - Microsoft Internet Explorer

Print Date: 10/10/2004

FINAL

Invoice/Payment Advice **01 September 2004**

Partner:

via Email:

Attention: Kaat Niele

Printed Date: 10/10/2004

Payments to Partners Due: 13 September 2004

Payments from Partners Due: 03 September 2004

Late fees will be assessed at: 5% per annum for first three days; 9% thereafter

Item	Description	Amount
0101	Prior Balance Due	5,339.59
0102	Last Amount Paid	0.00
	Last Payment Date :	
0201	Tier-based and Non-Tier-based Programs	280,705.00
0202	Program Contribution	101,200.00
0204	Emergency Fund	2,270.00
0205	ODC Fund	108,763.00
0206	Other	4,800.00
Total Payment Due		503,077.59

Notes:

Please reference this invoice number: Invoice# BFL20040901

Figure 3.21. Invoice Report Format.

ABC Petrochemical Co., Ltd. - Currency Exchange Transaction - Microsoft Internet Explorer

File Edit View Window Help

INCOMES AND EXPENSES SUMMARY REPORT

Incomes/Expenses Advice		01 September 2004
Item	Description	Amount
0101	Prior Balance Due	65,371.00
0102	Last Amount Paid	0.00
0201	Tier-based and Non-Tier-based Programs	(147,101.00)
0202	Program Contribution	3,872.00
0204	Emergency Fund	85.00
0205	ODC Fund	6,220.00
0206	Other	320.00
Total Payment Due		(71,733.00)

Figure 3.22. Income/Expense Report Format.

3.2.8 Database Design

The database design includes decisions about the nature and contents of the files themselves. It shows table name, element name in each table which is called attribute name, column name, and also shows the primary key and the foreign key. Elements in each table are regularly combined with several other elements in many structures which should be placed together into a structured record as shown in the following tables.

Table 3.28. Structure of User.

No	Field Name	Field Type	Index	Unique	Null Able	Key Type
1	UserID	Varchar(20)	Y	Y	N	Primary Key
2	Password	Varchar(40)	N	Y	N	Attribute
3	OfficeCode	Char(3)	N	N	N	Attribute
4	FirstName	Varchar(50)	N	N	N	Attribute
5	LastName	Varchar(50)	N	N	N	Attribute
6	Address	Memo	N	N	Y	Attribute

Table 3.29. Structure of User Menu.

No.	Field Name	Field Type	Index	Unique	Null Able	Key Type
1	ID	Varchar(20)	Y	Y	N	Primary Key
2	UserID	Varchar(20)	N	N	N	Foreign Key
3	MenuID	Varchar(20)	N	N	N	Foreign Key

Table 3.30. Structure of Menu_Item.

No.	Field Name	Field Type	Index	Unique	Null Able	Key Type
1	MenuID	Varchar(20)	Y	Y	N	Primary Key
2	MenuName	Varchar(50)	N	N	N	Attribute
3	LinkAccess	Varchar(255)	N	N	N	Attribute

Table 3.31. Structure of User_Transaction.

No.	Field Name	Field Type	Index	Unique	Null Able	Key Type
1	ID	Varchar(20)	Y	Y	N	Primary Key
2	UserID	Varchar(20)	N	N	N	Foreign Key
3	TransactionID	Varchar(20)	N	N	N	Foreign Key

Table 3.34. Structure of Transaction Stock.

No.	Field Name	Field Type	Index	Unique	Null Able	Key Type
1	ID	Varchar(20)	Y	Y	N	Primary Key
2	TransactionID	Varchar(20)	N	N	N	Foreign Key
3	StockItemID	Varchar(20)	N	N	N	Foreign Key
4	TransactionQuantity	Integer	N	N	N	Attribute

Table 3.35. Structure of Stock.

No.	Field Name	Field Type	Index	Unique	Null Able	Key Type
1	StockItemID	Varchar(20)	Y	Y	N	Primary Key
2	ProductName	Varchar(50)	N	N	N	Attribute
3	ProductCost	Money	N	N	N	Attribute
4	ProductRemaining	Integer	N	N	Y	Attribute
5	NextComing	DateTime	N	N	Y	Attribute

3.3 Hardware and Software Requirements

All hardware, software, and system layout that are required in the proposed system are described in the following tables and figures.

Table 3.36. The Specification of the Web Server and Database Server (Datacenter Machine).

Hardware	Specification
CPU	Intel® Xeon® 2.8GHz/800FSB
Cache	1MB Internal L2 Cache/800MHz System Bus
Memory	512 (2 x 256) ECC DDR-2 SDRAM (upgradeable to 8G)
Hard Drive	36GB1 10K Ultra320 SCSI Hard Drive
Network Card	Embedded Dual Intel® Gigabit NIC
Controller Card	Embedded U320 Single Channel SCSI

Table 3.37. The Specification of the Client Computer (Station Office Computer).

Hardware	Specification
CPU	Intel® Pentium® 4 Processor 2.8GHz
Cache	512KB Advanced Transfer Cache
Memory	256MB(1 x 256MB) 333Mhz DDR SDRAM
Hard Drive	40GB1 EIDE Hard Drive (7200 rpm)
Network Card	Integrated Intel® 10/100 Network Interface with support for Remote Wake Up
Video Card	Embedded Intel® Extreme Graphics
Sound Card	Integrated AC-97 Audio
Optical Device	48X CD-ROM Drive

Table 3.38. Software Specification on the Datacenter Machine.

Software Type	Specification
Operating System	Microsoft Windows Server 2003 Advance Server
Office Application	Microsoft Office 2003
Web Browser	Microsoft Internet Explorer 6.0

Table 3.39. Software Specification on the Client Computer (Station Office Computer).

Software Type	Specification
Operating System	Microsoft Windows XP Service Pack 2
Office Application	Microsoft Office 2003
Web Browser	Microsoft Internet Explorer 6.0

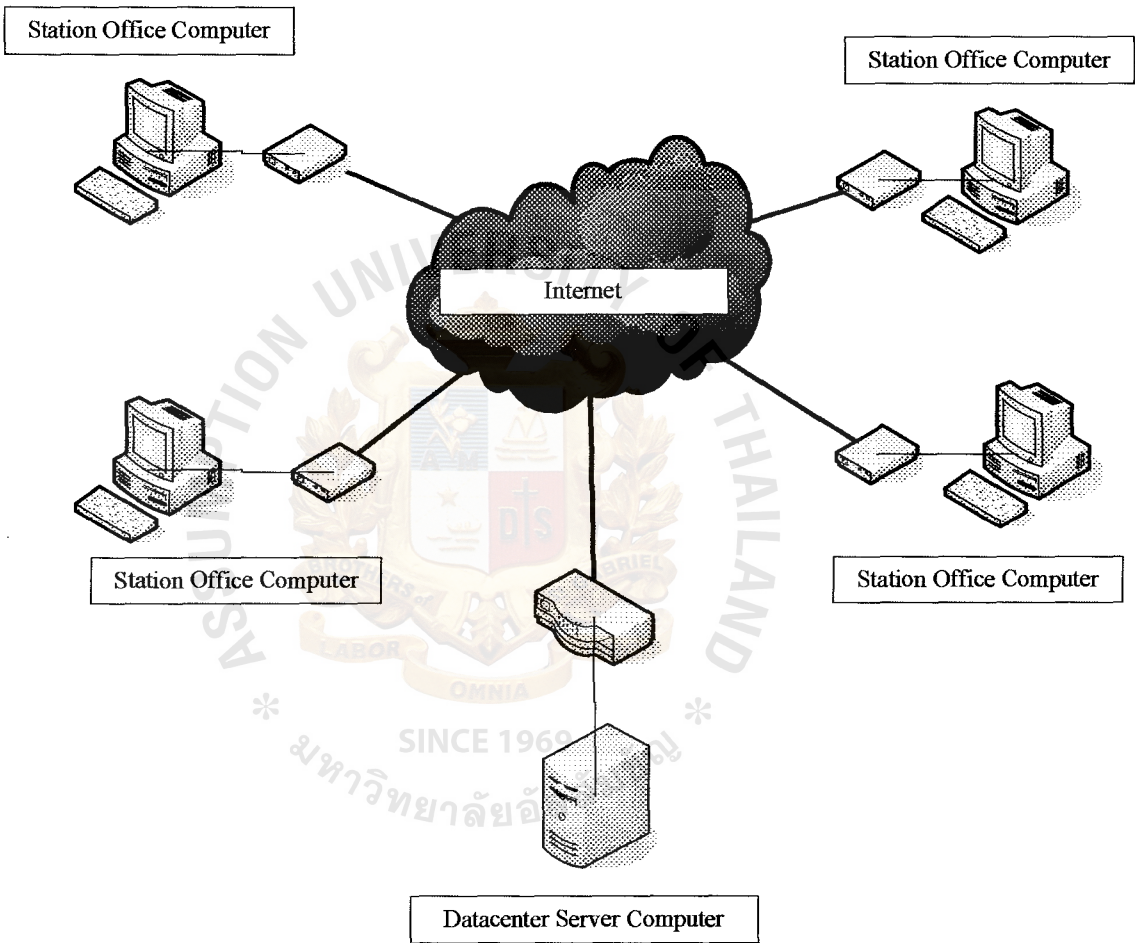


Figure 3.23. Computer Layout of the Currency Exchange Transaction System.

3.4 Security and Control

Computer systems are controlled by a combination of general controls and application controls. General controls govern the design, security, and use of computer programs and the security of data files in general throughout the organization's

information technology infrastructure. On the whole, general controls apply to all computerized applications and consist of a combination of hardware, software, and manual procedures that create an overall control environment. Application controls are specific controls unique to each computerized application, such as payroll or order processing. They consist of controls applied from the business functional area of a particular system and from programmed procedures.

In the proposed system, general controls will be applied for database to limit the user access and prevent hacking to the database. And the application control will be represented as the user login control every time the application is executed.

3.5 System Cost Analysis

To replace the current system with the new system, we need the method to make the efficient evaluation; the Replacement Analysis is a suitable method in this case.

In the replacement analysis method, we can create the comparison of two or more alternatives. The current system is referred to as the defender. The new systems are also referred to as the challengers.

3.5.1 The Defender and the Challenger Concept in Replacement Analysis Method

Before we make a comparison, we have to act according to a consultant views to evaluate purposes by assuming that we own neither asset. In order to purchase the defender, so we can estimate the market value of the used asset, the estimated market value is used as the first cost (PW) of the defender. There will be an associated salvage value (SV), an economic asset used life (N), and annual operating cost (AW) for the defender. Even though the asset value will be different from the original value data, it makes no or not much difference in the evaluation because we use the consultant's viewpoint and are thus making all previous data irrelevant to the present evaluation.

The irrelevant data in the replacement analysis is sometimes known as sunk cost.

The sunk cost can be computed as:

$$\text{Sunk cost} = \text{Present book value} - \text{present realizable value}$$

The remaining cost of investment after total depreciation charged is book value.

The book value is the present worth of the asset as recognized by acceptable accounting procedure.

In the replacement analysis, the sunk cost will be excluded because a sunk cost is a result of bad decision that was made at sometime in the past, and past economic decisions must not be allowed to influence decisions of the present. The sunk cost sometimes is charged to account as “Unrecovered Capital”, which will ultimately be reflected in the company’s income statement for the year in which the sunk cost is incurred.

3.5.2 Symbols and Meaning

The engineering economics mostly uses the following symbols:

PW	=	Value or sum of the present investment, Present Worth
FW	=	Value or sum of the future or end of expected time, Future Worth
AW	=	a series of consecutive, annual equity, Annual Worth
MARR	=	Minimum attractive rate of return
n	=	Number of interest rate
i	=	Interest rate per period of time

3.5.3 Step of comparison cost replacement method

The replacement analysis is a technique that considers the evaluation of the old and the new system. There are several factors we have to consider such as present worth (PW), annual worth (AW), minimum attractive rate of return (MARR). We have to compute all the factors to get the result in the same unit base. This case we will consider

to compute to the annual base because we will use the annual to compute the return of investment (ROI) as chain computation.

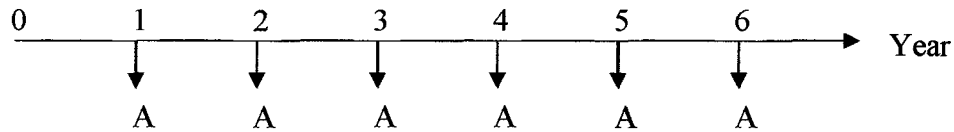


Figure 3.24. The Cash Flow of the Annual Cost.

The steps to prepare the replacement cost are as follows:

Step 1: Define the initiative cost of the current system. It consists of the hardware cost and software cost.

Step 2: Define the annual cost of the current system. It consists of the documentation cost, communication cost, transportation cost, and salary.

Step 3: Define the initiative cost of the new system. It can consists of the hardware cost, software cost, development cost and training cost.

Step 4: Define the annual cost. It consists of the communication cost and salary.

Step 5: Use all defined cost to compute by the replacement analysis method.

Step 1: Define the initiative cost of the current system

The initiative cost of the old system can be separated into two main parts which are hardware cost and software cost. The Company decided to buy computers to store data and print forms to the station since 1997. The specification of those stations is Pentium 166 MHz and the HQ office was assigned to use Pentium Pro 200 MHz and Pentium 166MHz. All price listed in Table 3.40. can be found in “Micro Computer” volume 96.

Table 3.40. The Hardware Cost of the current system of ABC Petrochemical Co.,Ltd.

Hardware	Quantity	Cost per Unit	Total Amount
Intel Pentium 166 MHz	69	40,000.00	2,760,000.00
Intel Pentium Pro 200 MHz	1	120,000.00	120,000.00
Printer Epson LQ 1080i+	69	17,000.00	1,173,000.00
Total			4,053,000.00

For the software, the company assigned to each station to use Microsoft Windows 95 OSR2 to be an operating system. For the HQ office, the company decided to use Microsoft Windows NT4 Service Pack 4 to be an operating system for the data center computer. For the Office tools, the company decided to use the full pack of Microsoft Office97 which includes Microsoft Word97, Microsoft Excel97, Microsoft PowerPoint97, and Microsoft Access97. All listed price in Table 3.41. are the price in 1997. It can be found in "Micro Computer" volume 96.

Table 3.41. The Software Cost of the Current System of ABC Petrochemical Co.,Ltd.

Software	Quantity	Cost per Unit	Total Amount
Microsoft Windows 95 OSR2	69	4,500.00	310,500.00
Microsoft Windows NT4 Service Pack 4	1	13,000.00	13,000.00
Microsoft Office97	70	25,000.00	1,750,000.00
Total			2,073,500.00

Step2: Define the annual cost for the current system.

The annual cost of the current system is the operating cost while transaction had been processed. There are two major process cost that occur while processing the transaction which are documentation cost and communication cost.

Documentation cost is the cost of the printed transaction and sent via mail to the related station or HQ office. The estimated printed transaction for each station is 2 printed transactions per day and 30 printed transactions per day for the HQ office. The form of transaction is the standard form that ABC Petrochemical Co.,Ltd. decided to use within the company. All transactions will be sent via mail to the related station before the end of each day. Each station and the HQ office hire one messenger to send the printed transactions to the post office. The table below is a summary of the annual documentation cost for the current system.



Table 3.42. Summary of Annual Documentation Cost of the Current System.

	Cost Item	Amount	Unit
(1)	Standard Printed Form	1.25	Bahts/Form
(2)	Estimated form used for each station per day	2	Forms
(3)	Total number of station	68	Stations
(4)	Total forms used for all stations per day (2)*(3)	136	Forms
(5)	Estimated form used for head quarter office per day	30	Forms
(6)	Total number of used form per day (4)+(5)	166	Forms
(7)	Total printed form cost per day (1)*(6)	207.50	Bahts
(8)	EMS Mailing cost per form	25.00	Bahts
(9)	Total sending form cost per day (6)*(8)	4,150.00	Bahts
(10)	Total form cost per day (7)+(9)	4,357.50	Bahts
(11)	Working day per month	22	Days
(12)	Total Form cost per month (10)*(11)	95,865.00	Bahts
(13)	Total form cost per year (12)*12	1,150,380.00	Bahts
(14)	Estimate time of messenger travel from station office to post office and process the sent form	45	Minutes
(15)	Total time for all stations (3)*(14)	3,060	Minutes
(16)	Estimate time of messenger travel from head quarter office to post office and process the sent form	120	Minutes
(17)	Total time per day (15)+(16)	3,180	Minutes
(18)	Total sending time per month (11)*(17)	69,960	Minutes
(19)	Total sending time per year (18)*12	839,520	Minutes
(20)	Converse to Working Day format (19) / (60*8)	1,749	Days
(21)	The lowest cost for messenger per day	180.00	Bahts
(22)	Total messenger cost per year (20)*(21)	314,820.00	Bahts
	Total Documentation Cost Per Year (13)+(22)	1,465,200.00	Bahts

Communication cost is the generated cost while the HQ officer or the station officer contact each other about their related transaction. The main communication channel is the telephone. The officers use the telephone to communicate with each other to accept, reject, or approve their transactions during working hours. The table below is

the summarized communication cost that is generated during working hours within one year.

Table 3.43. Summary of Annual Communication Cost of the Current System.

	Cost Item	Amount	Unit
(1)	Average calling cost for each station	9.00	Bahts/Minute
(2)	Estimated time to process each transaction	10	Minutes
(3)	Estimated transaction for each station per day	8	Transactions
(4)	Total number of transactions of all stations per day (3)*68	544	Transactions
(5)	Estimated transaction in head quarter office per day	60	Transactions
(6)	Total number of all transactions per day (4)+(5)	604	Transactions
(7)	Total used time for all transactions per day (2)*(6)	6,040	Minutes
(8)	Total calling cost per day (1)*(7)	54,360.00	Bahts
(9)	Working day per month	22	Days
(10)	Total calling cost per month (8)*(9)	1,195,920.00	Bahts
(11)	Total calling cost per year (10)*12	14,351,040.00	Bahts
(12)	Total calling time per month (7)*(9)	132,880	Minutes
(13)	Total calling time per year (12)*12	1,594,560	Minutes
(14)	Convert to day format (13)/(22*8)	9,060	Days
(15)	The Lowest employee wages	180.00	Bahts/Day
(16)	Total employee wages (14)*(15)	1,630,800.00	Bahts
	Total Communication Cost Per Year (11)+(16)	15,981,840.00	Bahts

The total annual cost of the current system is the total cost of both documentation cost and communication cost together. This cost will occur in the same amount every year if the company still uses the current system.

Table 3.44. The Annual Cost of the Current System.

Cost Item	Amount	Unit
Total Annual Documentation Cost	1,465,200.00	Bahts
Total Annual Communication Cost	15,981,840.00	Bahts
Total Annual Cost	17,447,040.00	Bahts

Step 3: Define the initiative cost of the new system

The company has decided to replace the entire computers in each station and the datacenter computer. To support the latest technology and speed of data transfer are reasons why the company decided to replace the entire system.

The new computer specification for each station office is Intel Pentium 4 2.8GHz with memory of 256 MB. The monitor will be LCD monitor 15". This computer model will be ordered from Dell with the model's name of "DellTM OptiPlexTM 170L Small Micro Tower". For the printer, the company decided to use the old model which is Printer Epson LQ 1080i+. The company replaced the datacenter computer with Intel Xeon 2.8GHz with memory of 512MB. This model will also be ordered from Dell with the model's name of "DellTM PowersEdgeTM 1850 Server". This computer will play 2 tasks which are the datacenter and the web server. All listed price in Table 3.45. can be found in the Dell web site at <http://www.dell.co.th>.

Table 3.45. The Hardware Cost of the New System of ABC Petrochemical Co.,Ltd.

Hardware	Unit	Cost per Unit	Amount
DellTM OptiPlex 170L Small Micro Tower	69	33,990.00	2,345,310.00
DellTM PowerEdgeTM 1850 Server	1	84,990.00	84,990.00
Total			2,430,300.00

For the software, the company decided that each station must use Microsoft Windows XP to be the base operating system. For the HQ office, the company decided to use Microsoft Windows 2003 Server to be the base operating system for the datacenter computer. For the Office tools, the company used the full pack of Microsoft Office2003 which includes Microsoft Word2003, Microsoft Excel2003, Microsoft

PowerPoint2003, and Microsoft Access2003. All listed price in Table 3.46. can be found in Microsoft web site at <http://www.microsoft.com>

Table 3.46. The Software Cost of the New System of ABC Petrochemical Co.,Ltd.

Software	Quantity	Cost per Unit	Total Amount
Microsoft Windows XP (\$299)	69	11,960.00	825,240.00
Microsoft Windows 2003 Server (\$3,999)	1	159,960.00	13,000.00
Microsoft Office2003 (\$499)	70	19,960.00	1,397,200.00
Total			2,235,440.00

There is one cost left for the initiative cost of the new system which is software development cost. The software development estimate cost (by using process base estimation cost) is 570,000 baht and the training cost is 230,000 baht. The total cost of software development and training is 800,000 baht.

Table 3.47. Project Planning - Estimation (Process Base).

Function	System Development Process					Cost	Total Cost
	Planning	Analysis	Design	Construction	Maintenance		
Verify user authorizer	1	0.5	0.5	1	0.5	15,000.00	52,500.00
Generate menu structure	0.5	0.5	0.5	0.5	0.5	15,000.00	37,500.00
Check transaction activity	0.5	0.5	0.5	0.5	0.5	15,000.00	37,500.00
Update transaction activity	0.5	0.5	0.5	0.5	0.5	15,000.00	37,500.00
Send email notification	1	0.5	0.5	1	0.5	15,000.00	52,500.00
Verify stock	0.5	0.5	0.5	0.5	0.5	15,000.00	37,500.00
Update stock	0.5	0.5	0.5	0.5	0.5	15,000.00	37,500.00
Verify transfer fee rate	0.5	0.5	0.5	0.5	0.5	15,000.00	37,500.00
Update transfer fee rate	0.5	0.5	0.5	0.5	0.5	15,000.00	37,500.00
Generate fee rate table	0.5	0.5	0.5	0.5	0.5	15,000.00	37,500.00
Generate invoice	1	0.5	1	1	0.5	15,000.00	60,000.00
Generate zero balance report	0.5	0.5	1	1	0.5	15,000.00	52,500.00
Generate stock report	0.5	0.5	1	1	0.5	15,000.00	52,500.00
						195,000.00	570,000.00

- System Analyst will be involved in Planning and Analysis Stage.
 - System Engineer will be involved in Design Stage.
 - Programmer will be involved in Construction and Maintenance Stage.
- Total cost for each function.
- | | |
|-----------|----------|
| 7,000.00 | Baht/Day |
| 5,000.00 | Baht/Day |
| 3,000.00 | Baht/Day |
| 15,000.00 | Baht/Day |

The table below is a summation of the initiative cost of the new system. The initiative cost consisted of hardware cost, software cost and software development cost.

Table 3.48. Total of All Initiative Cost of the New System.

Item	Cost	Unit
Total of Hardware Cost	2,430,300.00	Bahts
Total of Software Cost	2,235,440.00	Bahts
Total of Software Development Cost	800,000.00	Bahts
Total	5,465,740.00	Bahts

Step 4: Define the annual cost for the new system

If the new system is successfully installed, the company expects that the hard copy or documentation cost will be eliminated. So, there is one cost left which is the communication cost. The communication in the new system will not communicate via telephone but it will use Internet component like the email. The Internet connection price list detail can be found in the True website at <http://www.telecomasia.com>.

Table 3.49. Total cost of Annual Cost of the New System.

	Cost Item	Amount	Unit
(1)	Internet Connection Service of the Head Quarter Office 1.5 Mbps/512 Kbps	28,860.00	Bahts/Month
(2)	Internet Connection Service of the Station Office 256/128 Kbps	7,072.00	Bahts/Month
(3)	Number of Station Office	68	Stations
(4)	Total Internet connection cost of all stations (2)*(3)	480,896.00	Bahts/Month
(5)	Total Internet connection cost of all Offices (1)+(4)	509,756.00	Bahts/Month
(6)	Total Internet connection cost per year (5)*12	6,117,072.00	Bahts

Table 3.49. Total cost of Annual Cost of the New System (Continued).

	Cost Item	Amount	Unit
(7)	Average usage time to precess each transaction and send notification email	15	Minutes
(8)	Estimate transaction for each station office per day	10	Transactions
(9)	Total estimate transaction for all station offices (8)*(3)	680	Transactions
(10)	Estimate transaction for head quarter office per day	30	Transactions
(11)	Total estimate transaction for all offices (9)+(10)	710	Transactions
(12)	Total time to process all transactions per day (7)*(11)	10,650	Minutes
(13)	Total time to process all transactions per Month (12)*22	234,300	Minutes
(14)	Total time to process all transactions per Year (13)*12	2,811,600	Minutes
(15)	Convert to working date format (14)/(22*60)	2,130	Days
(16)	The lowest employee wage per day	180.00	Bahts
(17)	Total employee wage (15)*(16)	383,400.00	Bahts
(18)	Total Annual Communication Cost (6)+(17)	6,500,472.00	Bahts

Step 5: Use all defined cost to compute by the replacement analysis method.

From the replacement analysis, the current system will act as the defender and the new system will act as a challenger. All costs are concluded in the table below.

Table 3.50. The Cost of the Current System and the New System.

	Current System	New System
Initial Investment, PW	4,053,000.00	5,465,740.00
Annual Cost, AW	17,447,040.00	6,500,472.00
Life Estimate Year, n	5	5
MARR (%)	1.25	1.25
Estimate Depreciation (Straight Line Method)	810,600.00	1,093,148.00
Tax (%)	10	10

We will compare between the defender cost and the challenger cost by using the equivalent uniform annual cost (EUAC) because this term is commonly used in the definition of the economic life of an asset.

Table 3.51. Cash Flow of The Current System.

	(A)	(B)	(C) = (A) - (B)	(D) = 0.1 * (C)	(E) = (A) + (D)
End of Year, k	Book Value	Depreciation	Taxable Income	Income Taxes	After Tax Cash Flow
0	4,053,000.00		4,053,000.00	405,300.00	4,458,300.00
1	3,242,400.00	810,600.00	2,431,800.00	243,180.00	3,485,580.00
2	2,431,800.00	810,600.00	1,621,200.00	162,120.00	2,593,920.00
3	1,621,200.00	810,600.00	810,600.00	81,060.00	1,702,260.00
4	810,600.00	810,600.00	-	-	810,600.00
5	-	810,600.00	(810,600.00)	(81,060.00)	(81,060.00)

Table 3.52. Cash Flow of The New System

	(A)	(B)	(C) = (A) - (B)	(D) = 0.1 * (C)	(E) = (A) + (D)
End of Year, k	Book Value	Depreciation	Taxable Expense	Expense Taxes	After Tax Cash Flow
0	5,465,740.00		5,465,740.00	546,574.00	6,012,314.00
1	4,372,592.00	1,093,148.00	3,279,444.00	327,944.40	4,700,536.40
2	3,279,444.00	1,093,148.00	2,186,296.00	218,629.60	3,498,073.60
3	2,186,296.00	1,093,148.00	1,093,148.00	109,314.80	2,295,610.80
4	1,093,148.00	1,093,148.00	-	-	1,093,148.00
5	-	1,093,148.00	(1,093,148.00)	(109,314.80)	(109,314.80)

$$\begin{aligned}
 \text{Defender: EUAW}_0 &= PW(F/P, i\%, N)(A/P, i\%, n) + AW \\
 &= (4,458,300)(A/P, 1.25\%, 5) + [(3,485,580)(P/F, 1.25\%, 1) + \\
 &\quad (2,593,920)(P/F, 1.25\%, 2) + (1,702,260)(P/F, 1.25\%, 3) + \\
 &\quad (810,600)(P/F, 1.25\%, 4)] (A/P, 1.25\%, 5) - \\
 &\quad (81,060)(A/F, 1.25\%, 5) + 17,447,040
 \end{aligned}$$

$$\begin{aligned}
&= (4,458,300)(0.2076) + [(3,485,580)(0.9877) + \\
&\quad (2,593,920)(0.9755) + (1,702,260)(0.9634) + \\
&\quad (810,600)(0.9515)] (0.2076) - \\
&\quad (81,060)(0.1951) + 17,447,040 \\
&= 20,128,449.46 \text{ Bahts/Year}
\end{aligned}$$

Challenger: EUAW_n = PW(A/P, i%, n) + AW

$$\begin{aligned}
&= (6,012,314)(A/P, 1.25\%, 5) + [(4,700,536.40)(P/F, 1.25\%, 1) + \\
&\quad (3,498,073.60)(P/F, 1.25\%, 2) + (2,295,610.80)(P/F, 1.25\%, 3) + \\
&\quad (1,093,148)(P/F, 1.25\%, 4)] (A/P, 1.25\%, 5) - \\
&\quad (109,314.80)(A/F, 1.25\%, 5) + 6,500,472 \\
&= (6,012,314)(0.2076) + [(4,700,536.40)(0.9877) + \\
&\quad (3,498,073.60)(0.9755) + (2,295,610.80)(0.9634) + \\
&\quad (1,093,148)(0.9515)] (0.2076) - \\
&\quad (109,314.80)(0.1951) + 6,500,472 \\
&= 10,116,530.96 \text{ Bahts/Year}
\end{aligned}$$

Conclusion: Since the challenger has less annual amount than the defender, then the new system of the currency exchange transaction should be implemented.

After the EUAC of the new system and the current system are computed, we can see that the current system's annual cost is 1.9897 times $(20,128,449.46/10,116,530.96)$ greater than the new system. And the new system can save the annual cost spent around 10,011,918.50 Baht $(20,128,449.46 - 10,116,530.96)$

The cash flow diagram of the current system and the new system are shown in the Figure3.25. and Figure3.26.

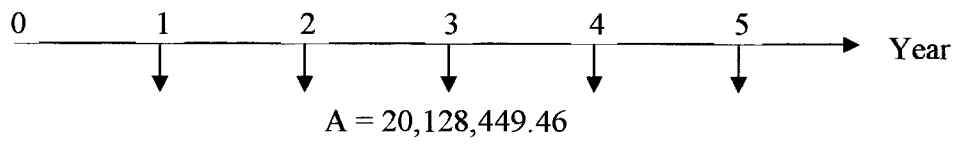


Figure 3.25. The Cash Flow of the Current System.

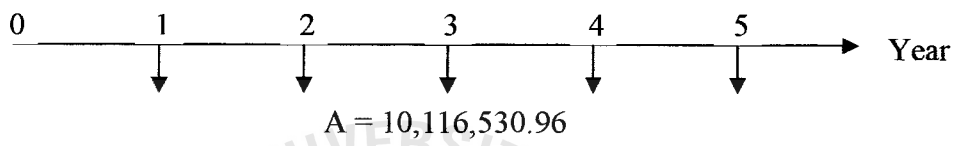
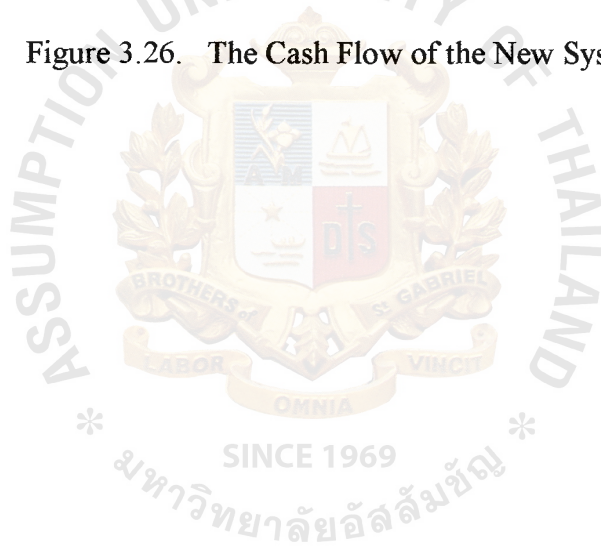


Figure 3.26. The Cash Flow of the New System.



3.5.3 Economic Feasibility Analysis

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	TOTALS
Cost Saving	0.00	10,011,918.50	10,011,918.50	10,011,918.50	10,011,918.50	10,011,918.50	
Interest Rate (1.25%)	1.0000	0.9877	0.9755	0.9634	0.9515	0.9398	
PV of Cost Saving	-	9,888,314.57	9,766,236.61	9,645,665.79	9,526,583.49	9,408,971.35	
NPV of all Cost Saving	-	9,888,314.57	19,654,551.18	29,300,216.97	38,826,800.46	48,235,771.81	48,235,771.81
One time Cost (Initiative (6,012,314.00))							
Recurring Cost	-	(6,500,472.00)	(6,500,472.00)	(6,500,472.00)	(6,500,472.00)	(6,500,472.00)	
Interest Rate (1.25%)	1.0000	0.9877	0.9755	0.9634	0.9515	0.9398	
PV of Recurring Cost	-	(6,420,219.2593)	(6,340,957.2931)	(6,262,673.8697)	(6,185,356.9084)	(6,108,994.4774)	
NPV of all Costs	(6,012,314.00)	(12,432,533.26)	(18,773,490.55)	(25,036,164.42)	(31,221,521.33)	(37,330,515.81)	(37,330,515.81)
Overall NPV							<u>10,905,256.00</u>
Overall of ROI - (Overall NPV/NPV of all Costs)							<u>0.292</u>
Break-even Analysis							
Yearly NPV Cash Flow (6,012,314.00)		3,387,842.57	3,265,764.61	3,145,193.79	3,026,111.49	2,908,499.35	
Overall NPV Cash Flow (6,012,314.00)		(2,624,471.43)	641,293.18	3,786,486.97	6,812,598.46	9,721,097.81	

Project break-even occurs between year 1 and 2

Use first year of positive cash flow to calculate break-even fraction - $((3,965,997.57 - 2,597,086.00) / 3,965,997.57) =$

Actual break-even occurs at 1.80 years

Note: All Baht values have been rounded to the nearest Baht

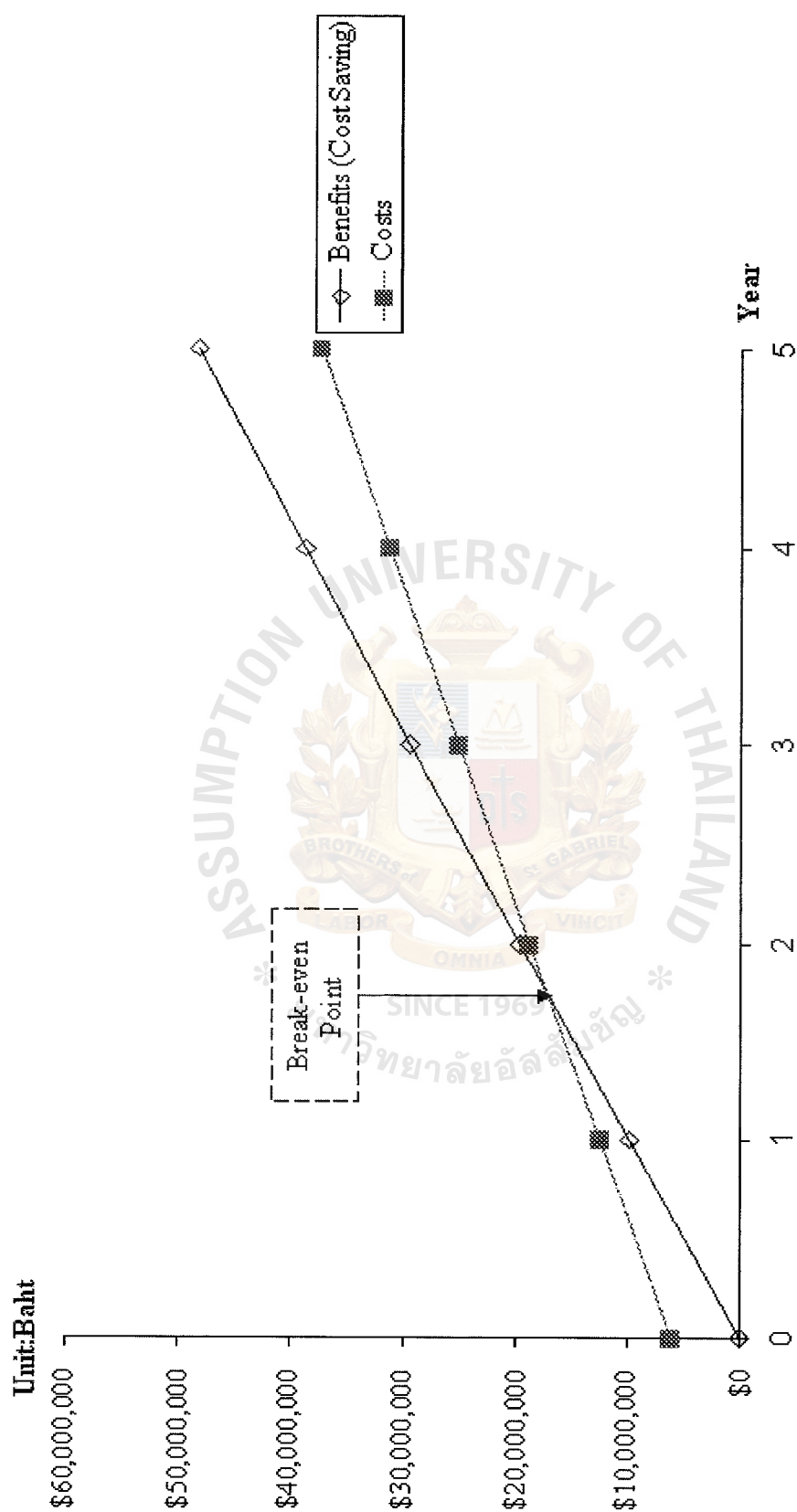
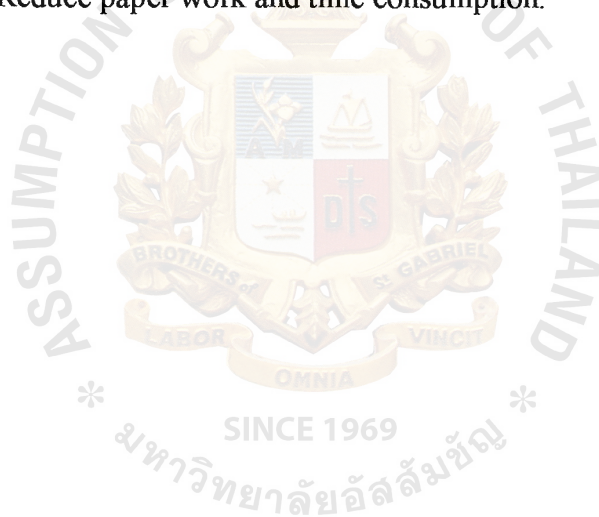


Figure 3.27. Break-even Analysis of the Currency Exchange Transaction System.

3.6. Intangible Benefit

Intangible benefit is a benefit derived from the creation of a proposed system that cannot be easily measured in values of money and with certainty. The major intangible benefit will be summarized as follows:

- (1) Enhance the accuracy, timeliness and efficiency of operation.
- (2) Retrieve exchange transactions data faster.
- (3) Easy to provide the various reports.
- (4) Faster decision making.
- (5) Reduce human risk errors.
- (6) Reduce paper work and time consumption.



IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

System Implementation is the phase that the project is really implemented. This phase is the planned and converted stage from the current system to the new system. This phase will use up the highest cost of the total cost of the project. The final decide should be evaluated to make sure that it reaches the proposed goals and objectives.

4.2 The Construction and Testing Phase

This phase can be separated into two parts which are construct software and construct database. Total time frame within this phase will take around 2 weeks. To develop the software will take 6 days and to build the database structure will take 4 days.

4.2.1 Software Development

The purpose of this activity is to develop and test the new currency exchange transaction via the Internet. In the first testing, this software will test the connection and transfer transaction within the local area network (LAN) to see how it works. Second, this software will be installed into the web server machine and allow the pilot station login and test transfer transaction to the HQ office.

4.2.2 Database Construction

Database construction must be finished before the software development starts because database is a main resource shared by the computer program to be developed. In the first stage, database will be created in the developer machine to test inside while developing the software. Second, the finished database will be installed into the datacenter machine and test how it works before allowing to access from outside. Finally, connect the database and the final currency exchange transaction software

together and allow the pilot station connection to the datacenter machine and transfer transaction to see how it works or not.

4.3 Installation

Both the new currency exchange transaction software and the database will be installed into the same computer which is the datacenter machine. This machine will play two roles which are the web server and the database server (datacenter). The steps to install the new system can be done as follows:

4.3.1 Setting up the Web Server

In the datacenter will be set up the Internet Information Service (IIS) Manager to make this machine as a web server. After this machine is finished in setting up IIS, this machine will be ready to be accessed from outside.

4.3.2 Setting up the Database Server

For the database server, the ODBE driver from MS Windows 2003 Server can be used to get connection between the database and the web server. Two things to be aware of are the database file names have to be the precise names and ODBC connection names must be precise names also, otherwise the database file and the Currency Exchange Transaction software will not connect to each other.

4.3.3 Data Conversion

This step is quite easy because all transactions are stored in the MS Access97 file format. Microsoft product has one useful feature which is production compatibility; it is an easy thing to convert the old database into the new database. But one concern is that the field mapping between the old database and the new database must be mapped in the right place otherwise the outcome of the conversion will go wrong.

4.4 Training

User training is very important for the implementation, since the user must be able to perform the whole system without intervention of the analyst. The analyst has to consider who need to be trained, objectives of the training, methods of instruction to be used, materials and training schedule.



V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The new Currency Exchange Transaction System is developed to make communicating the exchange transactions between each station office and HQ much easier. It is very difficult at the beginning of the project because it has to change the way of working from daily manual operation to a fully computerized operation. It takes more time and accomplishes many factors of the objectives. The system development cannot be implemented smoothly if the officers are not involved. Therefore, officers must participate in almost every phase including analysis, decide, and implementing the system, due to the officers being the ones who know exactly what the proposed system should be, to fulfill their objectives.

For the current system, all transaction activities are performed manually, which cause the company to face many problems. Exchange transaction time is of the highest concern, because there are a lot of the critical transactions which are needed to be sent and received from time to time. All of those transactions must be sent and received on time otherwise the company will lose the chance of the next order. There is another concerning factor which is the annual expense. The company pays almost 18 million baht a year for the communication while transferring the transaction and the paper work.

The proposed system is designed to meet the requirements of the users. It could reduce time consumption of the exchange transaction between each station office and HQ. By using web based infrastructure to send and receive transaction the paper work should be reduced a lot because there is no need to print out the transaction onto paper except to keep as reference or make correction. The communication channel via telephone is changed to email notification and transaction record on the web.

Table 5.1 shows the performance of each process of the proposed system compared with the current system. All process time in the current system came from self adjustment and working experience. The proposed system process time comes from self testing by using stop-watch with a hundred-thousand generated transactions to the database. Details of the processes are described in the list below.

Table 5.1. Degree of Achievement of the Proposed System.

Process	The Current System	The Proposed System
Transaction Process	2 days	15 minutes
Stock Checking	2 hours	5 minutes
Transaction Searching	15 minutes	1-2 minutes
Report Generating	2-3 days	10-15 minutes
Data Consistency and Accuracy	Less	More
Annual cost	20,128,449.46	10,116,530.96

(1) Transaction Process

All transactions in the current system can be processed whenever the officer receives the printed transaction. All printed transaction can be sent only by mail and it will take one day for sending in the EMS form and one day for processing. But the proposed system is based on the online transaction, so the exchange transaction can be real-time processed and it can take only 15 minutes (includes searching transaction, checks matching transaction, and sends email). It can be faster or slower than 15 minutes depending on the bandwidth of the Internet and number of transactions.

(2) Stock Checking

Stocking in the current system can be checked by checking in the shock folder and call HQ. After HQ receives the request from the service station office, HQ will send the request to the Production department to let them check the product in stock. The proposed system is based on web infrastructure and has query tools to retrieve the requested data. So, to search the product in stock will take only a few minutes. The checking time can be faster or slower than 5 minutes depending on the number of product checking and Internet bandwidth.

(3) Transaction Searching

To search transactions in the current system can be done only in the folder records. It will take a long time if the folder is too big and not well organized. The proposed system has query tools to retrieve the request data and it is online searching, so the officer can use the transaction search feature from anywhere not just in the office. The searching feature can be faster or slower depending on the Internet bandwidth and the number of transaction records.

(4) Report Generating

The proposed system can generate the report instead of creating report manual. All data are stored on the central database.

(5) Data Consistency and Accuracy

The current manual system will not assure data absolutely compared to the new system that has more efficiency. The consistency and accuracy of data in the current system is evaluated from tracking past transaction

records. The new system is evaluated from the transaction record in the central database.

(6) Annual Cost

The proposed system can save a lot of the annual cost than the current system.

So, it can be concluded that the proposed system is more efficient and effective than the current system.

5.2 Recommendations

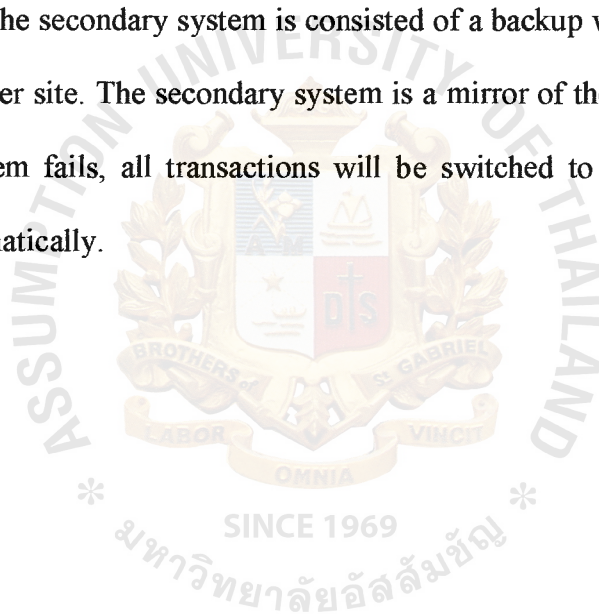
The system is developed in-house and it is a part of an ongoing project. It can be continuously developed, revised, and modified similar to the other projects in order to meet the users' requirement and make the system more effective and fulfill the company's need and support expansion.

To build the system on the well formed infrastructure, it can be recommended that the datacenter computer should have at least 3 computers, the web server, the database server, and the backup computer. The backup computer is used in case of either one of the web server or the database servers collapses.

To make this project to be a workable system, the developer should be involved in some point of installation of the system and data structure. Because this system is implemented on Active Server Page .Net (ASP.NET) format, files and the folder path cannot be changed and the database connection point must be the same as the original path. The database structure cannot be changed, otherwise errors will happen. If the data structure has to be changed, the source ASP.NET file must be compiled to the appropriate database structure.

This system is the initial stage to make an online application. If it is going smoothly, the Online Transaction Payment is recommended to be implemented. To make more effective and use the highest benefit of the Currency Exchange Transaction, all payment should be made through the Internet. This one can reduce the time to transfer money and also can transfer anytime and anywhere whenever they want. To secure the payment, the 128-bits encrypted will be applied while sending data through the Internet.

To prevent system failure, the backup system or the secondary system would be introduced. The secondary system is consisted of a backup web server site and a backup database server site. The secondary system is a mirror of the primary system. When the primary system fails, all transactions will be switched to be stored in the secondary system automatically.



BIBLIOGRAPHY

English References

1. Hoffer, Jeffrey A., Joey F. George, Joseph S. Valacich Modern Systems Analysis and Design Methods, Third Edition. NJ: Addison Wesley Longman, Inc., 2002.
2. Laudon, Kenneth C., Jane P. Laudon. Management Information Systems Managing the Digital Firm, Eight Edition. NJ: Prentice-Hall, Inc., 2004.
3. McAmis, Davis. Crystal Reports A Beginner's Guide, Osborne:McGraw-Hill 2002.
4. Sullivan, William G., Elin M. Wicks, James T. Luxhoj, Engineering Economy, Twelfth Edition, Upper Saddle River, NJ : Prentice-Hall, 2003.
5. Torok, Gabriel, Jeffrey Payne, Matt Weisfeld. JavaScript Primer Plus, CA: The Waite Group, Inc. 1996.

Thai References

1. ทรงลักษณ์ พิริยะไพโรจน์ และ สุนณา เกษมสวัสดิ์, เรียนลัด Data Structure ด้วย Visual Basic, กรุงเทพฯ: โปรวิชั่น, 2544.
2. ศุภชัย สมพานิช, Database Programming กับ Visual Basic ฉบับมืออาชีพ, กรุงเทพฯ: อีโพรส, 2543.

Website References

1. <http://www1.ap.dell.com/content/default.aspx?c=th&l=en&s=gen>
2. <http://msdn.microsoft.com/asp.net/>

St. Gabriel's Library, An

