



Books Rental Information System for  
Books 4 Life Co., Ltd.

by

Mr. Thawatchai Kanongnuk

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

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

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Project Title Books Rental Information System for Books 4 Life Co., Ltd.  
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Academic Year November 2004

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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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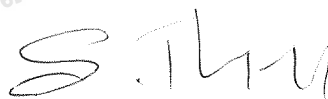
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## **ABSTRACT**

This project represents an analysis and design for Books Rental Information System of Books 4 Life Co., Ltd. The new computerized system is developed to improve the business process and to solve the problems occurring in the existing system.

The existing Books Rental Information System is based on manual system. All the data are stored on paper. Many staff members are required for information collection, and they face general problems in a manual system, which has caused error and has high maintenance costs.

The proposed information system will be developed to replace the manual maintenance system. All data are kept in a database server, which will be accessed through Microsoft Access 2000 through the server. The operating system and network management program would be Microsoft Visual Basic 6.0. It will reduce the number of administrative staff, and the time used to check routine maintenance schedules. It will also help in preparing reports, solving the problems of the manual system, and decreasing high maintenance costs. The system development costs will be recovered by the cost avoidance benefits after implementation. After users become familiar with the new system, it is found that the organization gets more efficient information than before to support decision-making. The proposed information system has break-even of 7 months and payback period of 1 year and 4.2 months.

## ACKNOWLEDGEMENTS

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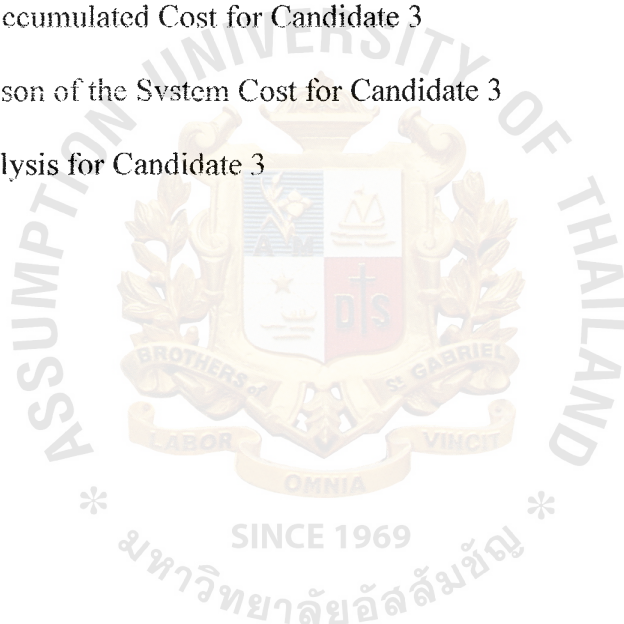
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## I. INTRODUCTION

### 1.1 Background of the Project

This report includes studying and analyzing the problems of the existing system, defining user requirements, and designing an appropriate computerized system to manage the Books Rental Information System for the company. The report is prepared and organized according to the requirements of Master of Science in Computer Information Systems program, CS 6998 System Development Project. The report involves replacing the manual system with the new computerized system.

Businesses are more competitive today. We should provide good services to maintain old customers and increase the number of new customers. Service is crucial for customer satisfaction. Therefore, it is necessary to install new systems to reduce the processing time providing faster service.

The Book Rental Information System is provided for "Books 4 Life" books rental stores because of the problems in the current manual system. The manual system is very slow and takes a lot of time to meet the customer's requirements. Thus, we set up a new system using computerized systems to solve this problem. It improves the procedures to be faster and satisfies customers. In addition, it is designed so that user can use it easily.

The initial investment in technology and software will not only reduce processing time, but also eliminate errors in calculation of the total rental income, and increase accuracy in rental fees and fines calculation. Therefore, Books 4 Life Co., Ltd. needs a new computerized Books Rental Information System to support the expanding business and to be competitive enough with the competitors.

## **1.2 Objectives of the Project**

The objectives of developing the Books Rental Information System project for Books 4 Life Co., Ltd. are as follows:

- (1) To analyze the existing system and design a new computerized system for more effectiveness and efficiency of the company.
- (2) To identify user requirements.
- (3) To identify business requirements.
- (4) To identify information system requirements.
- (5) To design and develop a new system based on all requirements.
- (6) To accommodate the growing amount of data of the company.
- (7) To equip the company with a new system that makes it ready for further business expansion.
- (8) To implement a new computerized system that systematically operates the business.

## **1.3 Scope of the Project**

The project will cover the fundamental functions of the books rental system that can be classified as follows:

- (1) Support information for books profile such as ISBN, name, category, publisher, price, rental fee and fine rate.
- (2) Manage and maintain information of members, such as recording and updating member number, name, address, and telephone number.
- (3) Support information record of rental operation process of books borrowing and returning, name of book borrowing and name of book overdue.

- (4) Facilitate calculation process in customer rental fees and fine payment in daily business operation.
- (5) Support books rental store income report in both incomes from rental fees and fine in case of overdue.

#### **1.4 Deliverables of the Project**

The deliverables of the Books Rental Information System are as follows:

- (1) Project Introduction
  - (a) Background of the project
  - (b) Objectives
  - (c) Scope
- (2) Description of the existing system
  - (a) Background of the organization
  - (b) Existing business function
  - (c) Current incurring problems and areas for improvements
  - (d) Existing manual system
- (3) Description of the proposed new system
  - (a) System specification
    - (1) Context diagram
    - (2) Data flow diagram
  - (b) System design
  - (c) Hardware and software requirement
  - (d) Security and controls
  - (e) Cost and benefit analysis



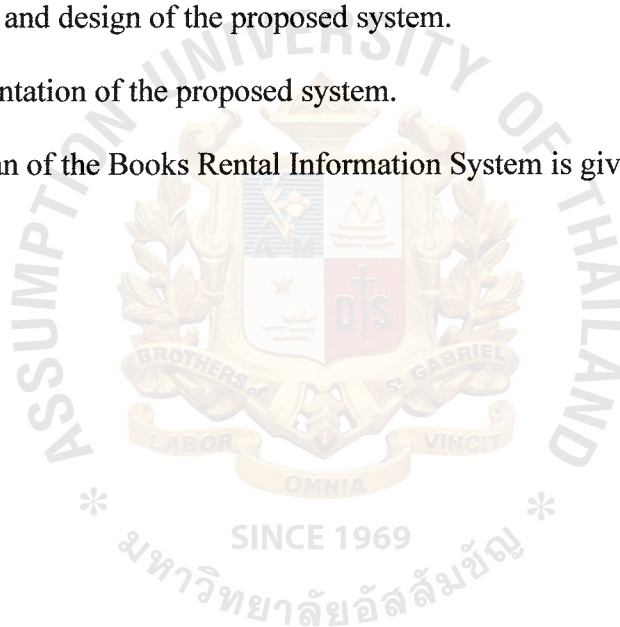
- (4) Project Implementation
  - (a) Overview of project implementation
  - (b) Test plan and results
- (5) Conclusion and Recommendations

### **1.5 Project Plan**

The project plan is based on the concept of System Development Life Cycle (SDLC). The processes are divided into 3 main phases as follows:

- (1) Analysis of the existing system.
- (2) Analysis and design of the proposed system.
- (3) Implementation of the proposed system.

The project plan of the Books Rental Information System is given in Figure 1.1.



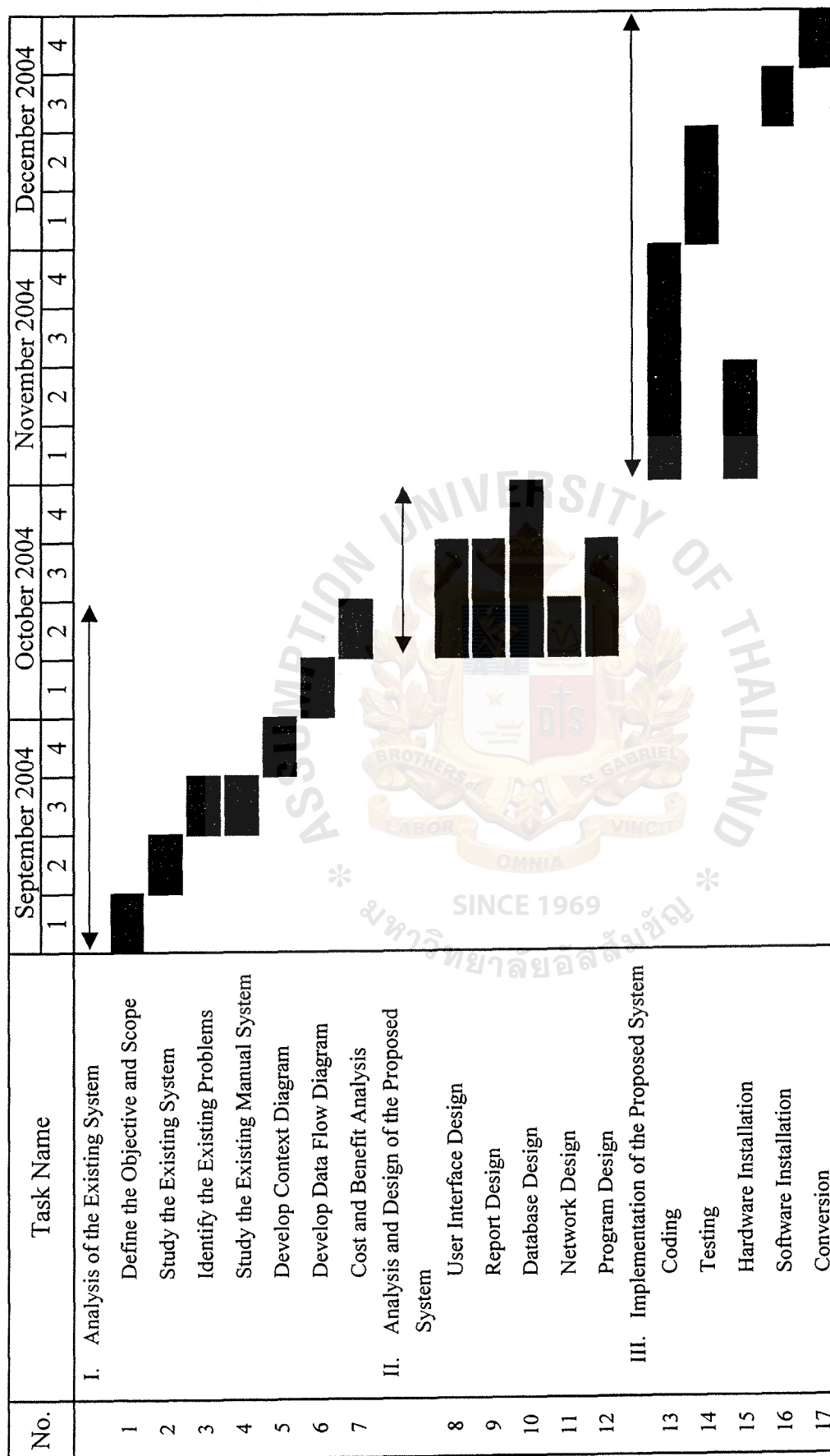


Figure 1.1. Project Plan of the Books Rental Information System.

## II. THE EXISTING SYSTEM

### 2.1 Background of the Organization

Books 4 Life Co., Ltd. was established in 2001 to offer the ultimate reading entertainment experience and knowledge to readers. The company operates the books rental store services under the name “Books 4 Life”. The company offers a wide selection of books such as cartoon comics, magazines, novels, and pocket books. It aims to satisfy readers with a wide range of books at reasonable prices. Book lovers are able to enjoy reading thousands of books at reasonable rental fees without having to buy the book themselves. Books 4 Life Co., Ltd. is located on 2017 Sukhumvit Road, Suanluang District, Bangkok 10250. The company has two books rental stores in area near Sukhumvit 77 Road and Ngamwongwan Road.

Currently, Books 4 Life stores still use a manual system, which means that the entire system is not linked together and all the documents are distributed on paper. However, for future business expansion, competition and so on, the company has decided to improve the existing system into a computerized system.

There are 4 main departments in the “Books 4 Life” books rental store.

#### (1) Operation Department

The main responsibility is to render quality services to customers during rental, collection of rental fees and fines, filing customer information profiles and filing books information records.

#### (2) Marketing Department

The department is responsible for creating business marketing strategies such as promotional activities of campaigns, discounts and advertisements.

(3) Procurement Department

The department is to make ordering and purchasing of books from source publishers on a timely basis.

(4) Accounting Department

The department deals with jobs concerning incomes, expenses, making accounting reports, producing payroll for all employees and more.

The organization chart is presented in Figure 2.1.

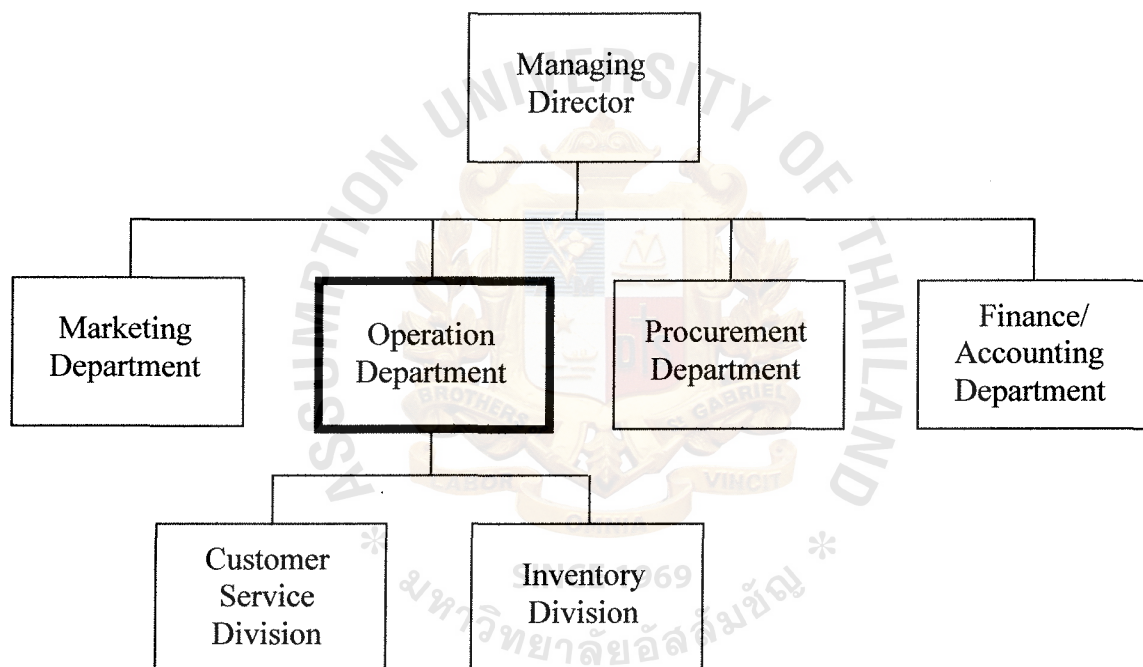


Figure 2.1. Organization Chart of Books 4 Life Co., Ltd.



## **2.2 Existing Business Function**

The existing system is operated manually. It can be divided into 4 major functions, which are as follows:

- (1) **Membership Record:** All customers have to apply for bookstore membership. It is a regulation that allows the customer to perform any transaction in the store with the membership. They have to follow the terms and conditions of membership specified in the application form. It is also added that relevant information in the application form has to be completed before approval i.e. name, I.D. number address, telephone number. The terms and conditions are defined as follows:

- (a) ID card, Government card or passport will be copied for membership references.
- (b) Annual membership fee is collected at 50 baht per year.
- (c) In the event of lost, stolen or damaged card, a fine of 50 baht will be charged for replacement of a new card.
- (d) The member card is not transferable and can only be used by members stated on the membership account.
- (e) If member has no contact with the store for one year their membership would be cancelled.

- (2) **Books Rental services:** This function can be divided into 2 major parts.

- (a) **Borrow Transaction**

Members must present their membership card for each rental service to verify their membership status. The steps of providing rental services are as follows:

- (1) The customer registration is valid.

- (2) The customer must present membership card for each transaction to verify status.
- (3) The customer selects the books and proposes to borrow at service counter with the staff.
- (4) The staff records the rental transaction in the book by completing all relevant information i.e. membership number, rental date, book title. The staff confirms the rental transaction as well as the date of return with the customer.

(b) Return Transaction

The member presents the member card for each return transaction to the staff at the store. The staff checks information from the rental record book, once the books are returned. The information should match the previous record. In case of damage, destruction or loss, the member must pay the full price of those books. There is discount or refund if the books are returned before due date. However, the member will be charged a fine for overdue books.

- (3) New Books Registration: The Procurement Department is responsible for the order of new books. Once the new books arrive at the store, registration of new record is needed. The books will be recorded with book items recorded in the file in the name of new type specifying more details of the book i.e. type of book, book title, author name and price. A unique item number is given for each new book so that it can be correctly identified.

- (4) Inventory Control: The staff will check the number of books in the stock daily in order to keep the records. The books can be returned to the vendors in case of damage. We also resell the books to vendors if the book is rented less often or becomes out dated. It also indicates that the mentioned expired book items can be deleted from the record. Therefore, we need to update every transaction to check the availability of books in the store.

Context diagram of the existing system is given in Figure 2.2.

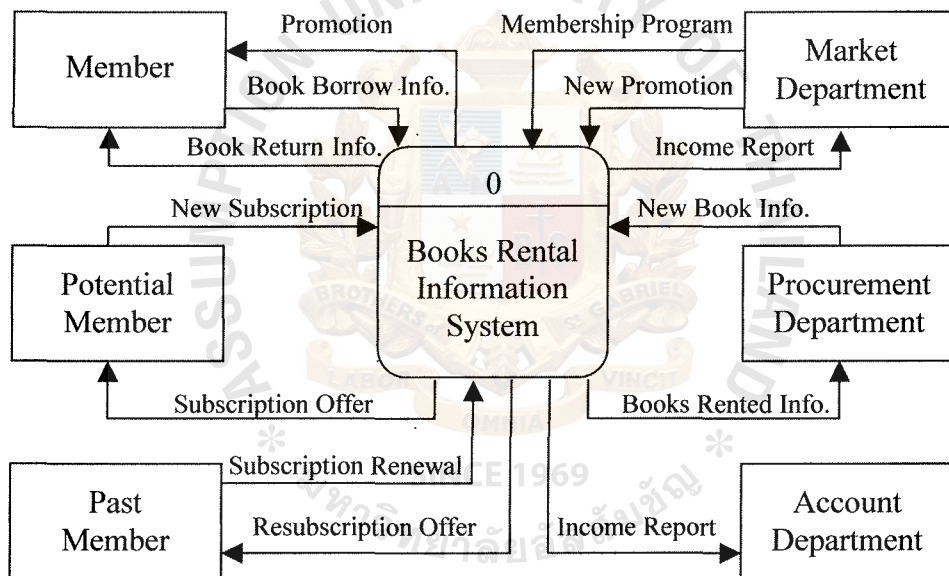


Figure 2.2. Context Diagram of Existing Books Rental Information System.

### 2.3 Current Problems and Areas for Improvement

The manual system of the company can generate some problems as follows:

(1) Problem of customer searching delay

The manual operating system renders some difficulties in searching and retrieving of customer record information. The staff takes a long time to find customer record in file, especially when they have to serve many customers at the same time.

(2) Problem of customer record keeping

The existing customer record keeping involves a lot of paper work which makes it difficult to keep all the customer profile as the number of accumulated record increases more and more.

(3) Problem of calculating rental fees and fines

The calculation of rental fees and fine is done manually, so sometimes errors occur. There is no automatic calculation for fees and fines, so when the staff has to handle many transactions they can make mistake or they need a long time to make them all correct.

(4) Problem of ineffective report

As everything is based on manual system, calculation errors and time consuming processing time will produce the ineffective report for the management.



### **III. THE PROPOSED SYSTEM**

#### **3.1 System Specification**

According to the background of the organization, Books 4 Life should have an effective computerized Books Rental Information System that will help the company to solve the problems that occur in the existing manual system. Moreover, it should provide considerably accurate, and consistent computerized information system.

In order to achieve the objective, the new proposed Books Rental Information System should consist of two requirements as follows:

- (1) Input Requirements
  - (a) Input screen should be simple and easy to use.
  - (b) Input screen should provide security to system such as Login and Password. Only authorized person will be allowed to access the system and its input screen.
  - (c) The volume of data to input should be minimized in order to reduce the risk of input errors.
  - (d) Input screen should be less time consuming.
  - (e) Input should be designed to maintain database tables in the system.

- (2) Output Requirements

Output should be able to calculate total payment, overdue fine charges and availability of books in the inventory. Also, reports are important outputs that present information to relevant users especially, the management level to assist in planning and control by generating summary reports. Therefore, reports should be simple to read and understand, accurate and up to date. The following are necessary aspects of the system.

- (a) Monthly New Member List Reports
- (b) Monthly New Books List Reports
- (c) Monthly Income Reports

### **3.2 System Design**

#### **(1) Entity Relationship Diagram**

Entity Relationship Diagram is the technique for organizing and documenting a system's data. Data modeling is sometimes called database modeling.

ERD of Books Rental Information System is shown in Appendix A as follows:

- (a) A context level of entity relation diagram
- (b) A key-based attributed relationship diagram
- (c) A fully attributed relationship diagram

Data dictionary is a table that describes the details of each entity and attribute in the entity relationship diagram, as shown in Appendix B.

#### **(2) Data Flow Diagram (DFDs)**

The logical Data Flow Diagrams (DFDs) are structure analysis and design tools that analysts can use to understand the process of the system and movement of data through the system.

The logical data flow diagram will indicate the flow of requirement and data type used in developing the program to support the new system. With DFDs, the analyst can design the file to cover the requirements of the report design of the system.

The proposed system is designed with the aim to solve the problems of the existing system as stated previously and to meet all user requirements as well. Context diagram of the proposed system is given in Figure 3.1 and level 0 Data flow Diagram of the proposed system is given in Figure 3.2.



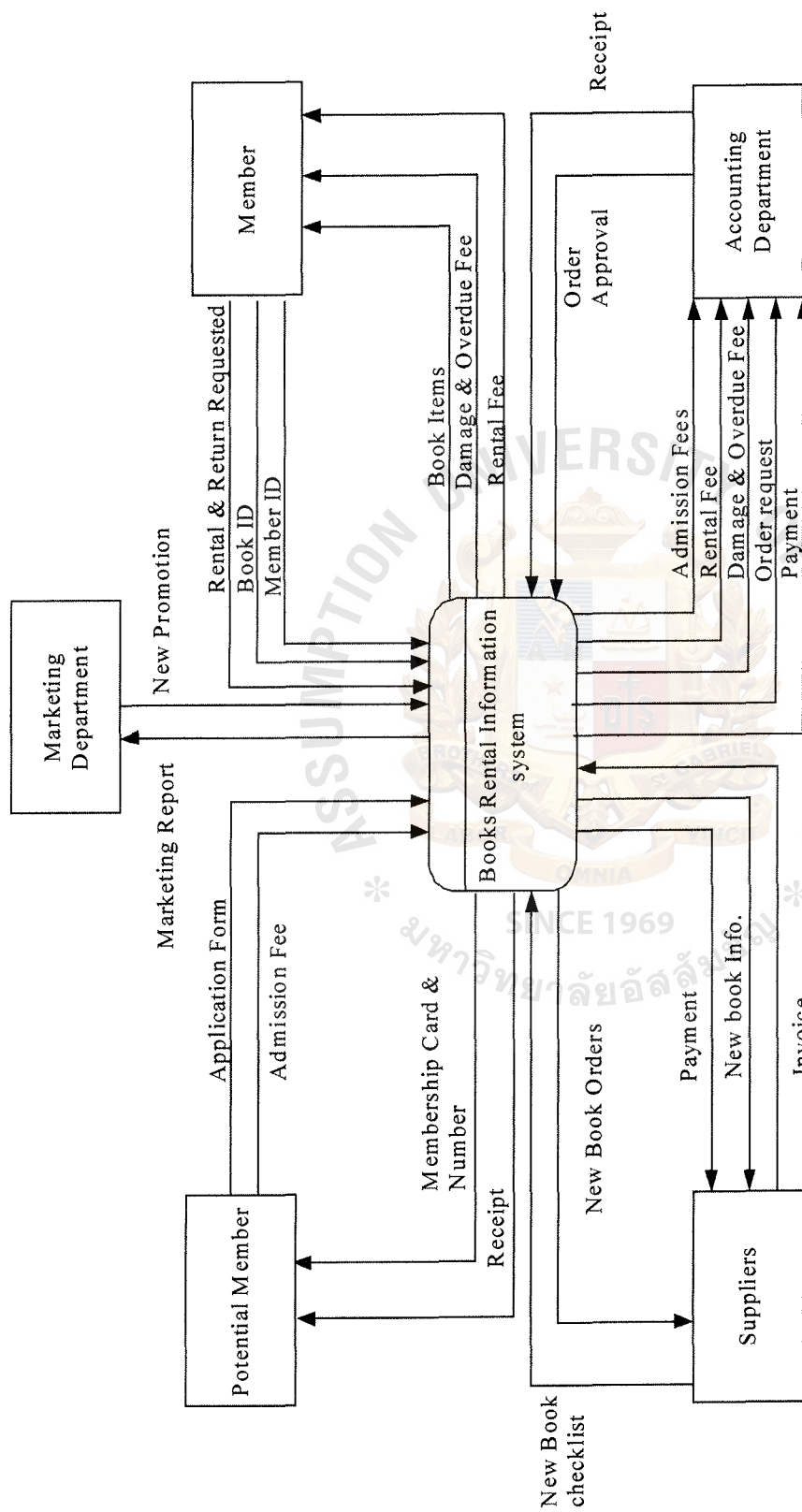


Figure 3.1. Context Data Flow Diagram of the Proposed System.





The details of data flow diagram of Books Rental Information System are shown in Appendix C, which includes:

- (a) Context Data Flow Diagram
- (b) Function Decomposition Diagram
- (c) Level 0 of Data Flow Diagram
- (d) Level 1 of Data Flow Diagram
- (e) Structure Chart

To understand the details of each process in data flow diagram, the process specification is shown in Appendix E.

(3) Input Design

The input screens of the system are in many forms for various purposes and are shown in Appendix E.

(4) Output Design

There are 2 types of system output forms that are in the form of hard copy and in the form of displayed screen. Some reports are generated periodically such as on a weekly, monthly or yearly basis. The outputs in the display screen are for monitoring daily operation purposes.

All the reports and outputs generated by the system is shown in Appendix F.

### 3.3 Hardware and Software Requirements

The proposed system will be developed in the form of windows based. Therefore, the server must have minimum specifications, which can run both Microsoft Windows and other software in the suit. The hardware and software specifications for the proposed system are shown in Table 3.1 and 3.2 respectively.

Table 3.1. Hardware Specification for Each Server Machine.

Hardware	Specification
CPU	Intel Pentium IV Processor 2.53 GHz
Memory	256 MB DDR RAM
Cache	L2 Cache (512 K)
Hard Disk	40 GB
CD-ROM Drive	52 x CD-ROM
Floppy Drive	1.44 MB diskette drive
Display Screen	17" Flat Monitor
Display Adapter	SVGA Card
Printer	HP Laser Jet 8100
UPS	Lenoic Model Acura1000 (1000 VA)

Table 3.2. Software Specification for the Server.

Software	Specification
Operating System	Microsoft Window XP (Thai Edition)
Application Software	(1) Microsoft Visual Studio (2) Microsoft Office 2000 Professional Edition

In the proposed system, the clients' machine will have a capacity high enough to run the database server. The hardware & software specification for each client machine is shown in Tables 3.3 and 3.4 respectively.

Table 3.3. Hardware Specification for Each Client Machine.

Hardware	Specification
CPU	Intel Pentium IV Processor 1.7 GHz
Memory	128 MB DDR RAM
Cache	L2 Cache (128 K)
Hard Disk	40 GB
CD-ROM DRIVE	52x CD-ROM
Floppy Drive	1.44 MB
Display Screen	17" Flat Monitor
Display Adapter	SVGA Card
Printer	HP Laser Jet 8100
UPS	Syndome ERA 5021 (500VA)

Table 3.4. Software Specification for Each Client Machine.

Software	Specification
Operating System	Microsoft Window XP (Thai Edition)
Database Software	Microsoft SQL Server
Application Software	(1) Microsoft Visual Studio (2) Microsoft Office 2000

The network configuration of the proposed Books Rental Information System is shown in Figure 3.3

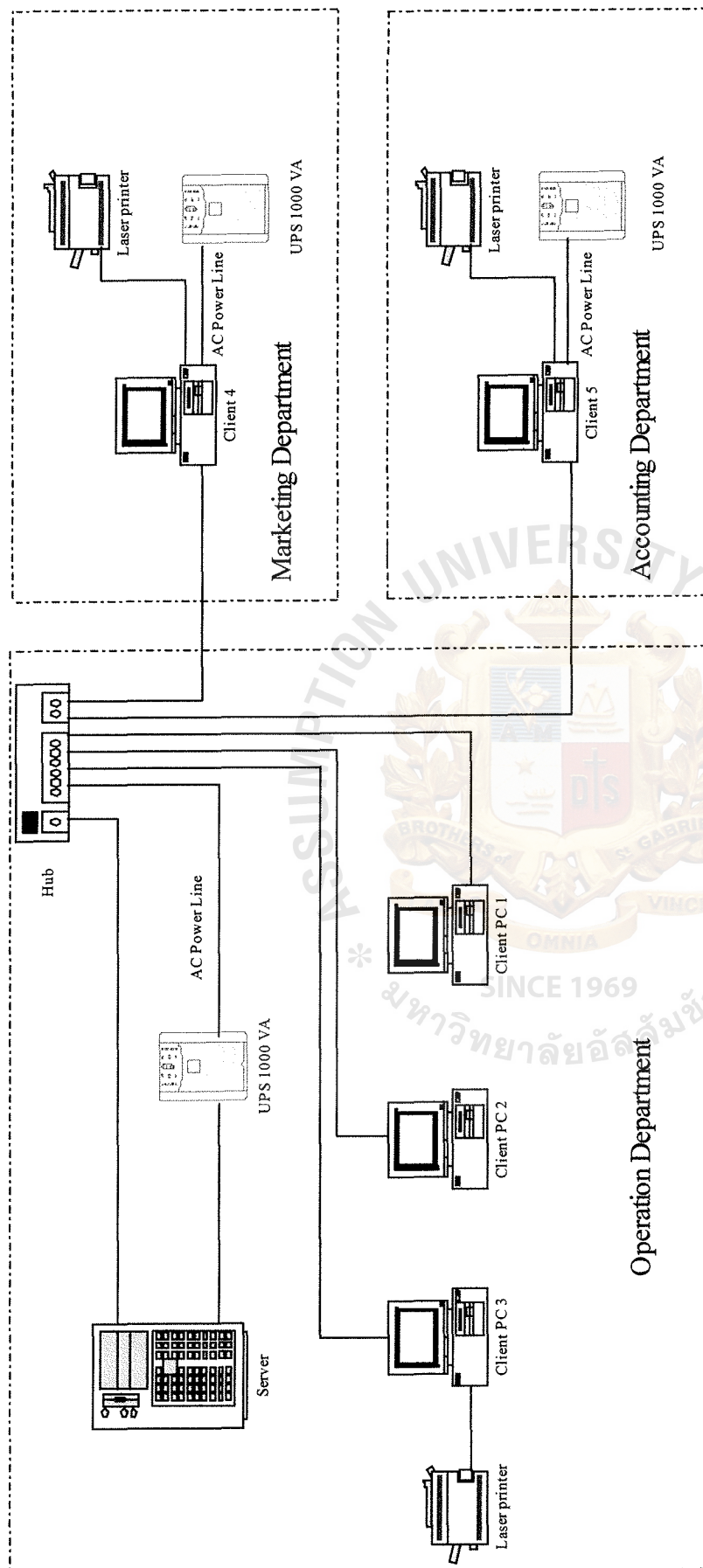


Figure 3.3 Network Configuration of Books Rental Information system.

### 3.4 System Cost Analysis

#### (1) Cost of Manual System

Table 3.5. Manual System Cost Analysis, in Baht.

Cost items		Years				
		1	2	3	4	5
<b>Fixed Cost</b>						
Electric Typewriter	2 units @ 8,500	3,400.00	3,400.00	3,400.00	3,400.00	3,400.00
Calculators	5 units @ 1,200	1,200.00	1,200.00	1,200.00	1,200.00	1,200.00
Total Fixed Cost		4,600.00	4,600.00	4,600.00	4,600.00	4,600.00
<b>Operating Cost</b>						
Salary Cost:						
Managing Director	1 person @20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Operation Manager	1 persons @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Marketing Manager	1 person @10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Procurement Manager	1 person @10,000	10,000.00	11,000.00	12,000.00	13,310.00	14,641.00
Accounting Manger	1 person @10,000	10,000.00	11,000.00	12,000.00	13,310.00	14,641.00
Store Clerks	5 persons @ 7,000	35,000.00	38,500.00	42,350.00	46,585.00	51,243.50
Total Monthly Salary Cost		95,000.00	104,500.00	114,750.00	126,445.00	139,089.50
Total Annual Salary Cost		1,140,000.00	1,254,000.00	1,377,000.00	1,517,340.00	1,669,074.00
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Paper	Per Annual	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Utility	Per Annual	35,000.00	38,500.00	42,350.00	46,585.00	51,243.50
Miscellaneous	Per Annual	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Total Annual Office Supplies & Miscellaneous Cost		95,000.00	104,500.00	114,950.00	126,445.00	139,089.50
Total Annual Operating Cost		1,235,000.00	1,358,500.00	1,491,950.00	1,643,785.00	1,808,163.50
Total Manual System Cost		1,239,600.00	1,363,100.00	1,496,550.00	1,648,385.00	1,812,763.50

Table 3.6. Five Year Accumulated Manual System Cost, in Baht.

Year	Total Manual System Cost	Accumulated Cost
1	1,239,600.00	1,239,600.00
2	1,363,100.00	2,602,700.00
3	1,496,550.00	4,099,250.00
4	1,648,385.00	5,747,635.00
5	1,812,763.50	7,560,398.50
Total	7,560,398.50	



(2) Cost of Proposed System.

Table 3.7. Computerized System Cost Analysis, in Baht.

Cost items		Years				
		1	2	3	4	5
<b>Fixed Cost</b>						
Hardware Cost:						
Computer Server Cost	1 unit @ 50,000	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Client Machine Cost	5 units @ 30,000	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00
Printer	3 units @ 15,000	9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
UPS 1000 VA	3 units @ 3,000	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00
Total Hardware Cost		50,800.00	50,800.00	50,800.00	50,800.00	50,800.00
Software Cost:						
MS Window XP	1 unit @ 12,000	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00
Windows 2000 Professional	1 unit @ 20,000	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
Ms Visual Basic 6	1 unit @ 15,000	3,000.00	3,000.00	3,000.00	3,000.00	3,000.00
MS SQL Server	1 unit @ 18,000	3,600.00	3,600.00	3,600.00	3,600.00	3,600.00
MS Office 2000	5 units @ 10,000	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Total Software Cost		23,000.00	23,000.00	23,000.00	23,000.00	23,000.00
Implementation Cost:						
Software Development Cost		175,000.00	-	-	-	-
Training Cost		100,000.00	-	-	-	-
Document Cost		50,000.00	-	-	-	-
Total Implementation Cost		325,000.00	-	-	-	-
Maintenance Cost		-	25,000.00	27,500.00	30,250.00	33,275.00
Total Fixed Cost		398,800.00	98,800.00	101,300.00	104,050.00	107,075.00
<b>Operating Cost</b>						
Salary Cost:						
Managing Director	1 person @ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Operation Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Marketing Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Procurement Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Accounting Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Stored Clerks	2 person @ 7,000	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Total Monthly Salary Cost		74,000.00	81,400.00	89,540.00	98,494.00	108,343.40
Total Annual Salary Cost		888,000.00	976,800.00	1,074,480.00	1,181,928.00	1,300,120.80

Table 3.7. Computerized System Cost Analysis, in Baht (Continued).

Cost items		Years				
		1	2	3	4	5
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annual	10,00.00	11,000.00	12,100.00	13,310.00	14,641.00
Paper	Per Annual	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Utility	Per Annual	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Miscellaneous	Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Annual Office Supplies & Miscellaneous Cost		75,000.00	82,500.00	90,750.00	99,825.00	109,807.50
Total Operating Cost		963,000.00	1,059,300.00	1,165,230.00	1,281,753.00	1,409,928.30
Total Computerized System Cost		1,361,800.00	1,158,100.00	1,266,530.00	1,385,803.00	1,517,003.30

Table 3.8. Five Years Accumulated Computerized System Cost, in Baht.

Year	Computerized System Cost	Accumulated Cost
1	1,361,800.00	1,361,800.00
2	1,158,100.00	2,519,900.00
3	1,266,530.00	3,786,430.00
4	1,385,803.00	5,172,233.00
5	1,517,003.30	6,689,236.30
Total	6,689,236.30	

- (3) The Comparison of the System Costs between Computerized System and Manual System.

Table 3.9. Comparison of the System Costs, in Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,239,600.00	1,361,800.00
2	2,602,700.00	2,519,900.00
3	4,099,250.00	3,786,430.00
4	5,747,635.00	5,172,233.00
5	7,560,398.50	6,689,236.30

Accumulated Cost, Baht

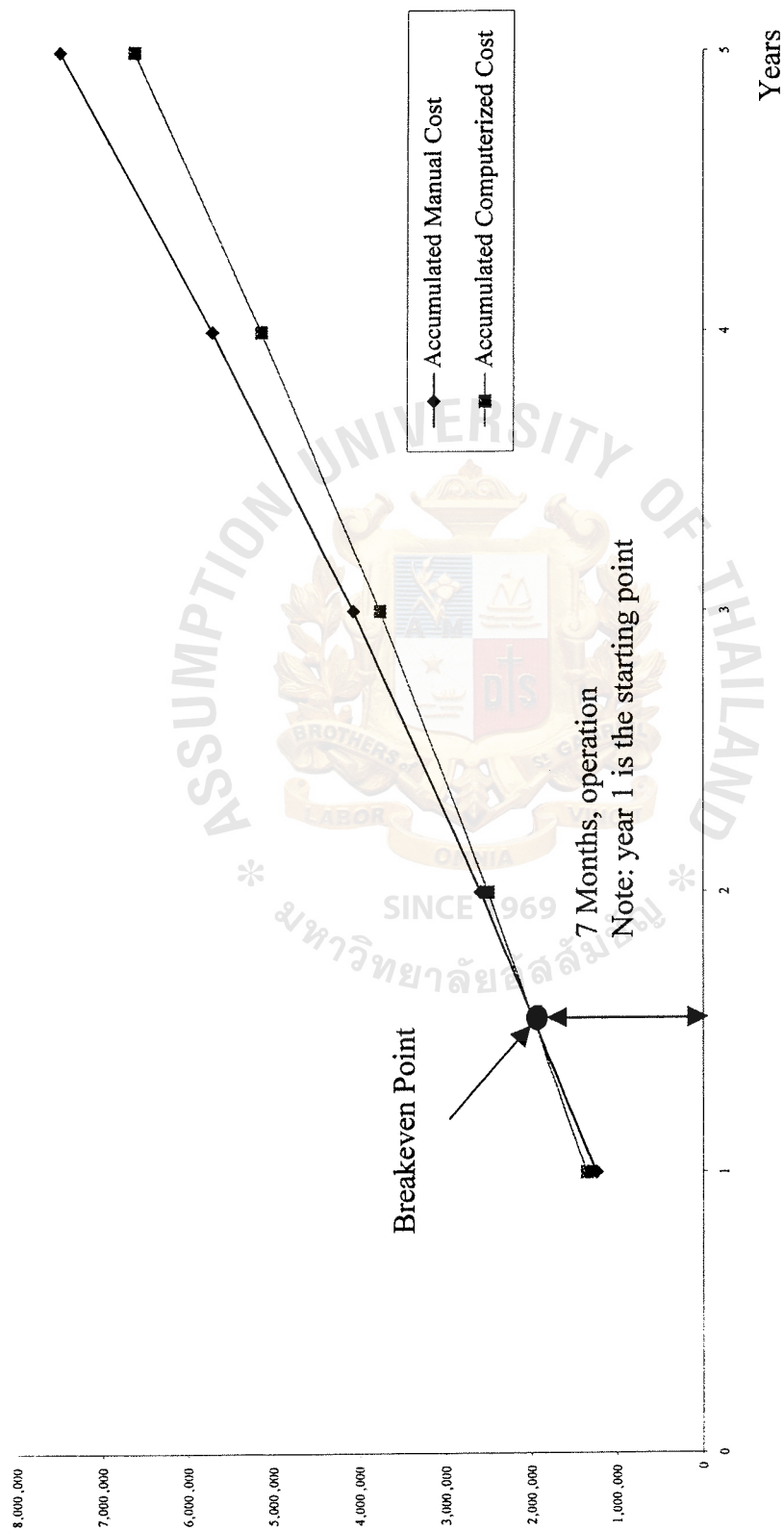


Figure 3.4. Cost Comparison between the Manual and Proposed System

#### (4) Payback Analysis

The following cost items are required as shown in Table 3.10.

##### Investment Cost:

Hardware Cost	245,300 Baht
Software Cost	115,000 Baht
Software development Cost	175,000 Baht
Training Cost	100,000 Baht
Document Cost	50,000 Baht
Total Investment Cost	685,300 Baht

##### Annual Operation Cost:

People-ware Cost	888,000 Baht
Office Supplies & Miscellaneous Cost	75,000 Baht
Total Annual Operating Cost	963,000 Baht

##### Annual Cost:

The formula of annual cost of the Computerized System is

$$\begin{aligned}\text{Annual Cost} &= (\text{Investment Cost/Estimated System Life}) + \\ &\quad \text{Annual Operating Cost} \\ &= (685,300/5) + 963,000 \\ &= 1,100,060 \text{ Baht}\end{aligned}$$

##### Saving:

Staff	252,000 Baht
Office Supplies & Miscellaneous	20,000 Baht
Opportunity Cost & Intangible Benefits	1,250,000 Baht
Total Saving	1,522,000 Baht

Table 3.10. Payback Analysis for the Proposed Books Rental Information System, in Baht.

Cost Item	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development Cost	685,300.00						
Operation and maintenance cost		963,000.00	1,059,300.00	1,165,230.00	1,281,753.00	1,409,928.30	1,550,921.13
Discount factors for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
The adjusted cost (adjusted to present value)	685,300.00	875,367.00	874,981.80	875,087.73	875,437.30	875,565.47	874,719.52
Cumulative time-adjusted costs over lifetime	685,300.00	1,560,667.00	2,435,648.80	3,310,736.53	4,186,173.83	5,061,739.30	5,936,458.82
Benefit derived from operation of new system	-	1,522,000.00	1,674,200.00	1,841,620.00	2,025,782.00	2,228,360.20	2,451,196.22
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted benefits (current of present value)	-	1,383,498.00	1,382,889.20	1,383,056.62	1,383,609.11	1,383,811.68	1,382,474.67
Cumulative time-adjusted benefits over lifetime	-	1,383,498.00	2,766,387.20	4,149,443.82	5,533,052.93	6,916,864.61	8,299,339.28
Cumulative lifetime-adjusted costs benefits	-685,300.00	-177,169.00	330,738.40	838,707.29	1,346,879.10	1,855,125.31	2,362,880.46



Payback period is the commonly used technique to assess the value of investment. Generally, payback period is the period that cash inflows can recover the initial investment within a specified period. To reflect the real value of money, the time value of money concept is also applied in this analysis. The discount rate is required to calculate discount value of all costs and benefits after the first year to the present value at the present year. Then the Payback period is calculated to judge the profitability of the system as shown in Table 3.10. and Figure 3.5.

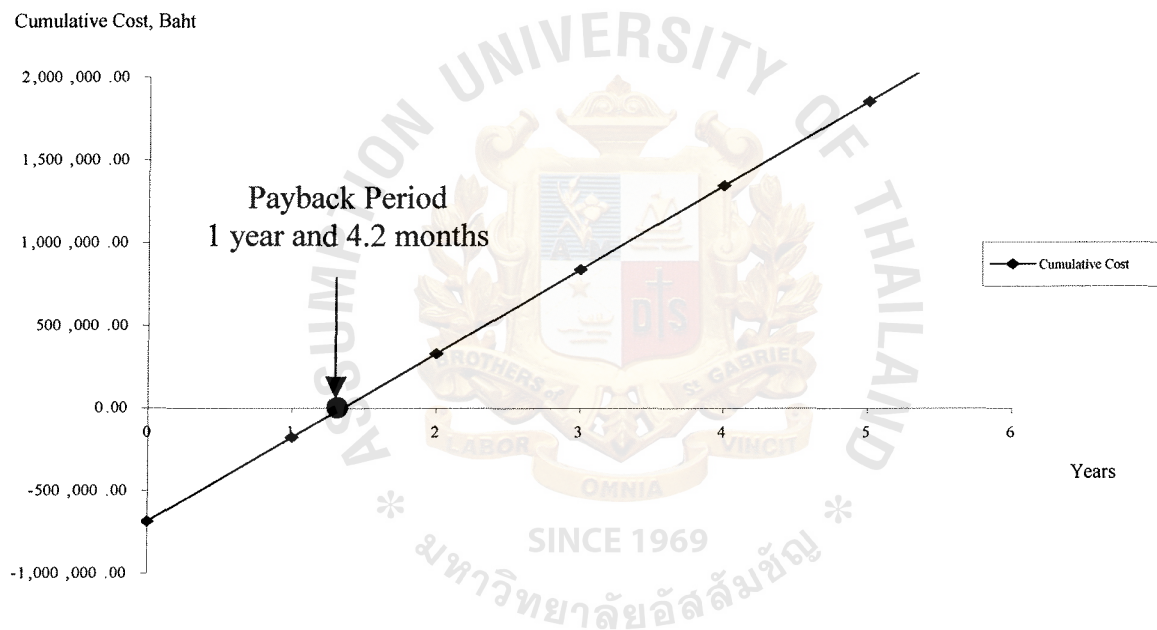


Figure 3.5. Payback Period of Books Rental Information System.

As in Figure 3.5. the graph of cumulative cost of computerized system crosses x-axis at 1.35 years or the payback period of the computerized system is 1 year and 4.2 months.

Moreover, the payback period can be calculated by the formula as follows:

$$P = \frac{\text{Last year of negative Cash flow difference}}{\text{Cumulative different last negative year}} + \frac{\text{Absolute value of cumulate difference (last negative plus first year positive year)}}{\text{Absolute value of cumulate difference (last negative plus first year positive year)}}$$

Where P = Payback Period

$$\begin{aligned} P &= 1 + \{(177,169 / (177,169 + 330,738)\} \\ &= 1.35 \text{ years or 1 year and 4.2 months} \end{aligned}$$

#### (5) Return-on-Investment Analysis (ROI)

Return-on-Investment Analysis technique compares the lifetime profitability of alternative solutions or projects. The ROI for a project is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. The ROI for a potential project is calculated by using the data from Table 3.10. as follows:

$$\text{ROI} = \frac{(\text{Estimated lifetime benefits} - \text{Estimated lifetime costs})}{\text{Estimated lifetime costs}}$$

$$\begin{aligned} \text{ROI} &= ((8,299,339.28 - 5,936,458.82) / 5,936,458.82) \times 100 \\ &= 0.3980 \times 100 \\ &= 39.80\% \end{aligned}$$

Therefore, the lifetime ROI is 39.80 percent. Simple division by the lifetime of the system yields an average ROI of 6.63 percent per year.

### 3.5 Security and Control

The information that is stored in the Books Rental Information System is very important, and it must be provided to many departments. Therefore, the data in the database must always be available to use when needed and a satisfactory level of shared ability must be achieved and unauthorized access must be prevented. The following security should be attained by the proposed system.

- (1) In order to prevent an unauthorized accessing to the system, the login password must be set in the Books Rental Information System.
- (2) Back up file must be done every month in the form of CD-ROM or diskette.
- (3) User profile is needed to exist in the Books Rental Information System to classify the group of user who can read, update, and execute the data in the database.
- (4) Input validation must exist in the Books Rental Information System in each menu screen to prevent the human errors.
- (5) The company should set rules for using the computer to protect physical components as well as the computer system:
  - (a) Virus checking schedule scan must be set at specific times and scan virus for all computers and server weekly.
  - (b) Virus scanning program needs to be updated weekly.
  - (c) Before opening any files from diskette, users have to scan for virus every time.
  - (d) Users are not allowed to fix any hardware of the computer.
  - (e) Users are not allowed to download any program into the computer by themselves.
  - (f) Always shut down the computer properly when not using it.

- (g) Every computer must be connected to U.P.S. and users are not allowed to remove U.P.S. to other places without permission.
- (h) All media such as floppy disk, CD-ROM must be kept in a safe place.
- (i) Air-conditioning must be switched on when the computer is used.
- (j) Do not allow any food and beverage near the computer.
- (k) Smoking near the computer area is prohibited.

In addition to this, there are some general controls to ensure effective operation of programmed procedures. General controls include the following:

- (1) Implementation controls
- (2) Software controls
- (3) Physical hardware controls
- (4) Computer operation controls
- (5) Data file security controls
- (6) Administrative controls (Segregation of functions)

## IV. PROJECT IMPLEMENTATION

### 4.1 Overview of the Project Implementation

System implementation is the conversion processes from a current manual system to the new computerized information system. The implementation process will begin after the top management agrees with the outline of the proposal for the new system and analyze the cost compared with the benefits. The final design should be evaluated first by the users and management teams to assure that the new computerized system can meet the requirements and objectives, and then the other remaining processes will be performed. It is expected that system implementation would take approximately eight weeks. The duration may vary depending on the readiness of the staff to use the new system. The processes of system implementation are:

- (1) Software Development
- (2) Hardware Installation
- (3) Personnel Training
- (4) Testing
- (5) Conversion
- (6) Documentation

### 4.2 Software Development

Software development for the Books Rental Information System of Books 4 Life Co., Ltd. is done as follows:

- (1) Using Microsoft Access as DBMS to develop the Books Rental Information System.
- (2) Designing the software must be based on user friendliness and capability in making reports.



- (3) The system allows users to add, edit, delete the data and also search for the desired data.
- (4) The design software must satisfy user requirements and should be mutually discussed between system analyst and users.
- (5) The system will join table in database file and make the calculation in the required field.

#### **4.3 Hardware Installation**

Hardware installation of the Books Rental Information System of this company will be based on the Cost/Benefit Analysis. The chosen candidate is Candidate 1. The installation is shown in Figure 3.3 that presents the diagram of network of Books Rental Information System.

#### **4.4 Personnel Training**

Training course is a very essential process in system implementation. The objective of training course is to make users understand, be familiar and able to operate the system correctly and use the system effectively. The training course should include computer concepts, functions of hardware and software, functions of the proposed system, how to use the system properly and efficiently and system maintenance. Users should be provided with the system manual, class lecture about the procedure and hands on experience on using new equipment. Moreover, the programmer or system analyst when initially using the system also should supervise and guide the users.

#### **4.5 Testing**

After the system has been designed and installed, module testing, program testing and system testing are required to ensure that the new system is free from errors and work well with other systems in the company.

Module testing would help to check errors in program module. It can detect errors in coding and errors in logic. After finishing all module testing, program testing is used to check the program to verify the way the system works and to check whether the proposed system can share data or work with other manual systems properly. When all testing is finished, testing document plans and results should be made so that when the company has to do the testing again in the future, programmers can use these plans and results to perform the test again. Furthermore, Security and Recovery testing is tested to ensure that the system can protect against unauthorized users from accessing into the system. If failure happens to the database, the system should be able to recover those data.

Effective testing of the program does not guarantee system reliability. Therefore, testing case should include Input Validation, Functionality, and Access Control.

#### **4.6 Conversion**

Conversion is the process of transforming from the existing manual system to the new proposed system. The conversion process is set up based on the replacing concept. Users have to key in the data into the database, and then install the program into the system.

#### **4.7 Documentation**

Documentation of the proposed system is divided into two documents. The first part is user guide, which describes how to access and use the program, how to correct the problems and how to use interface screens. The second part is the flow of the system and data dictionary. Both documents can assist the users whenever they need to operate the program or when they confront with problems and also can help the programmer to develop and maintain the system.

## **V. CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Conclusions**

“Books 4 Life” books rental stores provide a variety of books for rent. Its goal is to maximize the renting volume. The company is not satisfied with the current manual system and it looks for an effective and efficient automated system. This project is done as an alternative solution for expanding books rental stores to serve the customers with more satisfaction.

After defining business functions by constructing the data flow diagrams of the existing system, there appeared to be problems. Major problems are time consumption in operations, large volume of paper work, lack of inventory control and ineffectiveness in retrieving information. The problem of time consumption occurs when the staff manages the documents inefficiently. Especially, when there is a lot of paper work, they need an organized plan. The problem of lack of inventory control occurs when the staff does not have a good management of books but instead just put them on the shelves. The problem of retrieval of information occurs when all information is kept on paper. When the date is due, nobody checks it.

Instead of increasing more workers to solve the problem, the company changes the manual system to a computerized system. This Books Rental Information System is a computerized system that can reduce time in data processing, and data storing and provide timely and reliable information for management. Areas to be improved may cover operations to which database management is related. With the database, it can record all customer information and rental information in files. It is easy to retrieve or search the data by a primary key. The automated system shows the necessary information to the users when needed. These problems cause difficulties in good

services for customers. Therefore, the new system design will perform its activities, which are best suited to the user's requirement with data dictionaries, DFD and a user manual. Hardware and software requirements are modified to utilize the resources. New hardware or equipment is needed, including an operating system and application software, which supports the proposed system.

The cost and benefit analysis shows a payback period of 1 year 4.2 months and the break-even at 7 months. After that the cost of proposed system tends to decrease while the cost of the existing system tends to increase every year. Since the proposed system means a direct changeover from the old system, the staff will be trained for a period of time. It must consider the effectiveness of the new system by using a feasibility analysis according to user requirements. Feasibility analysis would provide a clear picture whether the new system would be more efficient than the existing manual system and show the benefits. The deliverables of the project are user-interface, reports and database. The following are the results of improvement in the new system:

- (1) Eliminate redundancy problems in work processing
- (2) Improve user satisfaction with the inquiry system
- (3) Increment data consistency and correctness
- (4) Reduce time consumption
- (5) Increase efficiency and decision making based on statistical reports

Table 5.1 shows the time taken on each process with the proposed system compared to the existing system. It also indicates that most processes of the proposed system spend less time than the existing system. Therefore, we can conclude that the proposed system has a more efficient database to support each process. Hence, it is easy to access and inquire data from the system including reduction of human errors.

Table 5.1 Degree of Achievement of the Proposed Computerized System.

Process	Existing System	Computerized System
Membership Application Process	15 Minutes	5 Minutes
Rental Transaction Process	10 Minutes	2 Minutes
Return Transaction Process	10 Minutes	2 Minutes
Inquiry Process	15 Minutes	1 Minute
Collect the fee Process	10 Minutes	1 Minute
Modification Process	15 Minutes	3 Minutes
Update Process	15 Minutes	3 Minutes

## 5.2 Recommendations

The new system has a wide scope and can be implemented by all books rental stores. Expansion of the system can be made further as well. Further development recommended for this system is divided by functions

### (1) Membership function

To further develop the functions to get faster access, membership cards may be changed into a magnetic card so that the staff can avoid making mistakes by wrong typing of the member's ID and this can reduce the steps in processing. The second choice for membership card is to use a bar code instead because the bar code can include time, date and vocational data in addition to identification data. This information is useful for analyzing the movement of items and determining what has happened during rent and return processes.



(2) Rental function

Similar to the membership function, we can also use bar codes to record the return and rental transactions, which will reduce data processing time. We should consider selling second hand books at reasonable prices to customers who want to purchase the items.

(3) Customer service function

To improve customer service, the books rental store can offer the customers periodic promotion to boost up the rent volume. It also can have phone services for those who want to make reservations for wanted items or can inquire about availability of books.

(4) Statistics function

Statistical reports for top rented books and categories for each period of time should be implemented with the use of questionnaire forms along with other reports such as graphs and figures so that the manager can make decisions easily to put more of those books on the shelves during suitable periods.

In addition, the system developed in this project still needs ongoing development, revision and modification similar to any other software system to meet future user's requirements. The improvement could be done in areas such as user inquiry and frequency for the report required. Further ongoing development in this system may be done in case of change in management policies, procedures, controls or operating system. In the future, the barcode system is recommended for membership cards and inventory control. Developing web-based information is also a good solution for the future.



Table A.1. Structure of Member Table

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	MemberID	Text(7)	Y	Y				Primary Key
2	MbTypeID	Text(4)						Attribute
3	MbDeposit	Number(Single)						Attribute
4	MbSince	Date/Time						Attribute
5	MbRenewDate	Date/Time						Attribute
6	MbExpDate	Date/Time						Attribute
7	MbNameTitle	Text(15)						Attribute
8	MbName	Text(30)						Attribute
9	MbLastName	Text(30)						Attribute
10	MbGender	Text(1)						Attribute
11	MbBirthDate	Date/Time						Attribute
12	MbAddress	Text(255)						Attribute
13	MbProvince	Text(4)						Attribute
14	MbzipCode	Text(5)	Y					Attribute
15	MbPhone	Text(9)						Attribute
16	MbMobile	Text(9)						Attribute
17	MbPicture	Text(30)						Attribute
18	MbIDCardNum	Text(15)	Y					Attribute

Table A.2. Structure of Rental and Return Table

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	MemberID	Text(7)	Y	Y		Member		Primary Key
2	RentID	Text(10)	Y	Y				Attribute
3	BookID	Text(10)	Y	Y				Attribute
4	RentDate	Date/Time					>1-Jan-01	Attribute
5	ReturnDate	Date/Time					>1-Jan-01	Attribute
6	IsDeposit	Yes/No						Attribute

Table A.3. Structure of Account Receivable Table

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	AccRno	text(10)	Y	Y				Primary Key
2	Date	Date/Time						Attribute
3	DueDate	Date/Time						Attribute
4	ReturnDate	Date/Time					>1-Jan-01	Attribute
5	MemberID	Text(7)	Y	Y		Member		Attribute
6	TotalCharge	Integer						Attribute

Table A.4. Structure of Suppliers Table

No.	Field Name	Field Type	Index	Unique	Null able	Foreign Key to table	Check	Key Type
1	SupID	text(10)	Y	Y				Primary Key
2	SupName	text(30)						Attribute
3	SupAdd	text(100)						Attribute
4	SupTel	text(9)						Attribute
5	SupFax	text(9)						Attribute
6	SupEmail	text(20)			Y			Attribute

Table A.5. Structure of Account Payable Table

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	AccPno	text(10)	Y	Y				Primary Key
2	Date	Date/Time						Attribute
3	SupID	text(10)	Y	Y		Suppliers		Attribute
4	BookID	Text(10)	Y	Y		Book		Attribute



Table A.6. Structure of Book Table

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	BkID	text(10)	Y	Y				Primary Key
2	BkTitleID	text(7)	Y					Attribute
3	BkCopyNum	text(3)	Y					Attribute
4	Bkstatus	text(4)						Attribute
5	BkTypeID	text(4)	Y					Attribute
6	BkTitle	text(50)						Attribute
7	BkISBN	text(10)						Attribute
8	BkPress	text(50)						Attribute
9	BkAuthor	text(50)						Attribute
10	BkTrans	text(50)						Attribute
11	BkPicture	text(30)						Attribute
12	BkTotal	Number(integer)						Attribute
13	BkRented	Number(Byte)						Attribute
14	BkDamaged	Number(Byte)						Attribute
15	BkMaxDayRent	Number(Byte)						Attribute
16	BkPrice	Number(Single)						Attribute
17	BkDeposit	Number(Single)						Attribute
18	BkRentFee	Number(Single)						Attribute
19	BkFineRate	Number(Single)						Attribute
20	BkIncome	Number(Single)						Attribute

Table A.7. Structure of Inventory Table

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	InvID	text(10)	Y	Y				Primary Key
2	DateRev	Date/Time						Attribute
3	BkPrice	Number(Single)						Attribute
4	BookID	Text(10)	Y	Y		Book		Attribute

Table A.8. Structure of Employee Table

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	EmpID	text(10)	Y	Y				Primary Key
2	EmpName	Text(30)						Attribute
3	EmpLastName	Text(30)						Attribute
4	EmpGender	Text(1)						Attribute
5	EmpBirthDate	Date/Time						Attribute
6	EmpAddress	Text(255)						Attribute
7	EmpProvince	Text(4)						Attribute
8	EmpzipCode	Text(5)	Y					Attribute
9	EmpPhone	Text(9)						Attribute
10	EmpMobile	Text(9)						Attribute
11	EmpPicture	Text(30)						Attribute

Table A.9 Structure of Purchase Order Table

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to table	Check	Key Type
1	PoID	text(10)	Y	Y				Primary Key
2	PoDate	Date/Time						Attribute
3	BkPrice	Number(Single)						Attribute
4	BookID	Text(10)	Y	Y		Book		Attribute
5	BkTitle	text(50)						Attribute
6	SupID	text(10)	Y	Y		Suppliers		Attribute
7	Qty	Integer						Attribute
8	UnitPrice	Integer						Attribute
9	TotalPrice	Integer						Attribute
10	PymtTerm	text(10)						Attribute



## APPENDIX B

### DATA DICTIONARY

Table B.1. Data Dictionary For Member.

Field Name	Description
MemberID	Identification number of Member
MbTypeID	Identification number of Member Type
MbDeposit	Cost of Deposit book
MbSince	Start date of Member
MbRenewDate	Renewable Date of Member
MbExpDate	Expired Date of Member
MbNameTitle	Name Title of Member e.g. Mr.,Mrs,Ms.
MbName	Name of Member
MbLastName	Last Name of Member
MbGender	Gender of Member
MbBirthDate	Birth date of Member
MbAddress	Address of Member
MbProvince	Province where the member lives
MbzipCode	Zipcode where the member lives
MbPhone	Telephone Number of member
MbMobile	Mobile Number of Member
MbPicture	Picture of Member
MbIDCardNum	Identification number card for member

Table B.2. Data Dictionary for Rental and Return Table.

Field Name	Description
MemberID	Identification number of Member
RentID	Identification number of Rent
BookID	Identification number of Book
RentDate	Date of Rent
ReturnDate	Date of Return

Table B.3. Data Dictionary for Account Receivable Table.

Field Name	Description
AccRno	Account Receivable Number
Date	Date of issue account receivable
DueDate	Due date of return book
ReturnDate	Date of return book
MemberID	Identification number of Member
TotalCharge	Total fee charge of book rent



Table B.4. Data Dictionary for Suppliers Table.

Field Name	Description
SupID	Identification number of Supplier
SupName	Name of Supplier
SupAdd	Address of Supplier
SupTel	Telephone Number of supplier
SupFax	Fax Number of supplier
SupEmail	E-mail of Supplier

Table B.5. Data Dictionary for Book Table.

Field Name	Description
BookID	Identification number of Book
BkTitleID	Identification number of Book Title
BkCopyNum	Number of Book copy
Bkstatus	Book Status
BkTypeID	Identification number of Book Type
BkTitle	Titles of book
BkISBN	ISBN number of book
BkPress	Press of Press
BkAuthor	Author of book
BkTrans	Name of transliterated book
BkPicture	Picture of book
BkTotal	Total number of book
BkRented	Number of book rented
BkDamaged	Number of book damaged
BkMaxDayRent	The maximum day of book rented
BkPrice	Price of book
BkDeposit	Rate of deposit book
BkRentFee	Rate of book rental fee
BkFineRate	Rate of book fine
BkIncome	Income of book

Table B.6. Data Dictionary for Account Payable Table.

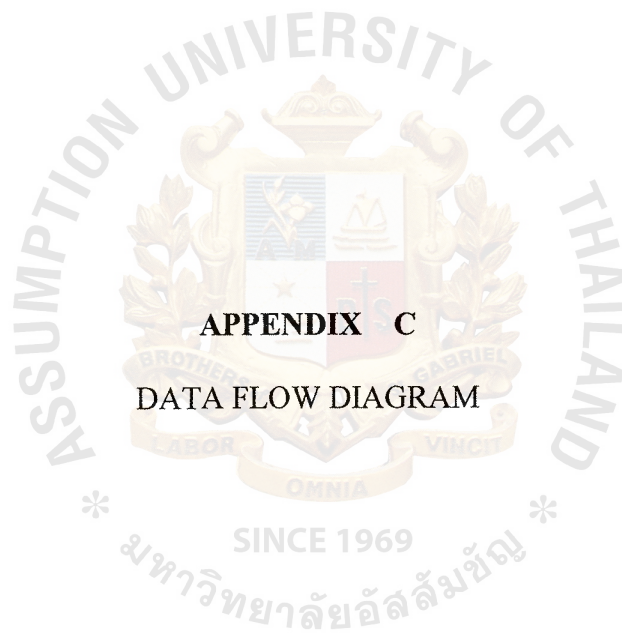
Field Name	Description
AccPno	Number of account payable
Date	Date of transaction
SupID	Identification number of Supplier
BookID	Identification number of Book

Table B.7. Data Dictionary for Employee Table.

Field Name	Field Type
EmpID	Identification number of Employee
EmpName	Name of Employee
EmpLastName	Last name of Employee
EmpGender	Gender of Employee
EmpBirthDate	Birth day of Employee
EmpAddress	Address of Employee
EmpProvince	Province of Employee
EmpzipCode	Zip code of Employee
EmpPhone	Telephone number of Employee
EmpMobile	Mobile number of Employee
EmpPicture	Picture of Employee

Table B.8. Data Dictionary for Purchase Order Table.

Field Name	Field Type
PoID	Identification number of Purchase Order
PoDate	Date of Purchase Order
BkPrice	Price of book
BookID	Identification number of Book
BkTitle	Title of book
SupID	Identification number of Supplier
Qty	Quantity
UnitPrice	Unit of Price
TotalPrice	Total Price
PymtTerm	Payment Term



**APPENDIX C**

**DATA FLOW DIAGRAM**

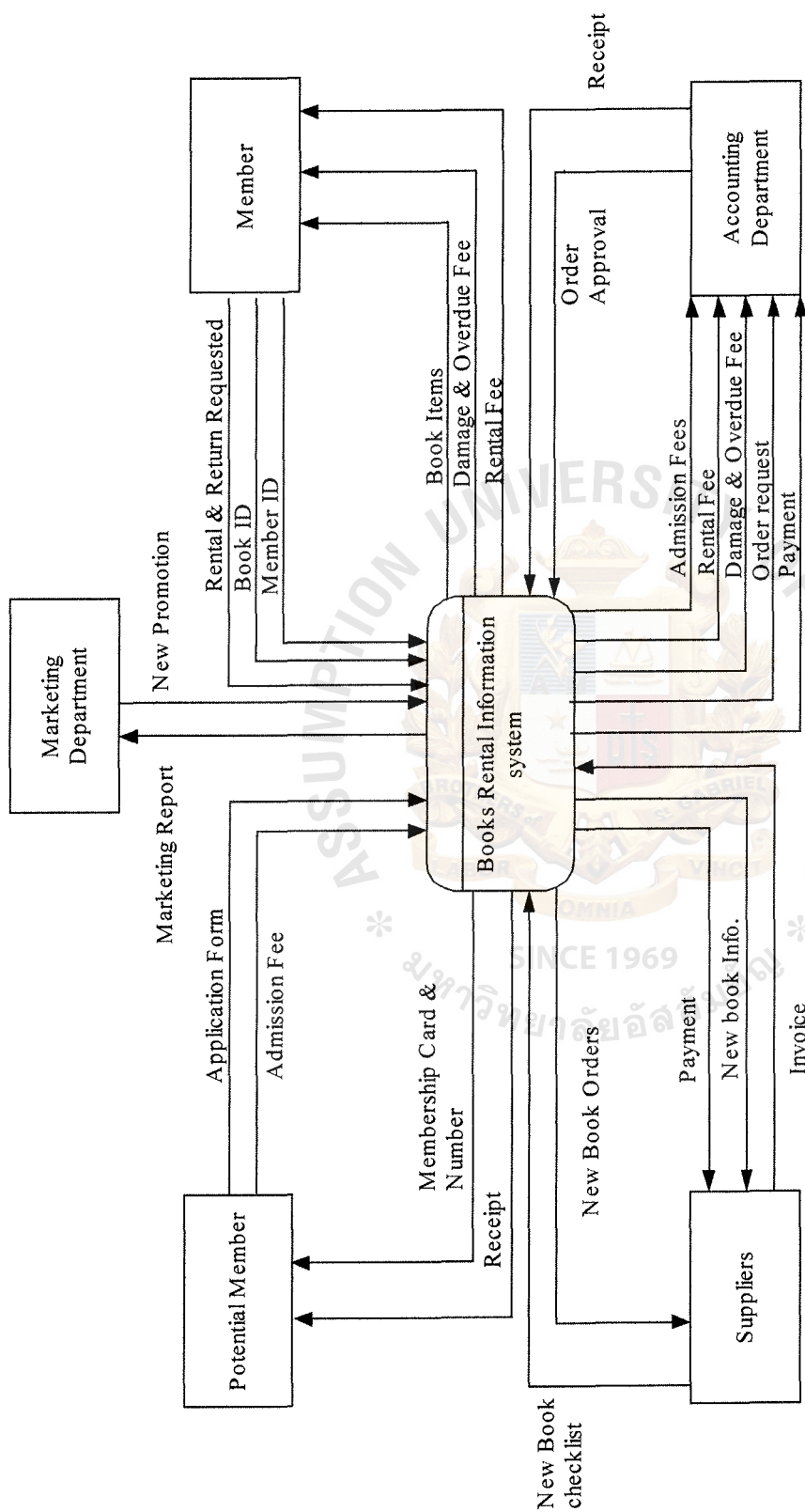


Figure C.1. Context Data Flow Diagram of the Proposed System.

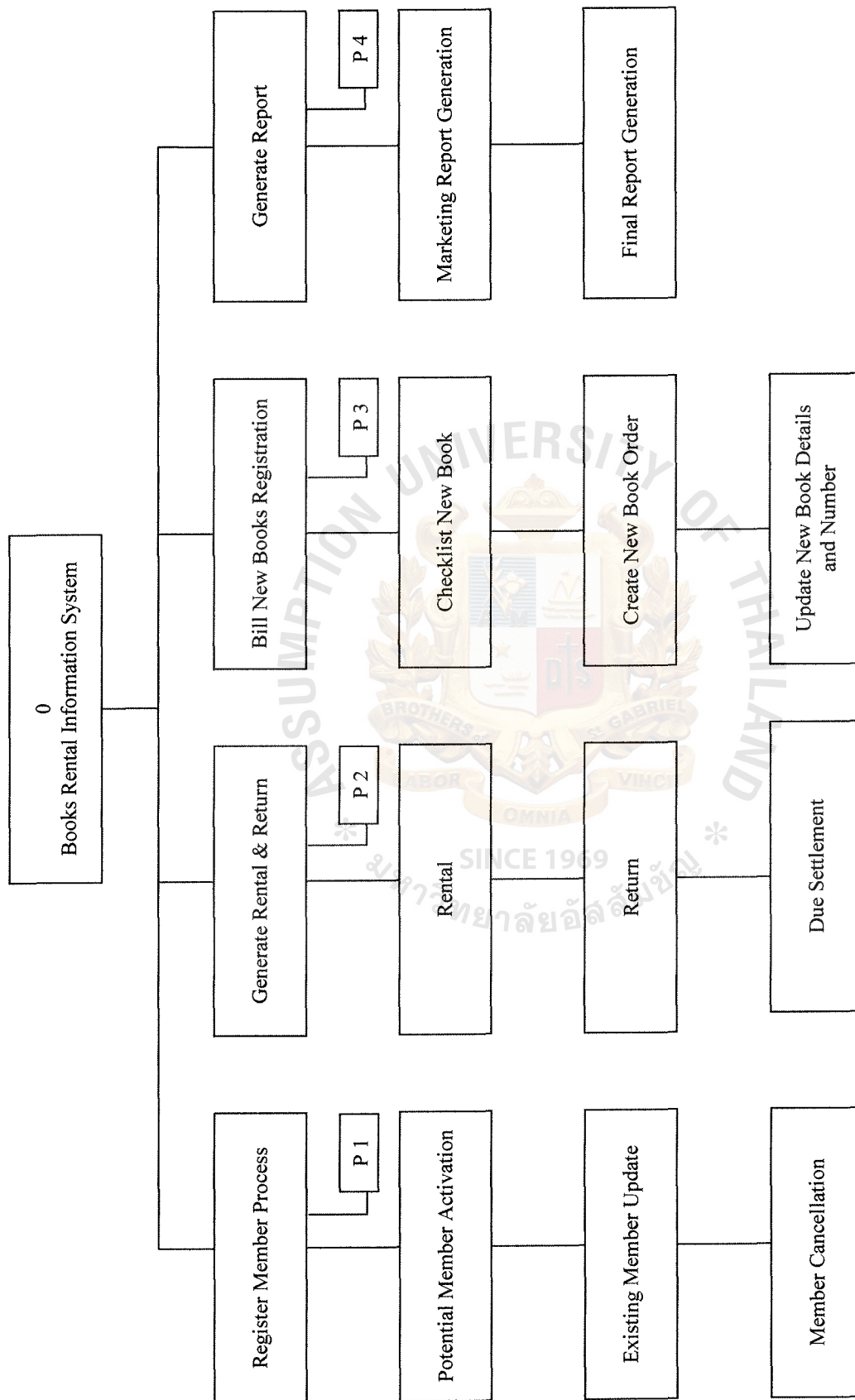


Figure C.2. Functional Decomposition Diagram.





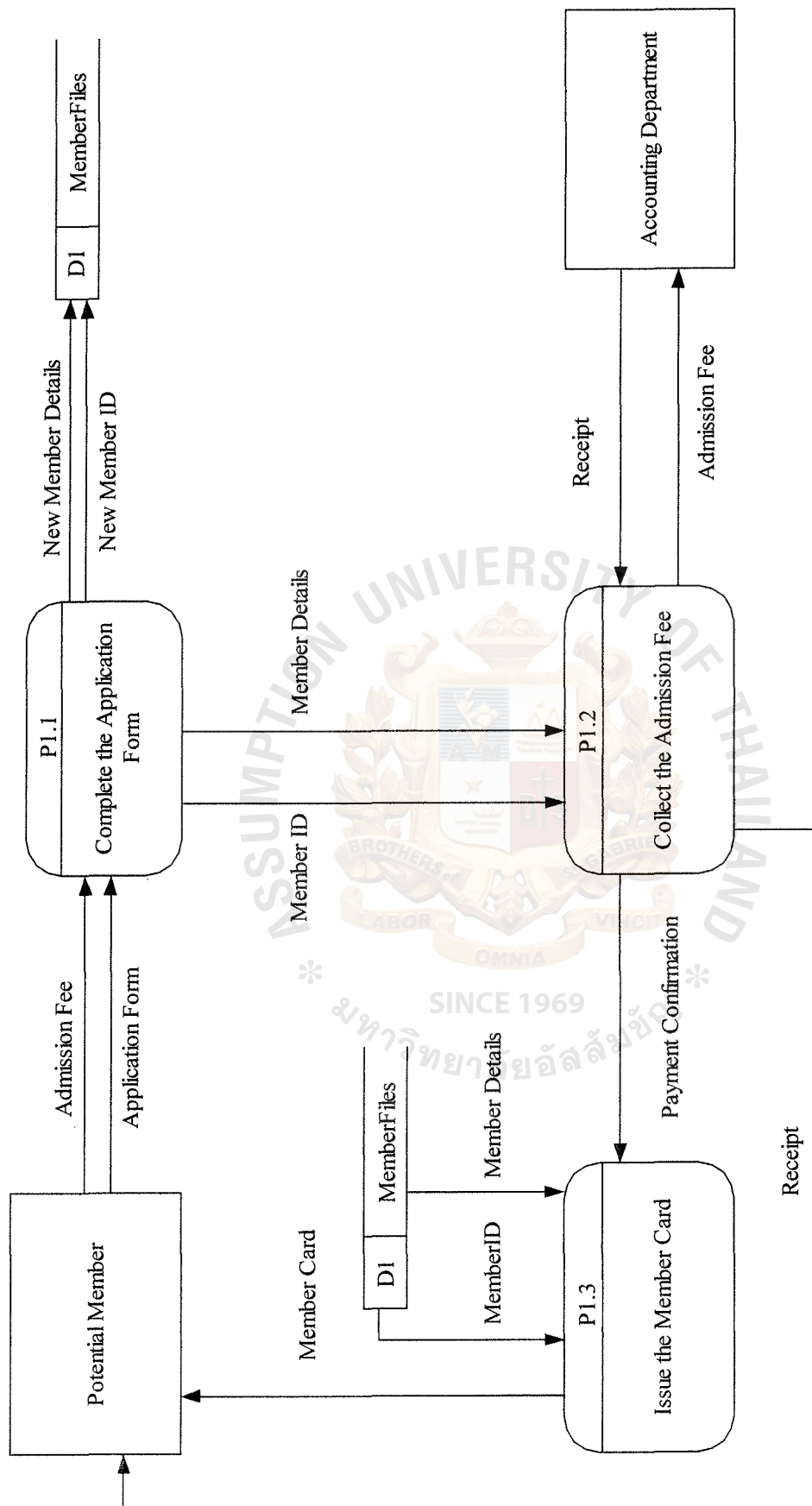


Figure C.4. Data Flow Diagram Level 1 of Register Member Process of the Proposed System.

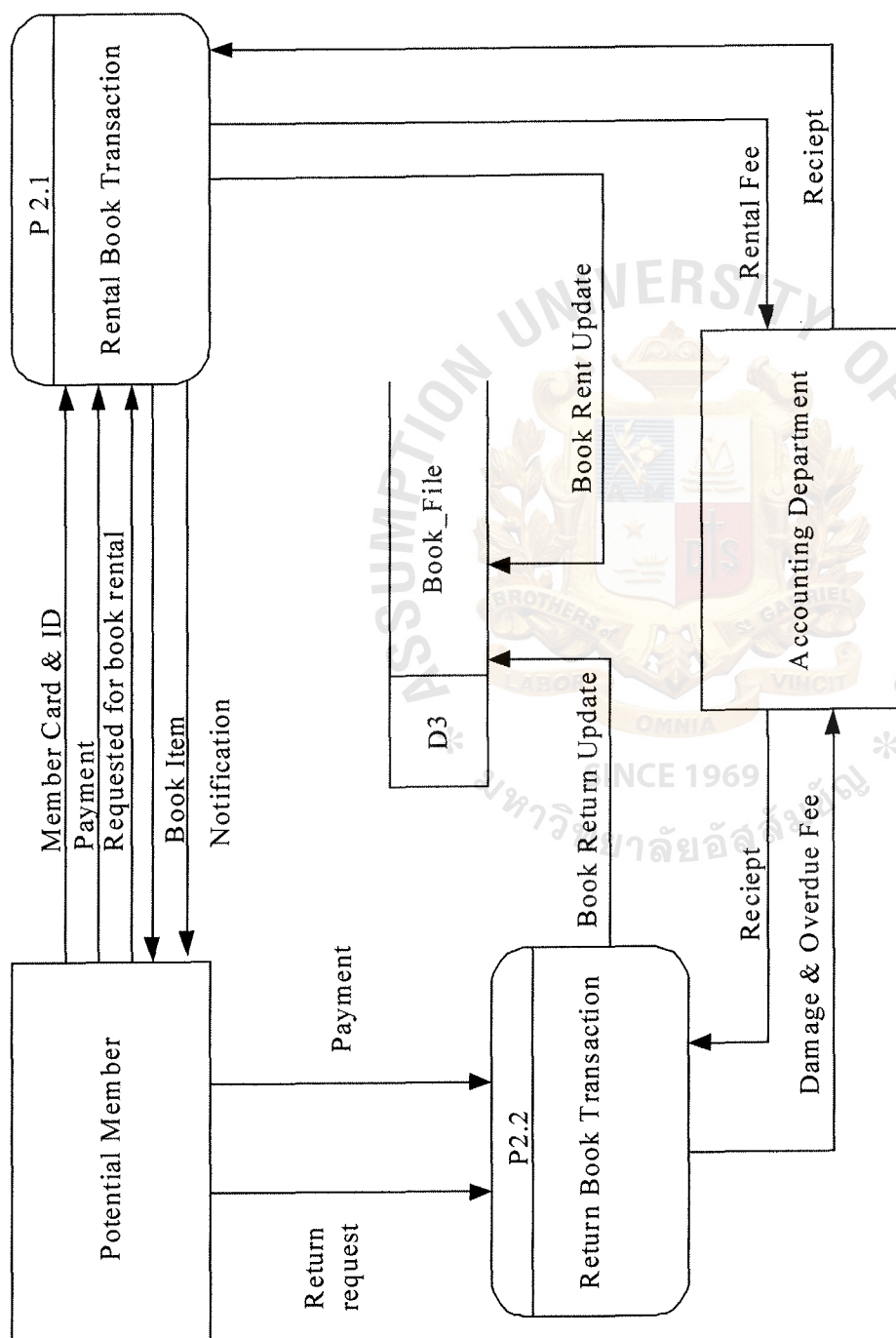


Figure C.5. Data Flow Diagram Level 1 of Rental & Return Process of the Proposed System.

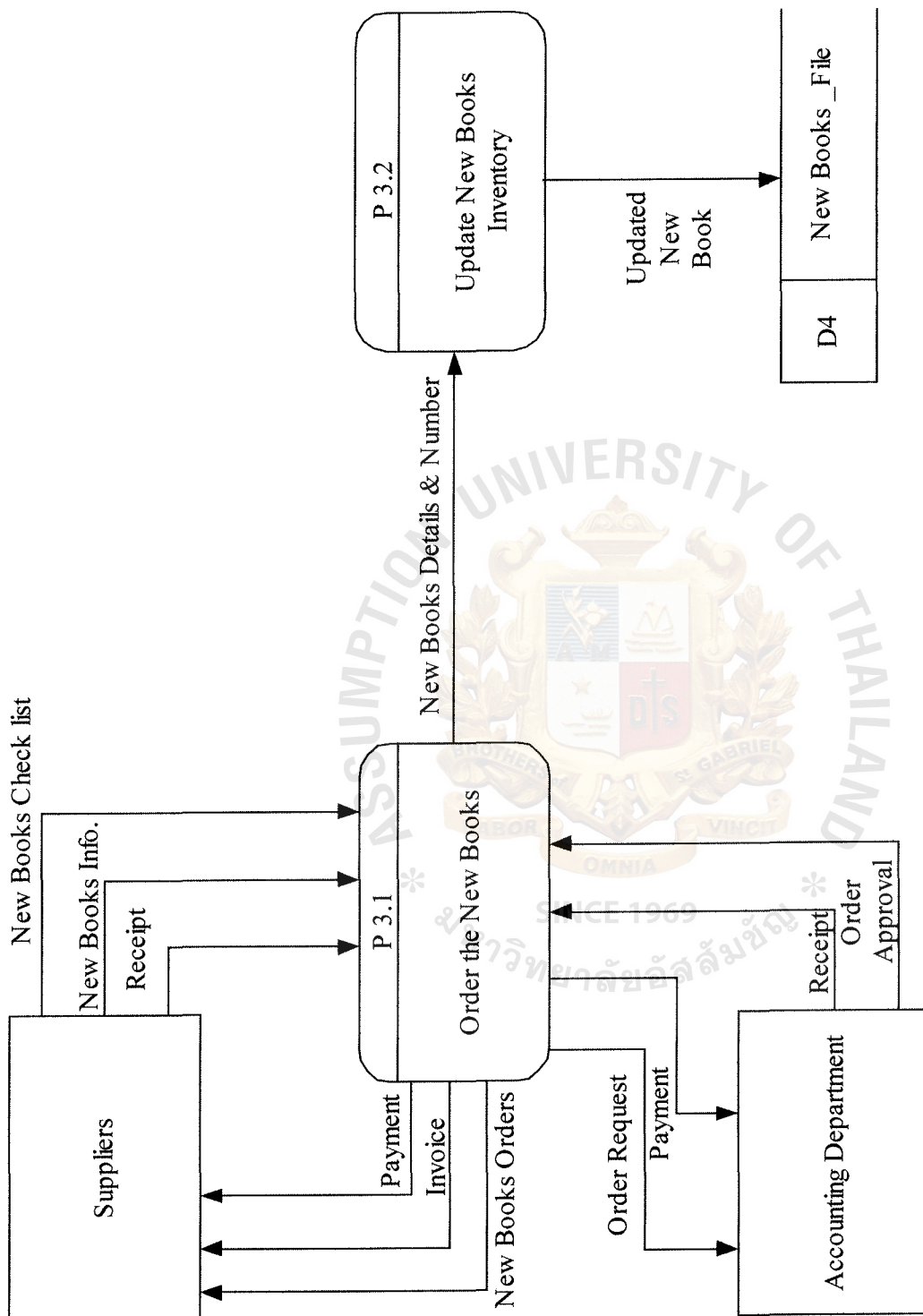


Figure C.6. Data Flow Diagram Level 1 of Edit New Book Registration Process of the Proposed System.

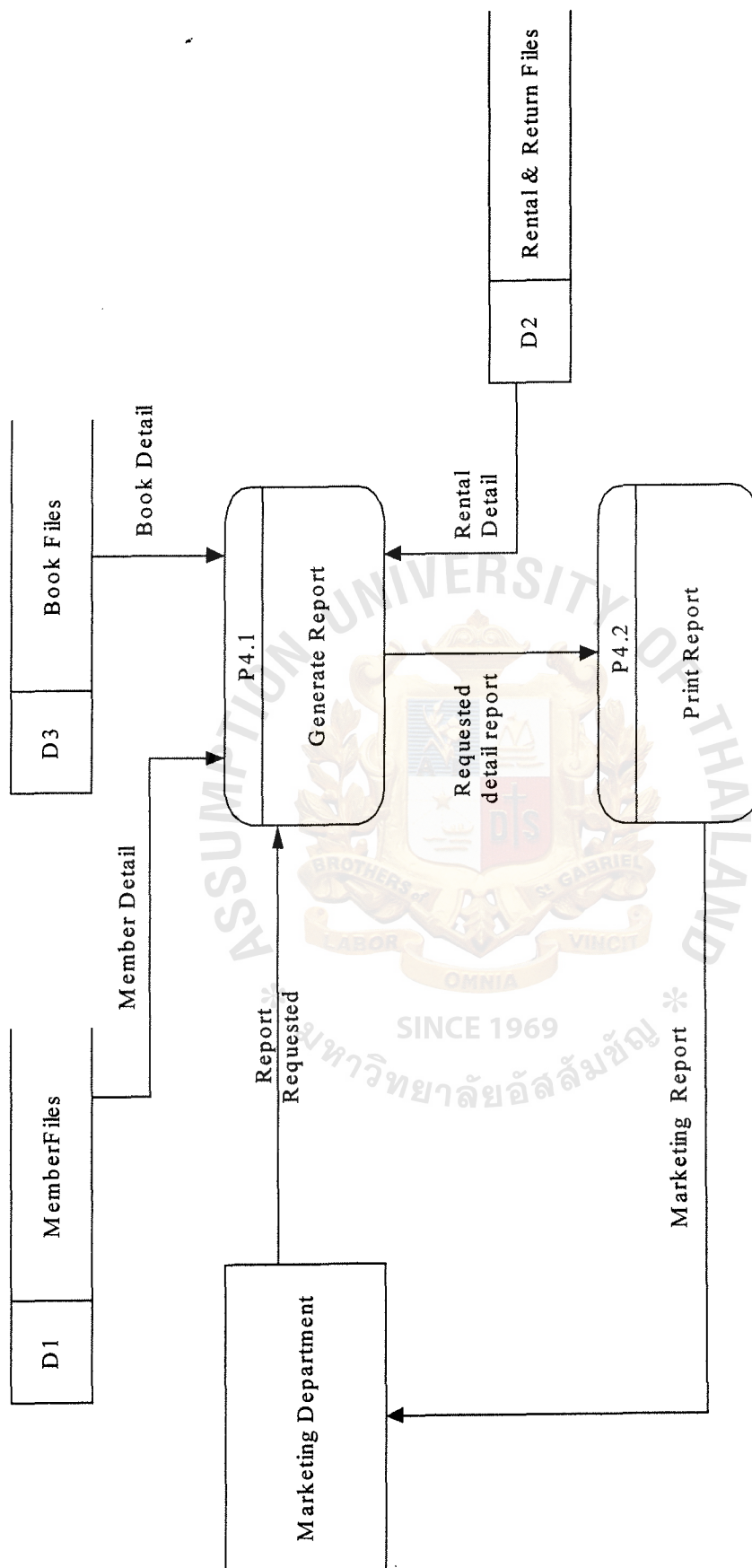


Figure C.7. Data Flow Diagram Level 1 of Generate Report Process of the Proposed System.



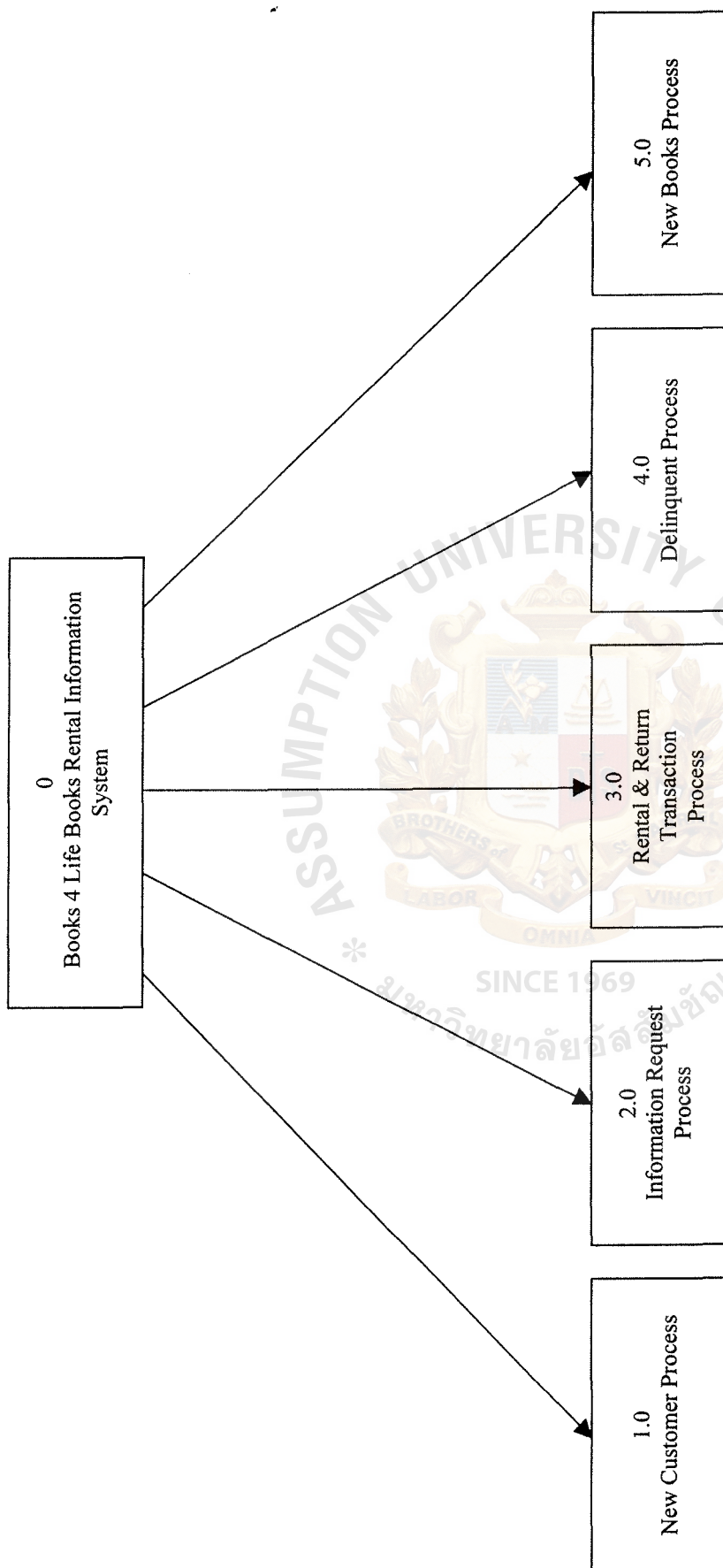


Figure C.8. Structure Chart of Books 4 Life Books Rental Information System.

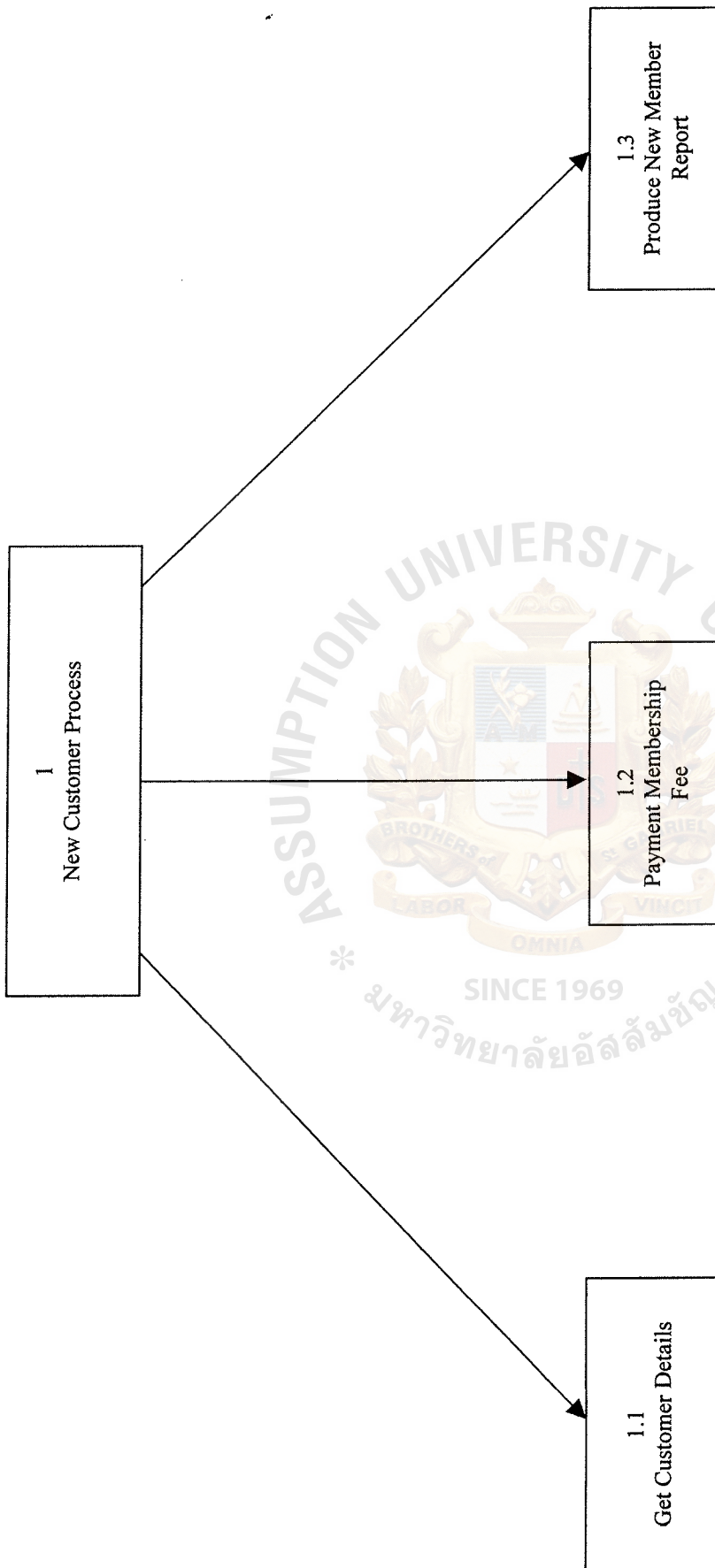


Figure C.9. Structure Chart of Request Information Process.

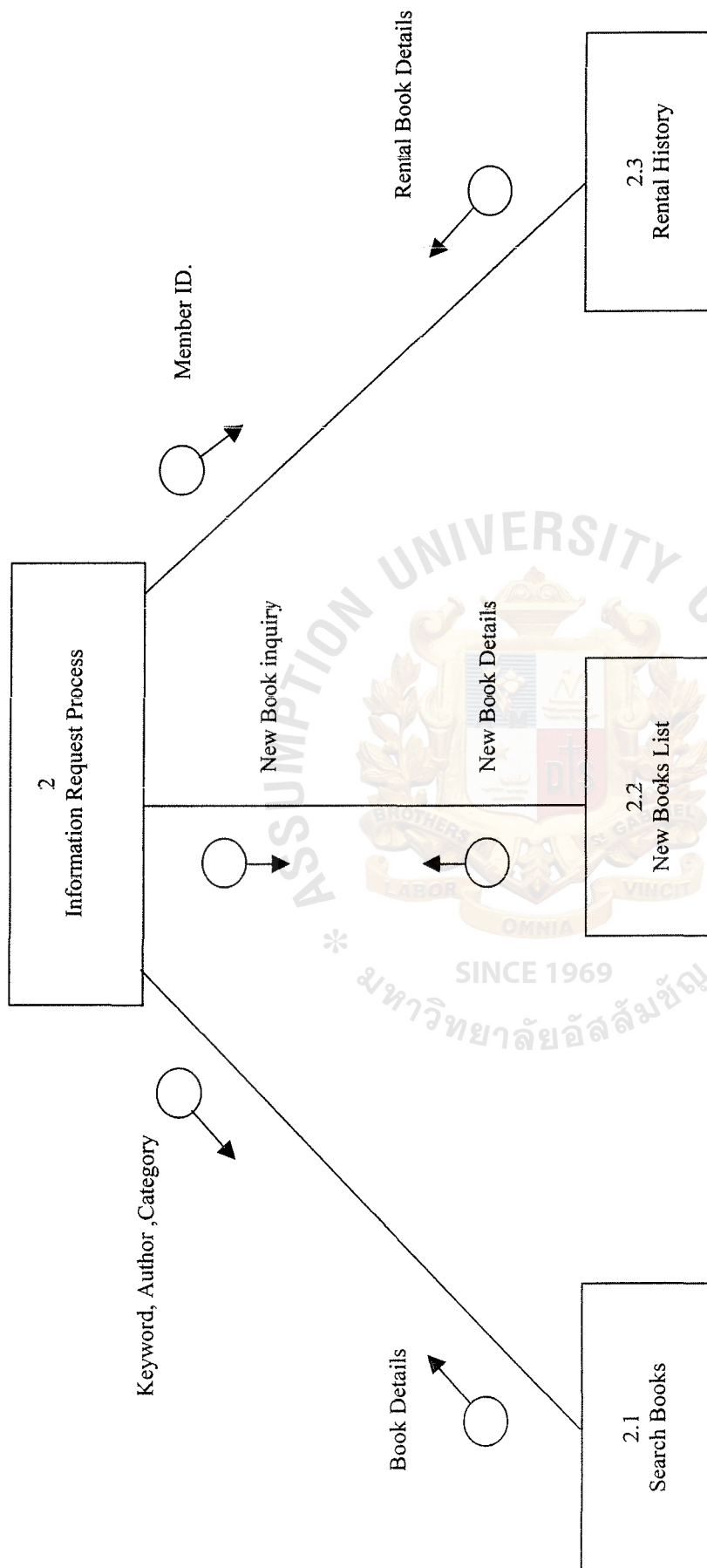


Figure C.10. Structure Chart of Request Information Process.

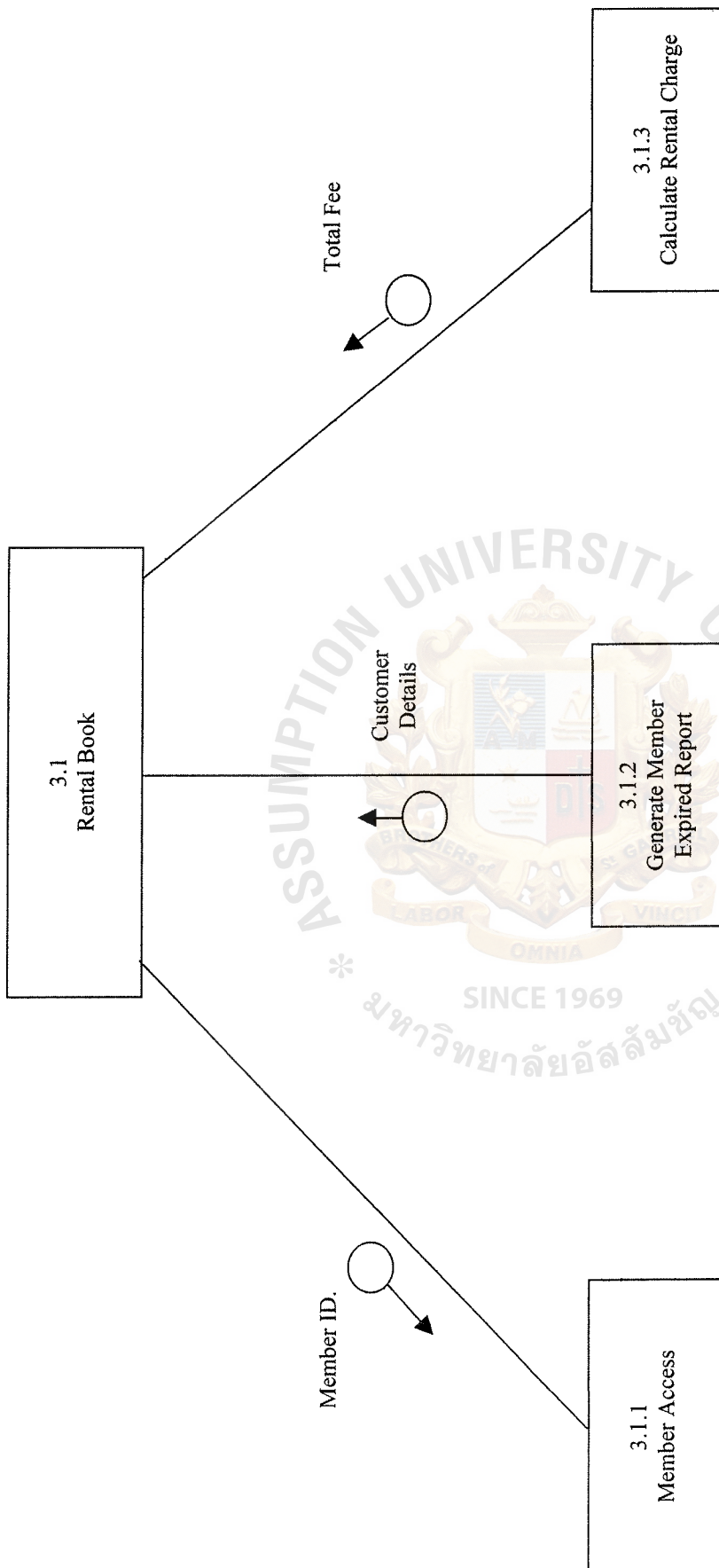


Figure C.11. Structure Chart of Rental Book Process.

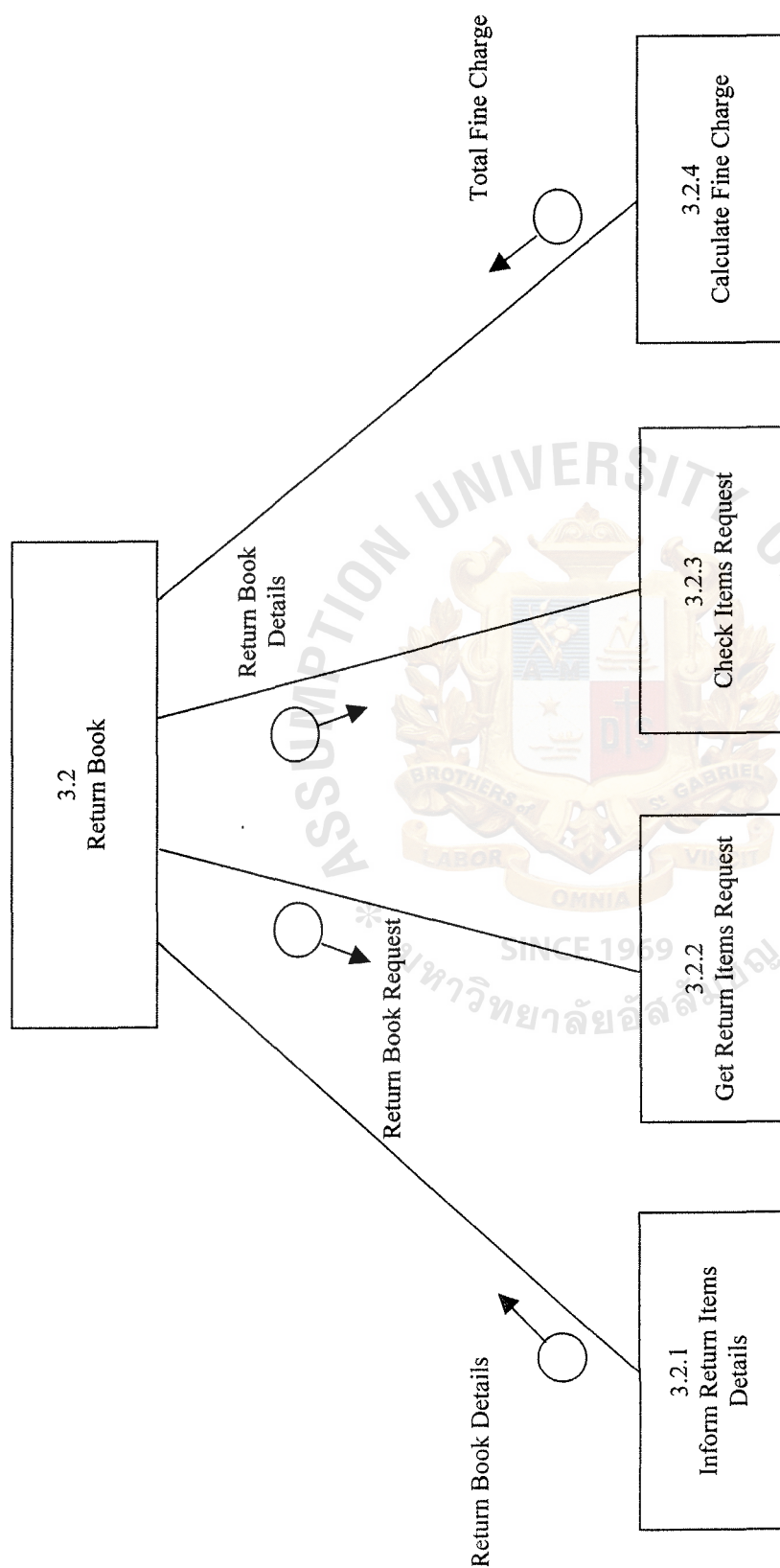


Figure C.12. Structure Chart of Return Book Process.



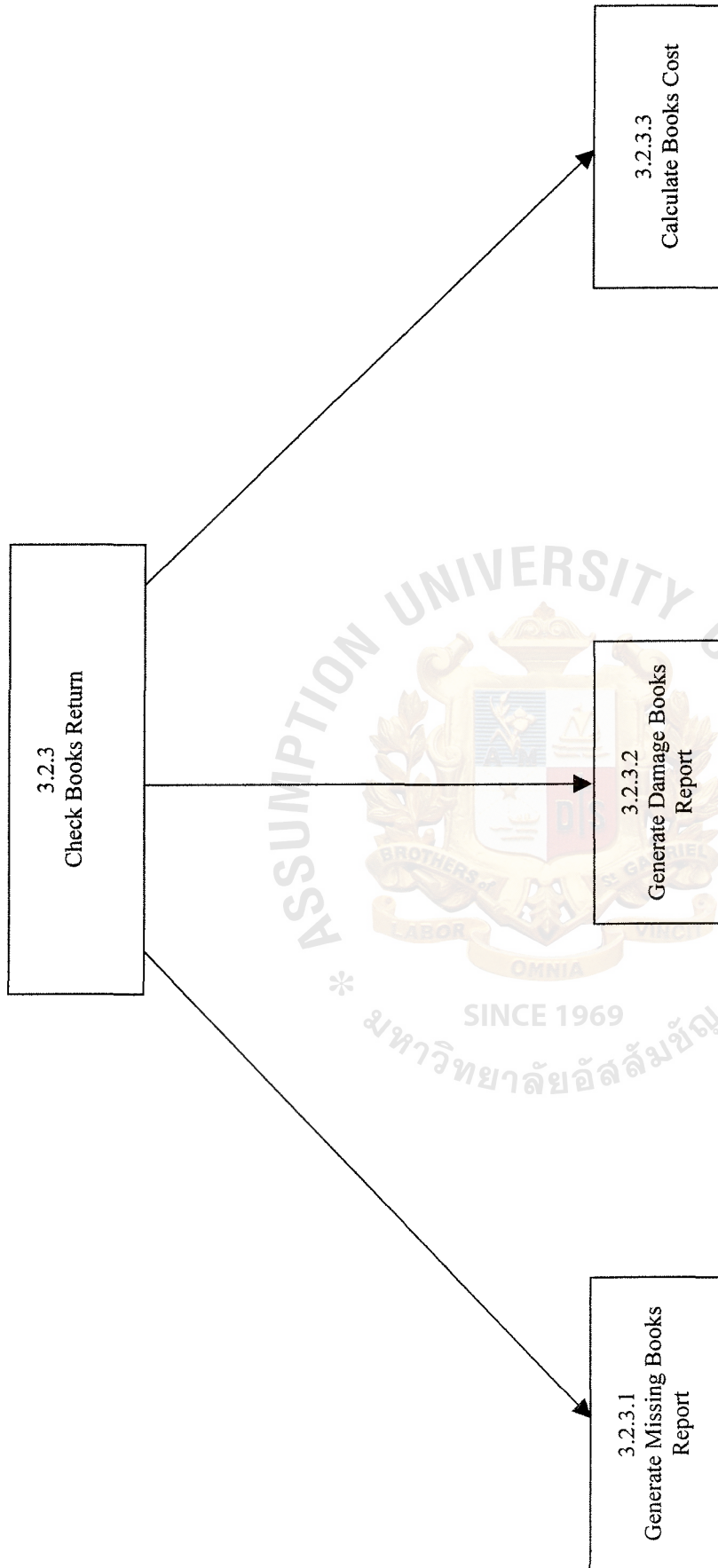


Figure C.13. Structure Chart of Check Book Return Process.

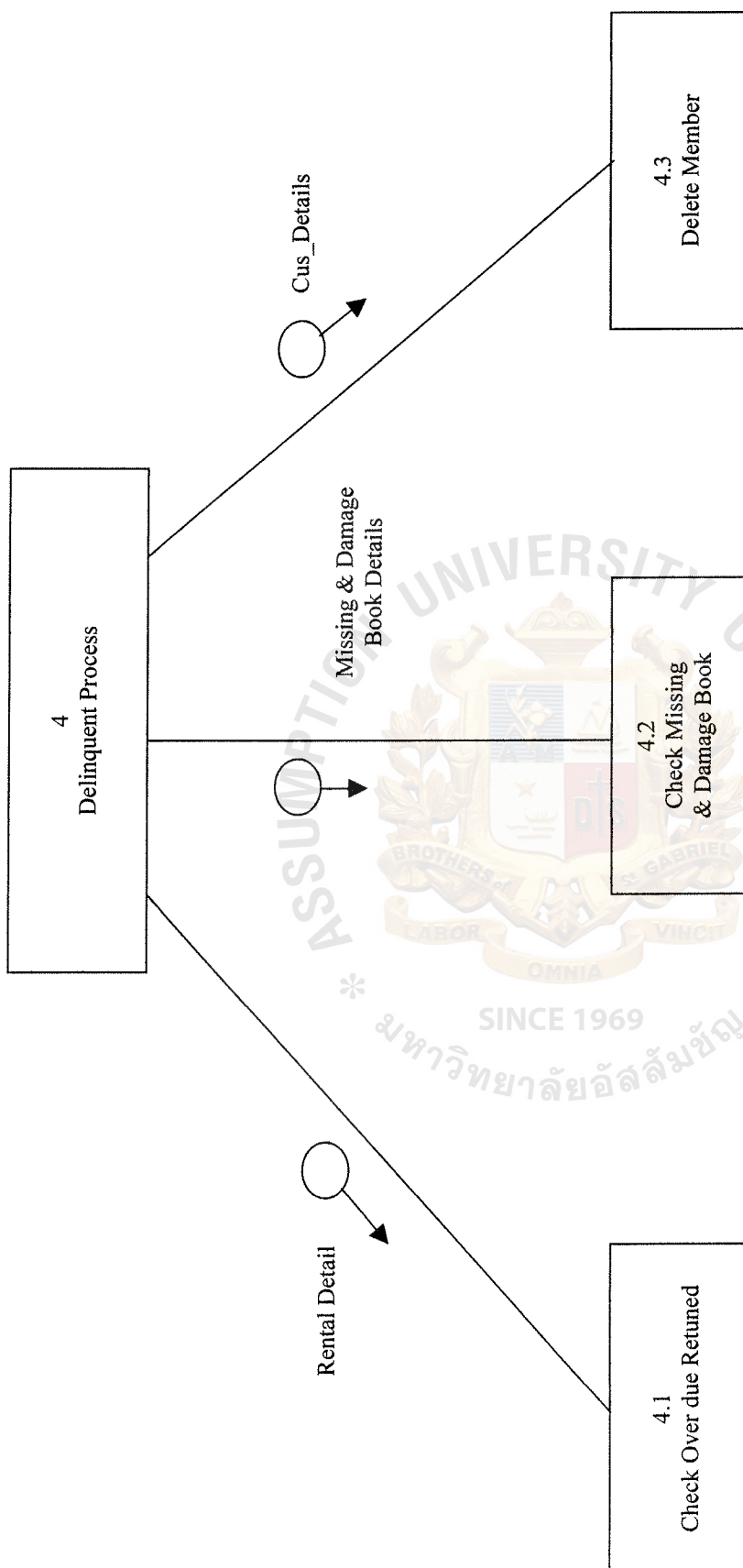


Figure C.14. Structure Chart of Delinquent Process.

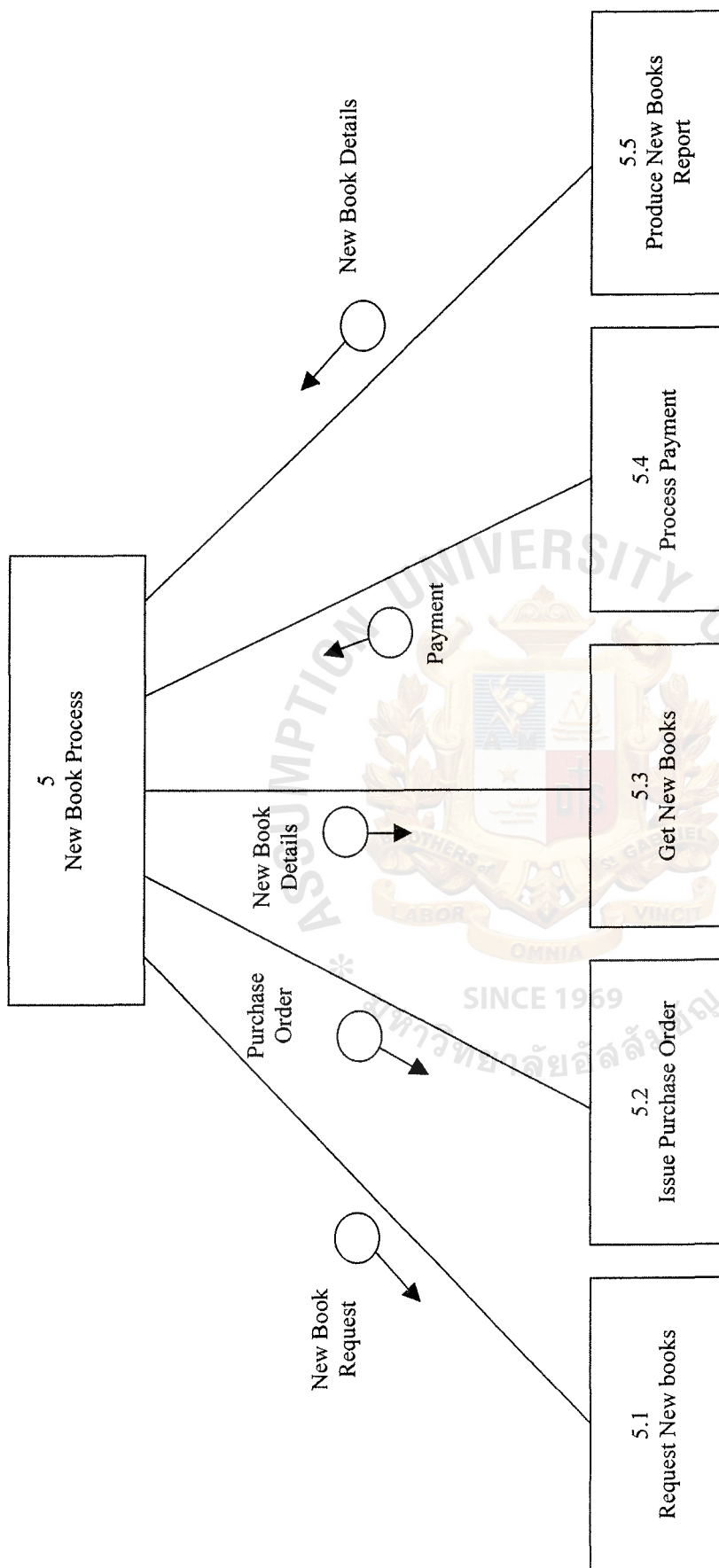


Figure C.15. Structure Chart of New Book Item Process.



**APPENDIX D**  
**PROCESS SPECIFICATION**

Table D.1. Process Specification of Process 1.

Items	Description
Process Name	Edit Registration Process
Data In:	Member Details, Payment
Data Out:	Membership Record Receipt New membership report
Process	(1) Get member information such as name, surname, address, telephone number, Email, etc. and assign new member Id. (2) Record the member information into member database. (3) Collect payment from member. (4) Member get payment receipt (5) Generate new membership report
Attachment:	(1) Member (2) Member file (3) Manager (4) Get Membership Details Process (5) Payment Membership Fee Process (6) Product New Member Report Process

Table D.2. Process Specification of Process 1.1.

Items	Description
Process Name	Complete Application Form
Data In:	Member Details
Data Out:	Member Record
Process	(1) Get Membership data such as name, surname, address, telephone number, etc. and assign new Member Id. (2) Record the Member date into Member database
Attachment:	(1) Member (2) Member file



Table D.3. Process Specification of Process 1.2.

Items	Description
Process Name	Collect the admission Fee
Data In:	Admission Fee
Data Out:	Receipt
Process	(1) Get membership fee from potential member. (2) Member gets a payment receipt.
Attachment:	(1) Member (2) Receipt (3) Process get Customer details

Table D.4. Process Specification of Process 1.3.

Items	Description
Process Name	Issue the member card
Data In :	Member Card
Data Out :	Member details
Process	Generate new member report
Attachment:	(1) Member details (2) Process Get Customer Details (3) Process Payment Membership fee (4) Member file (5) Account Received file (6) Report (7) Manager

Table D.5. Process Specification of Process 2.

Items	Description
Process Name	Generate Rental and Return Transaction
Data In :	Member Id Return & Rental Request Book ID Damage Damage & Overdue Fee Admission Fee
Data Out :	Receipt Notification
Process	(1) Customer request for renting book (2) Verify customer (3) Calculate rental charge. (4) Record rental and return details to Rental and return transaction database
Attachment:	(1) Member (2) Member file (3) Member Access Process (4) Select book Process (5) Calculate rental charge process (6) Inform return Items Details Process (7) Generate Member Expired Report Process (8) Return book Process (9) Get Return Items Request Process

Table D.6. Process Specification of Process 2.1.

Items	Description
Process Name	Rental Book Transaction
Data In :	Member Card & Id Requested for book rental Payment
Data Out :	Book items Notification
Process	(1) Member sends a rental request form (2) Verify membership (3) Calculate the rental charge (4) Generate a payment receipt (5) Record rental details to rental and return Transaction
Attachment:	(1) Member (2) Member file (3) Member Access Process (4) Calculate Rental Charge Process (5) Receipt

Table D.7. Process Specification of Process 2.2.

Items	Description
Process Name	Return Book Transaction
Data In:	Return request Damage & Overdue Fee Payment
Data Out:	Receipt
Process	(1) Member sends a return request form. (2) Calculate penalty charge (3) Calculate Missing books cost (4) Calculate damage book cost (5) Member pays penalty charge (6) Member gets payment receipt (7) Record missing book details to Book file. (8) Record damage book details to Book file
Attachment	(1) Member file (2) Calculate rental charge process. (3) Inform return items detail process. (4) Return book process. (5) Get return items request process.

Table D.8. Process Specification of Process 3.

Items	Description
Process Name	Edit new book registration Process
Data In:	New book checklist Invoice
Data Out:	New book order New book Payment
Process	(1) Member request new book (2) New book checklist (3) New book order
Attachment:	(1) Member (2) Book details (3) Book Files (4) New book check list

Table D.9 Process Specification of Process 3.1

Items	Description
Process Name	Order new books
Data In:	New Books New checklist Receipt
Data Out:	New Book Orders Invoice Payment
Process	(1) Member request for new book details (2) Order new book from supplier
Attachment:	(1) New Book checklist (2) Book file

Table D.10. Process Specification of Process 3.2.

Items	Description
Process Name	Update new books
Data In:	New order book detail & Number
Data Out:	New book details
Process	(1) Register new book (2) Update new book information in database
Attachment:	(1) Member (2) Book details (3) Book file

Table D.11. Process Specification of Process 4.

Items	Description
Process Name	Generate Report
Data In:	Book details
Data Out:	Request report
Process	(1) Generate book report (2) Record book details to Book Files (3) Record book details to Rental & Return File
Attachment:	(1) Rental & Return Files (2) Book Files (3) Manager

Table D.12. Process Specification of Process 4.1.

Items	Description
Process Name	Retrieve Request Information
Data In :	Requested Report
Data Out :	Rental Details Book Details Member Details
Process	(1) Request Information (2) Generate report
Attachment:	(1) Member Files (2) Rental & Return Files (3) Book File

Table D.13. Process Specification of Process 4.2.

Items	Description
Process Name	Print Report
Data In :	Requested Detail report
Data Out :	Income Report
Process	(1) Requested Detail report from Marketing (2) Generate report to Marketing
Attachment:	(1) Member Files (2) Rental & Return Files (3) Book File





**APPENDIX E**  
**INTERFACE DESIGN**

Books Rental Information System (Login)

**BOOKS 4 LIFE CO., LTD.**

User Name:

Password:

Figure E.1. Login Screen.

Books Rental Information System (Rent/Return)

Program

Report

Help

Rent

Return

10 / 10 / 2004 15 : 00

Member ID

Name

Surname

Book ID	Book Title	Rent Fee	Copy	Day	Total

Book

Copy

Total

Baht

Search

Clear

Enter

Figure E.2. Rent/Return Screen (Rent)



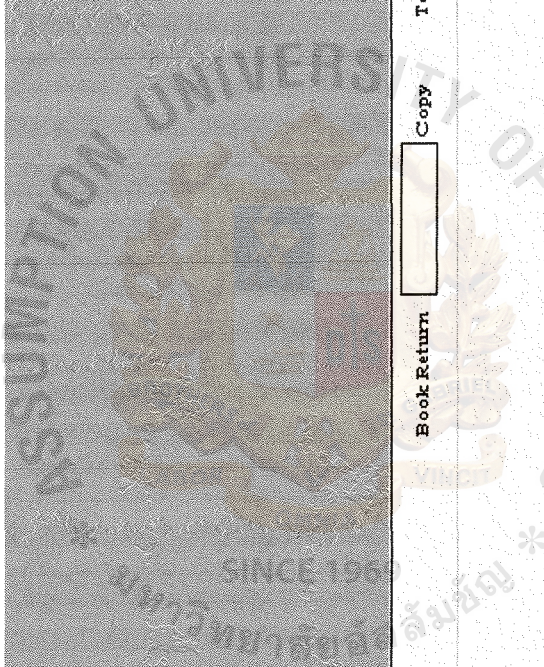
Book Rental Information System (Rent/Return)

Program Report Help

Rent Return

10 / 10 / 2004 15 : 00

Member ID  Name  Surname

Book ID	Book Title	Copy	Rented Date	Total Day	Fine
					

Book Return  Copy  Total  Baht

Enter

Rent / Return Books Member

Figure E.3. Rent/Return Screen (Return)

Books Rental Information System (Book)

Program

Report

Help

Book

Book Search

Book Type

Publisher

Author

Book Information

Book ID

ISBN

Book Title

Author

... Book Type

...

Publisher

...

Rental Fee

Cover Price

Baht

Rental Fee

Baht

Rent Allowed

Day

Fine Rate

Baht

Enter

Clear

Figure E.4. Books Screen (Book)



Book	Book Search	Book Type	Publisher	Author
B-ID	<input type="text"/>	ISBN	<input type="text"/>	<input type="text"/>
Publisher	<input type="text"/>	Type	<input type="text"/>	Author
Book ID	ISBN	Book Title	Author	
<div style="background-color: #cccccc; height: 100px;"></div>				

Search

Delete Edit

Figure E.5. Books Screen (Book Search)



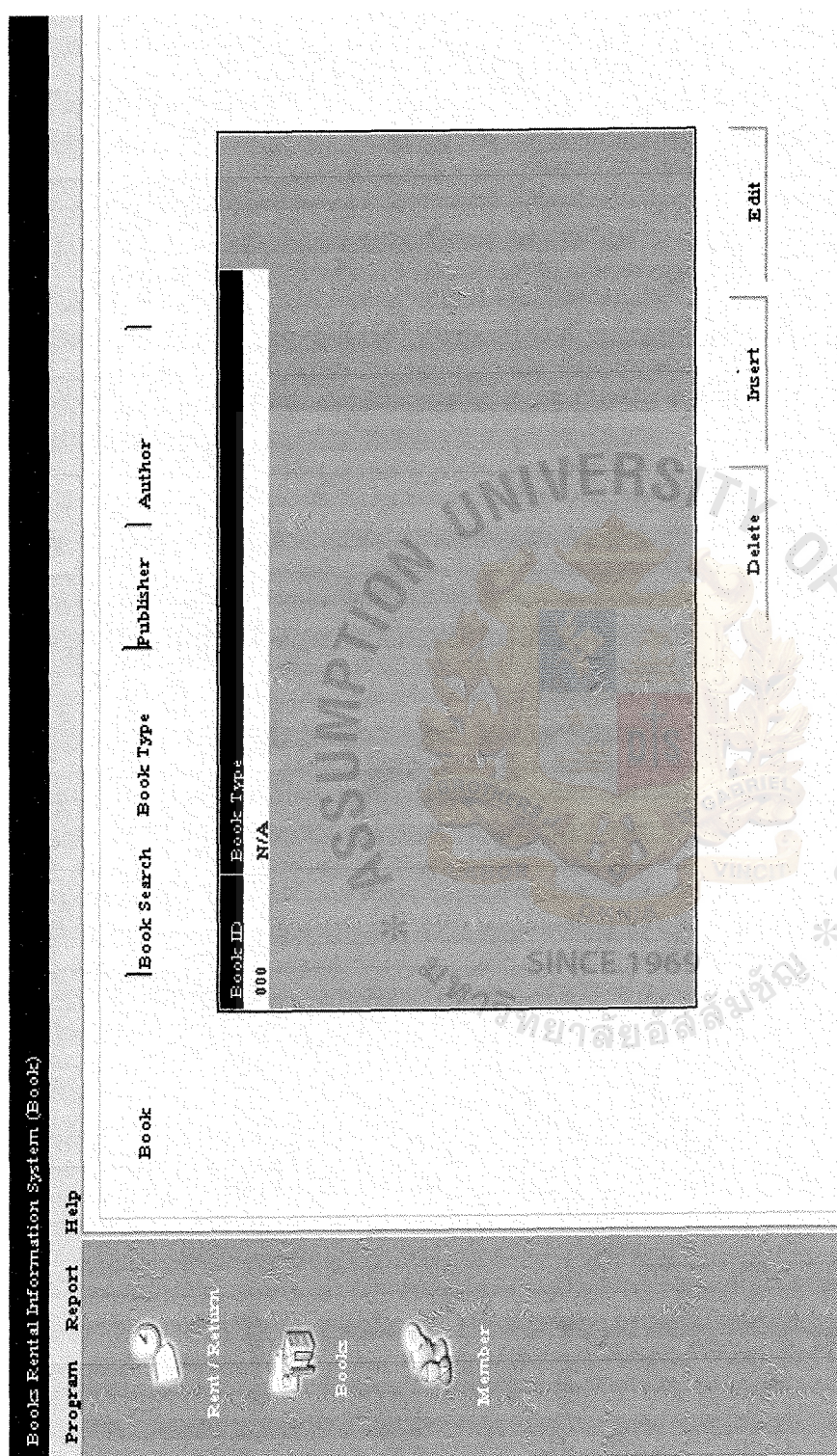


Figure E.6. Books Screen (Book Type)



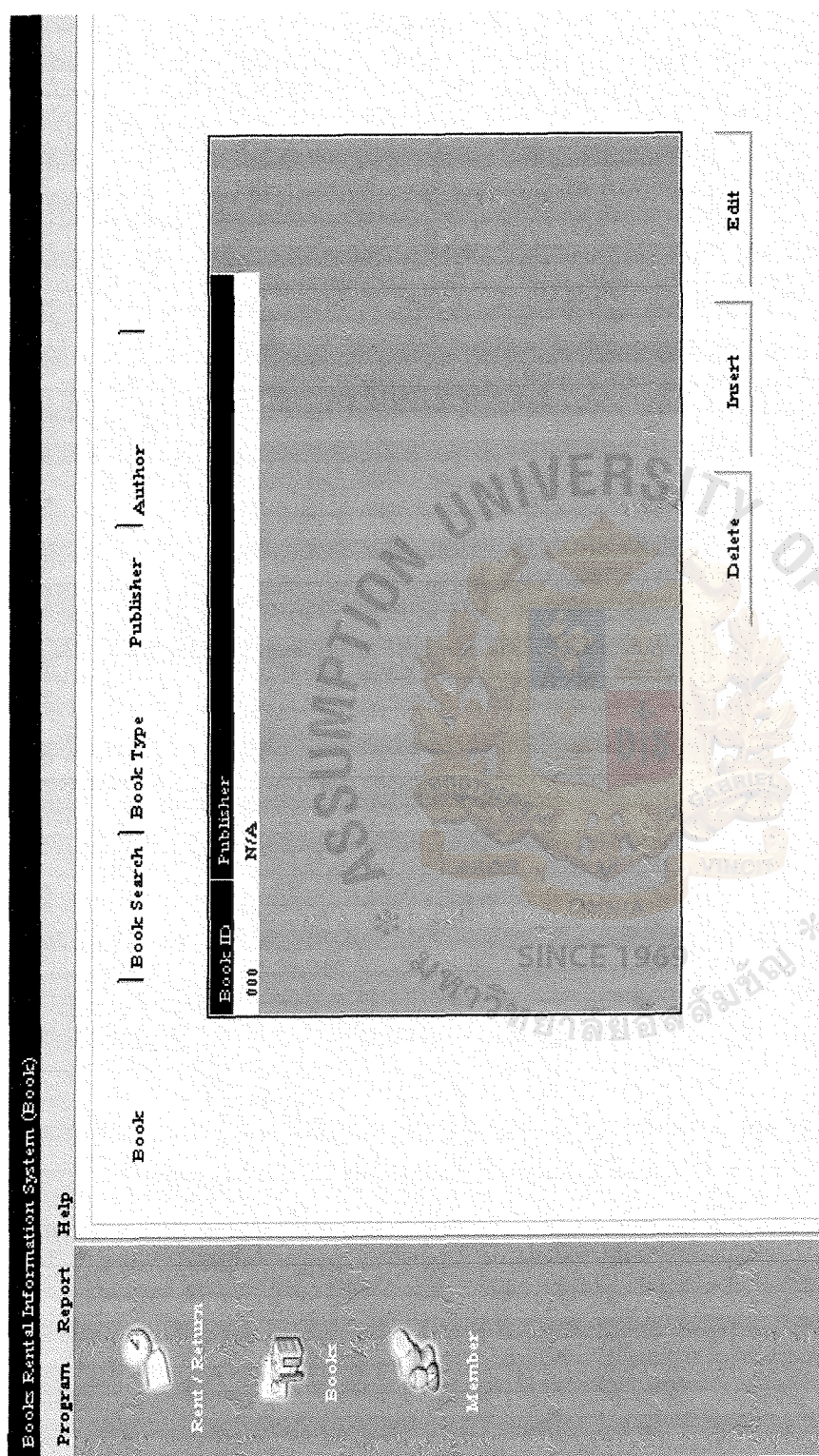


Figure E.7. Books Screen (Publisher)



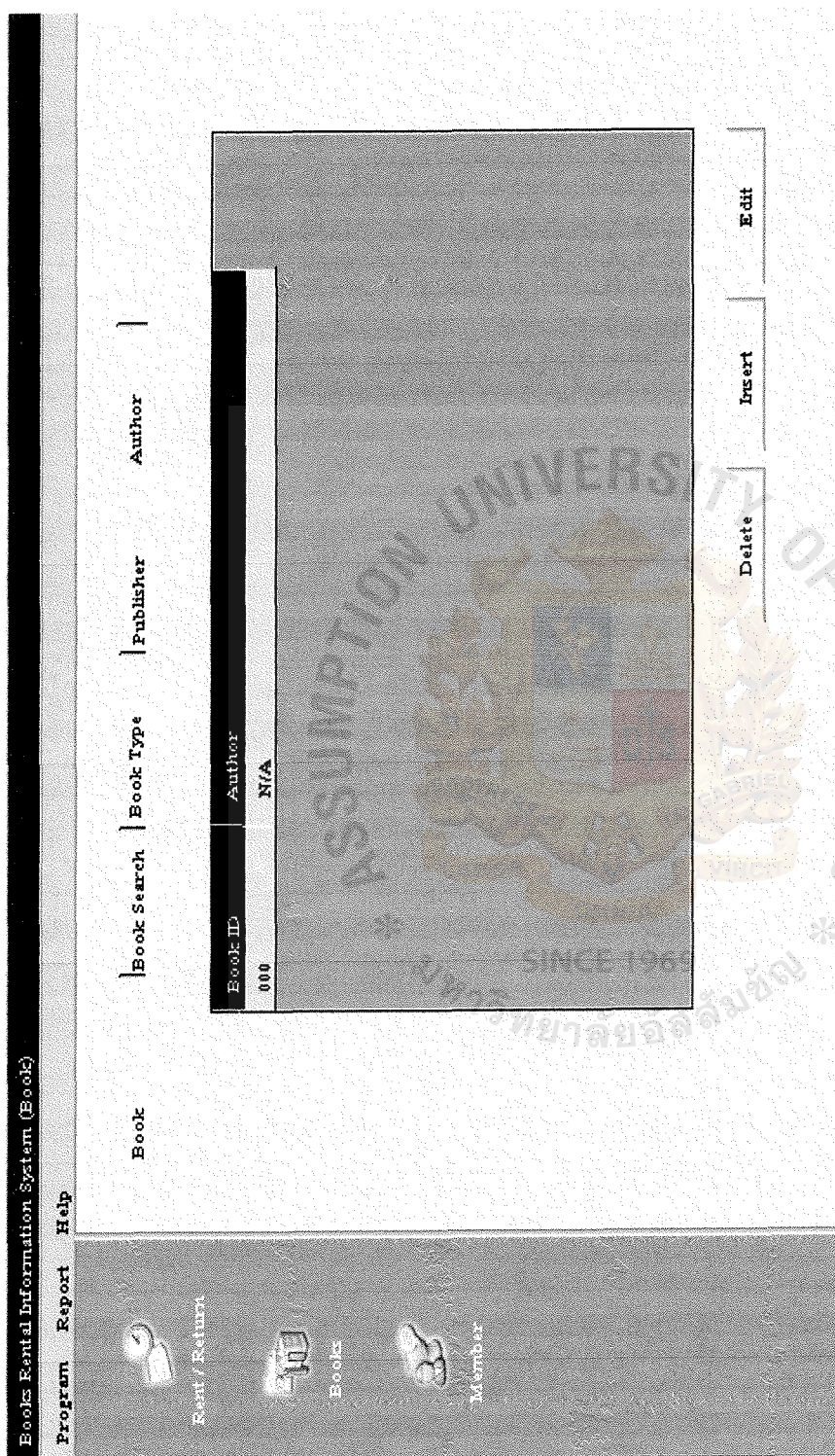


Figure E.8. Books Screen (Author)

Books Rental Information System (Member)

ProgramReportHelp

Member

Search

Member Information

Member ID

Name

Address

Member Since

ID Card No.

Member Status

Surname

Expiration Date

Phone

Figure E.9. Member Screen (Member)



Books Rental Information System (Member)

Program Report Help

Member Search

Member ID Name Surname

Member ID	Name	Surname	Address	Phone
-----------	------	---------	---------	-------

Delete Edit Search

Figure E.10. Member Screen (Member Search)



**APPENDIX F**  
**REPORT DESIGN**

Rental Report				
Books 4 Life Co.,Ltd				
From : 10/10/2004 To : 11/10/2004				
No. Member ID	Member Name	Book Title	Rental Date	Rental Fees
3 0001	Thawatchai Kanongnuk	Love Book 1	11/10/47	3.50
4 0001	Thawatchai Kanongnuk	Love Book 2	11/10/47	3.50
5 0004	Anna Lee	Alients	11/10/47	25.00
6 0004	Anna Lee	Elle 10/2004	11/10/47	8.00
7 0002	Narumon Jongkit	Doramon 1	11/10/47	3.50
8 0002	Narumon Jongkit	Doramon2	11/10/47	3.50
9 0002	Narumon Jongkit	Doramon 3	11/10/47	3.50
10 0002	Narumon Jongkit	Doramon 4	11/10/47	3.50
11 0003	Piti Meedee	Image 10/2004	11/10/47	8.00
12 0003	Piti Meedee	Image 09/2004	11/10/47	8.00
<b>Total</b>	<b>10 Items</b>			<b>70.00</b>

Figure F.1. Rental Report

## Books 4 Life Co.,Ltd.

### Fine Report

From : 10/10/2004      To : 14/10/2004

No	Member ID	Member	Book Title	Rent	Return	Over Due	Fine
1	0001	Thawatchai Kanongru	Lowe Book 1	11/10/47	14/10/47	2	7.00
2	0001	Thawatchai Kanongru	Lowe Book 2	11/10/47	14/10/47	2	7.00
3	0004	Anna Lee	Alients	11/10/47	14/10/47	2	50.00
4	0004	Anna Lee	Elle 10/2004	11/10/47	14/10/47	2	16.00
5	0002	Narumon Jongkit	Daramon 3	11/10/47	14/10/47	2	7.00
6	0002	Narumon Jongkit	Daramon 4	11/10/47	14/10/47	2	7.00
7	0003	Piti Meedee	Image 09/2004	11/10/47	14/10/47	2	16.00
<b>Total</b>				<b>Total</b>			<b>110.00</b>



Figure F.2. Fine Report



Due Books Report		Books 4 Life Co.,Ltd.	
		From : 11/10/2004	To : 14/10/2004
Member ID	0004	Anna Lee	
		Alien's	11/10/47
		Elle 10/2004	11/10/47
		<b>Total</b>	<b>2 Books</b>
Member ID	0002	Narumon Jonglat	
		Doramon 1	11/10/47
		Doramon2	11/10/47
		Doramon 3	11/10/47
		Doramon 4	11/10/47
		<b>Total</b>	<b>4 Books</b>
Member ID	0003	Piti Meedee	
		Image 10/2004	11/10/47
		Image 09/2004	11/10/47
		<b>Total</b>	<b>2 Books</b>
Member ID	0001	Thawatchai Kanongnuak	
		Love Book 1	11/10/47
		Love Book 2	11/10/47
		<b>Total</b>	<b>2 Books</b>

Figure F.3. Due Books Report





**APPENDIX G**  
**ENTITY RELATIONSHIP DIAGRAM**

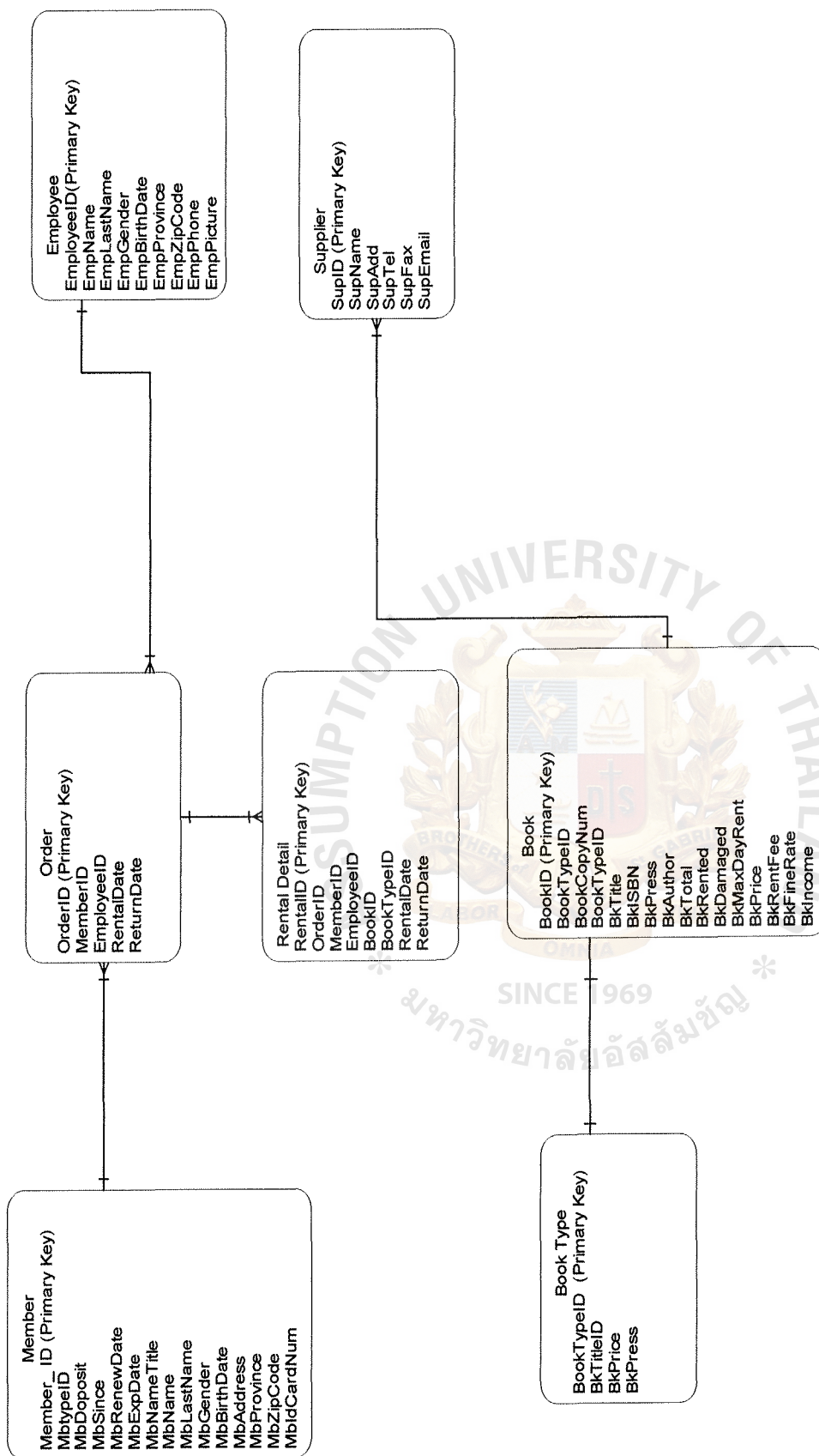


Figure G.1. Fully Attributed Data Model of Entity Relationship Diagram of Books Rental Information System.



**APPENDIX H**  
**ALTERNATIVE CANDIDATE SOLUTIONS**

## H.1 Alternative Candidate

There are alternatives for the new system as presented below:

Table H.1. Candidate Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
<u>Portion of System Computerized</u> Brief description of portion of the system that would be computerized in this candidate.	Books Rental Service Information System which supports front office service and inquiry.	Outsourcing Company will develop all applications.	Same as candidate 2.
<u>Benefit</u> Brief description of the business benefit gained from this candidate.	This solution fully supports all user requirements, provides efficient interaction between users.	High technology & technical support	Quick implementation & meet business required
<u>Server and Clients</u> A description of the servers and clients needed to support this candidate.	Server: Intel Pentium IV Processor 2.53 GHz., 256 MB DDR RAM ,L2 Cache (512 K), 40 GB, 52 x CD-ROM, 1.44 MB. Floppy Drive, with MS SQL Server  Clients: Intel Pentium IV Processor 1.7 GHz., 128 MB DDR RAM, 40 GB. HDD, 128 MB DDR RAM L2 Cache (128 K), 1.44 MB Floppy Drive, with MS Office 2000	Server: Intel Pentium IV Processor 2.8 GHz., 40 GB. HDD, Cache 1 GB., RD RAM 256 MB., 1.44 MB. Floppy Drive, CD-RW with Sybase SQL Server  Clients: Same as candidate 1.	Same as candidate 2.

Table H.1. Candidate Matrix (Continued)

Characteristics	Candidate 1	Candidate 2	Candidate 3
<u>Software Tools needed</u> Software tools needed to design and build the candidate. Not generally applications software packages are to be purchased.	MS Visual Basic 6.0 MS Access 2000	Same as candidate 1.	C++ and MS DOS.
<u>Application Software</u> A description of the software to be purchased, built, accessed, or some combination of these techniques.	Custom Solution.	Outsourcing Solution.	Same as candidate 2.
<u>Method of Data Processing</u> Generally some combination of: online, batch, and real time.	Client/Server.	Same as candidate 1.	Same as candidate 1.
<u>Output Devices</u> A description of output devices that would be used, special output requirements, and output considerations.	Printer (HP Laser Jet 8100)	Same as candidate 1.	Same as candidate 1.
<u>Input Devices and Implications</u> A description of input methods to be used, input devices, special input requirements, and input considerations.	Key board, Mouse	Same as candidate 1.	Same as candidate 1.



Table H.1. Candidate Matrix (Continued)

Characteristics	Candidate 1	Candidate 2	Candidate 3
<u>Storage Database Method</u> Brief description of how data would be organized, and what storage media would be used.	Microsoft SQL Server.	Sybase SQL Server	Microsoft SQL Server.

There are differences among the three alternative candidates. Not only the characteristics, but also processing efficiency, flexibility, end-user friendliness, and programming complexity should be considered. The capacity of each alternative can be determined from Table H.2.

Table H.2. Comparison of Alternative Candidates.

Alternative	Processing Efficiency	Flexibility	End-User Friendliness	Programming Complexity
Candidate 1	High	High	High	Low
Candidate 2	High	High	High	Low
Candidate 3	Low	Low	Low	Low

### Explanation of the degree of capacity:

#### (1) Processing Efficiency

Candidate 3 uses C++ Application for processing. So processing efficiency is lower than others. For candidate 2 and 3, MS Visual Basic 6.0 MS Access 2000 Desktop can support high speed processing.

#### (2) Flexibility

According to the characteristic of Candidate 1 and 2, the system is flexible and easy to expand to support other operations.

#### (3) End-User Friendliness

The interface of Candidate 3 generating from C++ is not object-oriented, which is not user friendly as interface of Candidate 1 and 2.

#### (4) Programming Complexity

The programming of Candidate 1 uses custom solution, so programming complexity is too low. The programming of Candidate 2 and Candidate 3 can use both custom solution and outsourcing because programming complexity is low.

## H.2 Feasibility Analysis

From the Feasibility Analysis Matrix below, Candidate 1 is the best overall solution, as it gets the highest score of 95.5 in ranking.

Table H.3. Feasibility Analysis Matrix.

Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3
<u>Operational Feasibility</u>  Functionality: A description of to what degree the candidate would benefit the company and how well the system would work.	30%	Fully supports the required functionality.  Many users and management highly accept this candidate, as it fully supports their requirements and can be easily expanded to support other functions.	Supports the required functionality only partially.  Many users and management accept this solution, as it partially supports their requirements.	Supports the required functionality only partially.  Less users and management accept this solution, as it partially supports their requirements.
		Score: 100	Score: 90	Score: 75

Table H.3. Feasibility Analysis Matrix (Continued).

Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3
<p><u>Technical Feasibility</u></p> <p>Technology: An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate.</p> <p>Expertise: An assessment of the level of expertise needed to develop, operate and maintain the candidate.</p>	30%	<p>Ms Visual Basic 6 is a widely accepted industry standard for application development and is well supported by Microsoft.</p> <p>MS Access has been chosen for design and implementation of the database, as it requires virtually little training to use.</p>	<p>Most of the application development is outsourced. The problem with this approach is that it is expensive and consultants must be hired to put the system into operation and for periodic checks. Also personnel have to be trained.</p> <p>Require hiring a company to construct all the system, and the users can do maintenance.</p>	<p>Microsoft DOS and C++ can easily be used to design and build the system. It can operate the system, but the system is not user friendly. So it will not be able to work effectively.</p> <p>Required to hire or train C++ expertise to perform modifications for integration requirements.</p>
		Score: 95	Score: 80	Score: 70

Table H.3. Feasibility Analysis Matrix (Continued).

Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3
<u>Economic feasibility</u>  Development Cost:  Break-Even Point:  Payback Period:  Detailed Calculations:	30%	Approximately  685,300 baht  7 months  1 year and 4.2 months  See page 89-95  Score:95	Approximately  791,000 baht  1 year  2 years and 1 months  See page 96-102  Score:90	Approximately  724,000 baht  8.5 months  2 years and 7 month  See page 103-109  Score:80
<u>Schedule Feasibility</u>  An assessment of how long the solution will take to design and implement.	10%	About 3-4 months  Score:85	About 5-7 months  Score:75	About 2-3 months  Score:90
Ranking	100%	95.5	85.5	76.5



### H.3 Cost/Benefit Analysis for Candidate 1

#### (1) Cost of Candidate 1 Computerized System

Table H.4. Computerized System Cost Analysis Candidate 1, in Baht.

Cost items		Years				
		1	2	3	4	5
<b>Fixed Cost</b>						
Hardware Cost:						
Computer Server Cost	1 unit @ 50,000	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Client Machine Cost	5 units @ 30,000	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00
Printer	3 units @ 15,000	9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
UPS 1000 VA	3 units @ 3,000	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00
Total Hardware Cost		50,800.00	50,800.00	50,800.00	50,800.00	50,800.00
Software Cost:						
MS Window XP	1 unit @ 12,000	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00
Windows 2000 Professional	1 unit @ 20,000	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
Ms Visual Basic 6	1 unit @ 15,000	3,000.00	3,000.00	3,000.00	3,000.00	3,000.00
MS SQL Server	1 unit @ 18,000	3,600.00	3,600.00	3,600.00	3,600.00	3,600.00
MS Office 2000	5 units @ 10,000	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Total Software Cost		23,000.00	23,000.00	23,000.00	23,000.00	23,000.00
Implementation Cost:						
Software Development Cost		175,000.00	-	-	-	-
Training Cost		100,000.00	-	-	-	-
Document Cost		50,000.00	-	-	-	-
Total Implementation Cost		325,000.00	-	-	-	-
Maintenance Cost		-	25,000.00	27,500.00	30,250.00	33,275.00
Total Fixed Cost		398,800.00	98,800.00	101,300.00	104,050.00	107,075.00
<b>Operating Cost</b>						
Salary Cost:						
Managing Director	1 person @ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Operation Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Marketing Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Procurement Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Accounting Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Stored Clerks	2 person @ 7,000	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Total Monthly Salary Cost		74,000.00	81,400.00	89,540.00	98,494.00	108,343.40
Total Annual Salary Cost		888,000.00	976,800.00	1,074,480.00	1,181,928.00	1,300,120.80

Table H.4. Computerized System Cost Analysis Candidate 1, in Baht (Continued).

Cost items		Years				
		1	2	3	4	5
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Paper	Per Annual	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Utility	Per Annual	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Miscellaneous	Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Annual Office Supplies & Miscellaneous Cost		75,000.00	82,500.00	90,750.00	99,825.00	109,807.50
Total Operating Cost		963,000.00	1,059,300.00	1,165,230.00	1,281,753.00	1,409,928.30
Total Computerized System Cost		1,361,800.00	1,158,100.00	1,266,530.00	1,385,803.00	1,517,003.30

Table H.5. Five Years Accumulated Computerized System Cost, in Baht.

Year	Computerized System Cost	Accumulated Cost
1	1,361,800.00	1,361,800.00
2	1,158,100.00	2,519,900.00
3	1,266,530.00	3,786,430.00
4	1,385,803.00	5,172,233.00
5	1,517,003.30	6,689,236.30
Total	6,689,236.30	

(2) The Comparison and Breakeven Analysis for Candidate 1.

Table H.6. The Comparison of the System Costs for Candidate 1, in Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,239,600.00	1,361,800.00
2	2,602,700.00	2,519,900.00
3	4,099,250.00	3,786,430.00
4	5,747,635.00	5,172,233.00
5	7,560,398.50	6,689,236.30

Accumulated Cost, Baht

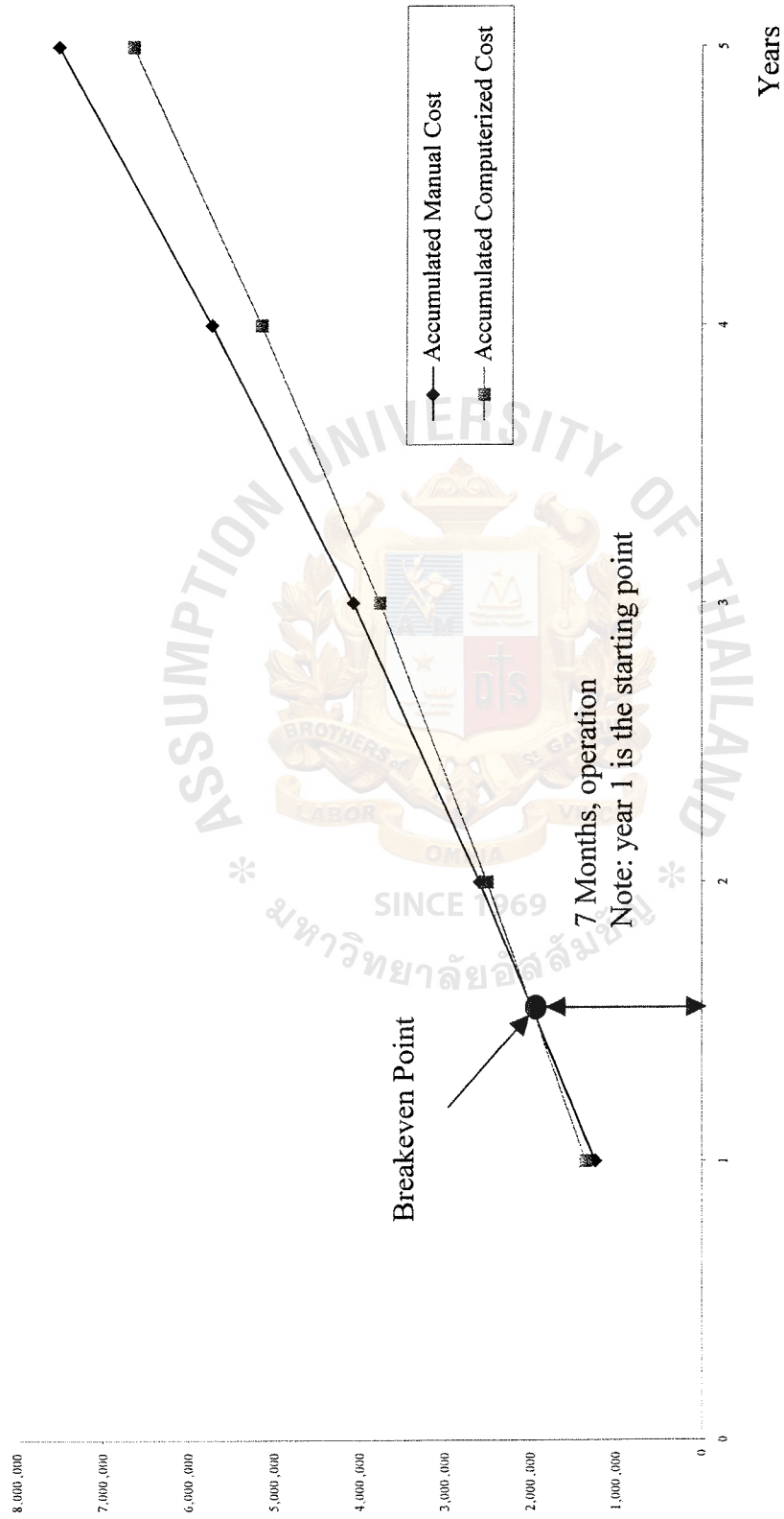


Figure H.1.1. Cost Comparison between the Manual and Proposed System for Candidate 1.

### (3) Payback Analysis

The following cost items are required, shown in Table H.7.

#### Investment Cost:

Hardware Cost	245,300 Baht
Software Cost	115,000 Baht
Software Development Cost	175,000 Baht
Training Cost	100,000 Baht
Document Cost	50,000 Baht
Total Investment Cost	685,300 Baht

#### Annual Operation Cost:

People-ware Cost	888,000 Baht
Office Supplies & Miscellaneous Cost	75,000 Baht
Total Annual Operating Cost	963,000 Baht

#### Annual Cost:

The formula of annual cost of the Computerized System is

$$\begin{aligned}\text{Annual Cost} &= (\text{Investment Cost/Estimated System Life}) + \\ &\quad \text{Annual Operating Cost} \\ &= (685,300/5) + 963,000 \\ &= 1,100,060 \text{ Baht}\end{aligned}$$

#### Saving:

Staff	252,000 Baht
Office Supplies & Miscellaneous	20,000 Baht
Opportunity Cost & Intangible Benefits	1,250,000 Baht
Total Saving	1,522,000 Baht

Table H.7. Payback Analysis for Candidate 1, in Baht.

Cost Item	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development Cost	685,300.00						
Operation and maintenance cost		963,000.00	1,059,300.00	1,165,230.00	1,281,753.00	1,409,928.30	1,550,921.13
Discount factors for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
The adjusted cost (adjusted to present value)	685,300.00	875,367.00	874,981.80	875,087.73	875,437.30	875,565.47	874,719.52
Cumulative time-adjusted costs over lifetime	685,300.00	1,560,667.00	2,435,648.80	3,310,736.53	4,186,173.83	5,061,739.30	5,936,458.82
Benefit derived from operation of new system	-	1,522,000.00	1,674,200.00	1,841,620.00	2,025,782.00	2,228,360.20	2,451,196.22
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted benefits (current of present value)	-	1,383,498.00	1,382,889.20	1,383,056.62	1,383,609.11	1,383,811.68	1,382,474.67
Cumulative time-adjusted benefits over lifetime	-	1,383,498.00	2,766,387.20	4,149,443.82	5,533,052.93	6,916,864.61	8,299,339.28
Cumulative lifetime-adjusted costs Benefits	-685,300.00	-177,169.00	330,738.40	838,707.29	1,346,879.10	1,855,125.31	2,362,880.46



Payback period is the commonly used technique to assess the value of investment. Generally, payback period is the period that cash inflows can recover the initial investment within a specified period. To reflect the real value of money, the time value of money concept is also applied in this analysis. The discount rate is required to calculate discount value of all costs and benefits after the first year to the present value at the present year. Then the Payback period is calculated to judge the profitability of the system as shown in Table H.7. and Figure H.2.

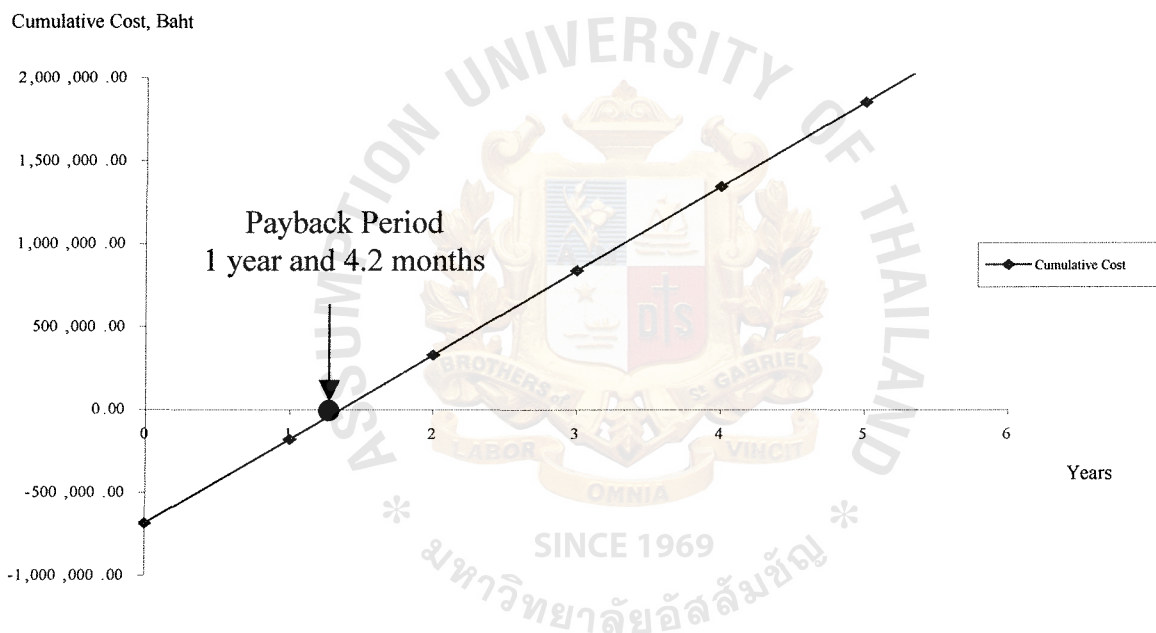


Figure H.2. Payback Period for Candidate 1.

As in Figure H.2. the graph of cumulative cost of computerized system crosses x-axis at 1.35 years or the payback period of the computerized system is 1 year and 4.2 months.

Moreover, the payback period can be calculated by the formula as follows:

$$P = \frac{\text{Last year of negative Cash flow difference}}{\frac{\text{Cumulative different last negative year}}{\text{Absolute value of cumulate difference (last negative plus first year positive year)}}}$$

$$\text{Where } P = \text{Payback Period}$$

$$P = 1 + \{(177,169 / (177,169 + 330,738))\}$$

$$= 1.35 \text{ years or 1 year and 4.2 months}$$

#### (4) Return-on-Investment Analysis (ROI)

Return-on-Investment Analysis technique compares the lifetime profitability of alternative solutions or projects. The ROI for a project is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. The ROI for a potential project is calculated by using the data from Table H.7. as follows:

$$\text{ROI} = \frac{(\text{Estimated lifetime benefits} - \text{Estimated lifetime costs})}{\text{Estimated lifetime costs}}$$

$$\text{ROI} = \frac{((8,299,339.28 - 5,936,458.82) / 5,936,458.82) \times 100}{0.3980 \times 100}$$

$$= 39.80\%$$

Therefore, the lifetime ROI is 39.80 percent. Simple division by the lifetime of the system yields an average ROI of 6.63 percent per year.

## H.4 Cost/Benefit Analysis for Candidate 2

### (1) Cost of Candidate 2 Computerized System

Table H.8. Computerized System Cost Analysis For Candidate 2, in Baht.

Cost items		Years				
		1	2	3	4	5
<b>Fixed Cost</b>						
<b>Hardware Cost:</b>						
Computer Server Cost	1 unit @ 70,000	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00
Client Machine Cost	5 units @ 30,000	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00
Printer	3 units @ 15,000	9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
UPS 1000 VA	3 units @ 3,000	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00
Total Hardware Cost		54,800.00	54,800.00	54,800.00	54,800.00	54,800.00
<b>Software Cost:</b>						
MS Window XP	1 unit @ 12,000	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00
Windows 2000 Professional	1 unit @ 20,000	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
Ms Visual Basic 6	1 unit @ 15,000	3,000.00	3,000.00	3,000.00	3,000.00	3,000.00
Sybase SQL Server	1 unit @ 20,000	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
MS Office 2000	5 units @ 10,000	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Total Software Cost		23,400.00	23,400.00	23,400.00	23,400.00	23,400.00
<b>Implementation Cost:</b>						
Software Development Cost		250,000.00	-	-	-	-
Training Cost		100,000.00	-	-	-	-
Document Cost		50,000.00	-	-	-	-
Total Implementation Cost		400,000.00	-	-	-	-
Maintenance Cost		-	25,000.00	27,500.00	30,250.00	33,275.00
Total Fixed Cost		478,200.00	103,200.00	105,700.00	108,450.00	111,475.00
<b>Operating Cost</b>						
<b>Salary Cost:</b>						
Managing Director	1 person @ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Operation Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Marketing Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Procurement Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Accounting Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Stored Clerks	2 persons @ 7,000	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Total Monthly Salary Cost		74,000.00	81,400.00	89,540.00	98,494.00	108,343.40
Total Annual Salary Cost		888,000.00	976,800.00	1,074,480.00	1,181,928.00	1,300,120.80

Table H.8. Computerized System Cost Analysis for Candidate 2, in Baht (Continued)

Cost items		Years				
		1	2	3	4	5
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Paper	Per Annual	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Utility	Per Annual	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Miscellaneous	Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Annual Office Supplies & Miscellaneous Cost		75,000.00	82,500.00	90,750.00	99,825.00	109,807.50
Total Operating Cost		963,000.00	1,059,300.00	1,165,230.00	1,281,753.00	1,409,928.30
Total Computerized System Cost		1,441,200.00	1,162,500.00	1,270,930.00	1,390,203.00	1,521,403.30

Table H.9. Five Years' Accumulated Cost for Candidate 2, in Baht.

Year	Computerized System Cost	Accumulated Cost
1	1,441,200.00	1,441,200.00
2	1,162,500.00	2,603,700.00
3	1,270,930.00	3,874,630.00
4	1,390,203.00	5,264,833.00
5	1,521,403.30	6,786,236.30
Total	6,786,236.30	-

(2) Cost Comparison and Breakeven Analysis for Candidate 2.

Table H.10. The Comparison of the System Cost for candidate 2, in Baht.

Year	Accumulated Manual Cost	M Accumulated Computerized Cost
1	1,239,600.00	1,441,200.00
2	2,602,700.00	2,603,700.00
3	4,099,250.00	3,874,630.00
4	5,747,635.00	5,264,833.00
5	7,560,398.50	6,786,236.30

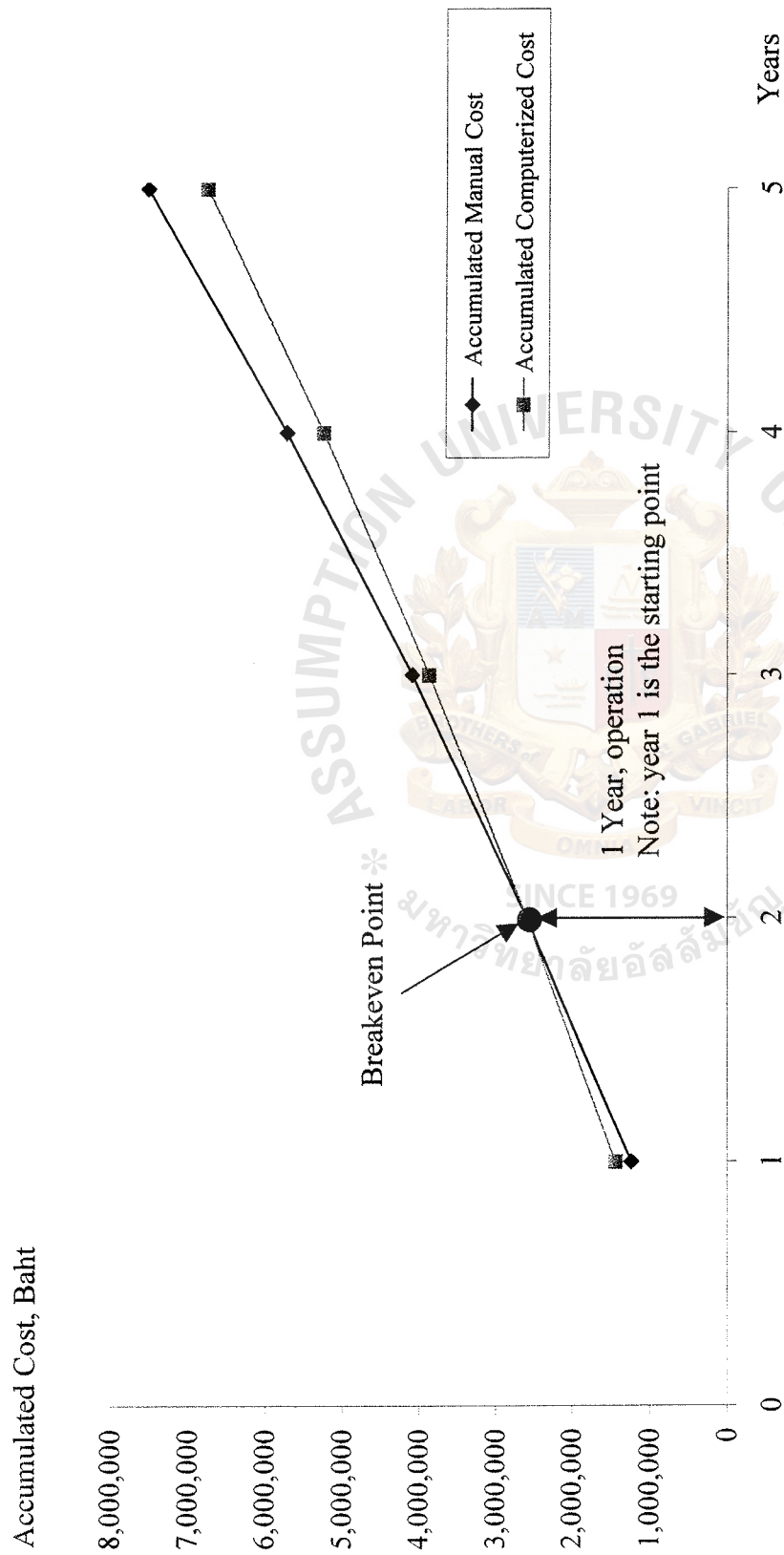


Figure H.3. Cost Comparison Between the Manual and Proposed System for Candidate 2.



### (3) Payback Analysis

The following cost items are required, as shown in Table H.11.

#### Investment Cost:

Hardware Cost	274,000 Baht
Software Cost	117,000Baht
Software development Cost	250,000 Baht
Training Cost	100,000 Baht
Document Cost	50,000 Baht
Total Investment Cost	791,000 Baht

#### Annual Operation Cost:

People-ware Cost	888,000 Baht
Office Supplies & Miscellaneous Cost	75,000 Baht
Total Annual Operating Cost	963,000 Baht

#### Annual Cost:

The formula of annual cost of the Computerized System is

$$\begin{aligned}\text{Annual Cost} &= (\text{Investment Cost/Estimated System Life}) + \\ &\quad \text{Annual Operating Cost} \\ &= (791,000/5) + 963,000 \\ &= 1,121,200 \text{ Baht}\end{aligned}$$

#### Saving:

Staff	252,000 Baht
Office Supplies & Miscellaneous	20,000 Baht
Opportunity Cost & Intangible Benefits	1,110,000 Baht
Total Saving	1,382,000 Baht

Table H.11. Payback Period for Candidate 2, in Baht.

Cost Item	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development Cost	791,000.00						
Operation and maintenance cost		963,000.00	1,059,300.00	1,165,230.00	1,281,753.00	1,409,928.30	1,550,921.13
Discount factors for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
The adjusted cost (adjusted to present value)	791,000.00	875,367.00	874,981.80	875,087.73	875,437.30	875,565.47	874,719.52
Cumulative time-adjusted costs over lifetime	791,000.00	1,666,367.00	2,541,348.80	3,416,436.53	4,291,873.83	5,167,439.30	6,042,158.82
Benefit derived from operation of new system	-	1,382,000.00	1,520,200.00	1,672,220.00	1,839,442.00	2,023,386.20	2,225,724.82
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted benefits (current of present value)	-	1,256,238.00	1,255,685.20	1,255,837.22	1,256,338.89	1,256,522.83	1,255,308.80
Cumulative time-adjusted benefits over lifetime	-	1,256,238.00	2,511,923.20	3,767,760.42	5,024,099.31	6,280,622.14	7,535,930.94
Cumulative lifetime-adjusted costs benefits	-791,000.00	-410,129.00	-29,425.60	351,323.89	732,225.48	1,113,182.84	1,493,772.12

Payback period is the commonly used technique to assess the value of investment. Generally, payback period is the period that cash inflows can recover the initial investment within a specified period. To reflect the real value of money, the time value of money concept is also applied in this analysis. The discount rate is required to calculate discount value of all costs and benefits after the first year to the present value at the present year. Then the Payback period is calculated to judge the profitability of the system as shown in Table H.11. and Figure H.4.

Cumulative Cost, Baht

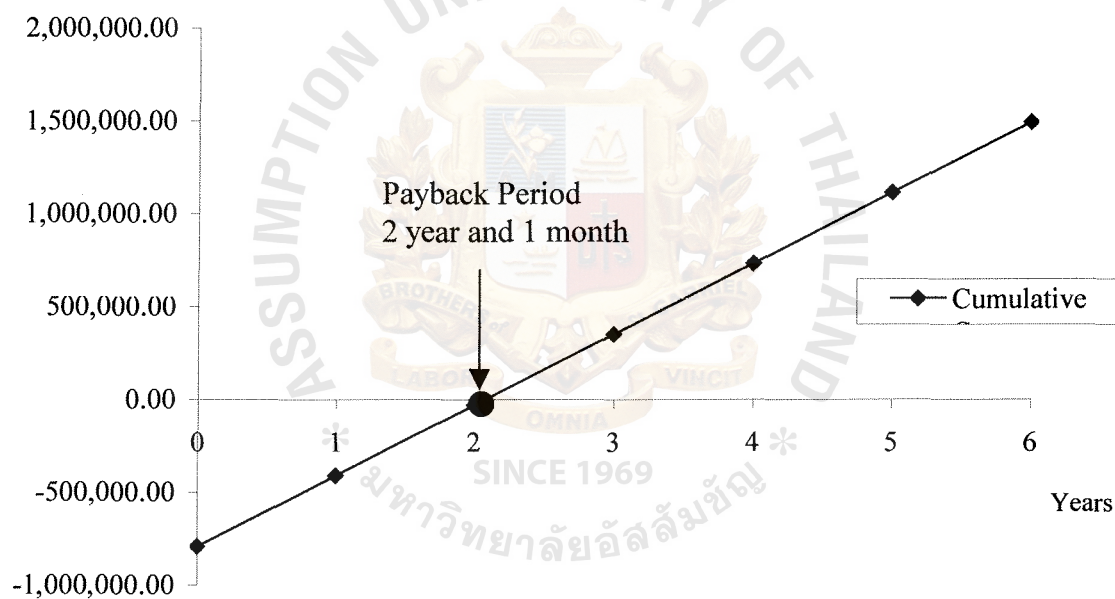


Figure H.4. Payback Period for Candidate 2.

As in Figure H.4. the graph of cumulative cost of computerized system crosses x-axis at 2.08 years or the payback period of the computerized system is 2 year and 1 months.

Moreover, the payback period can be calculated by the formula as follows:

$$P = \frac{\text{Last year of negative Cash flow difference}}{\text{Cumulative different last negative year Absolute value of cumulate difference (last negative plus first year positive year)}}$$

Where P = Payback Period

$$P = 2 + \{(29,425.60 / (29,425.60 + 351,323.89))\}$$

$$= 2.08 \text{ years or 2 years and 1 month}$$

#### (4) Return-on-Investment Analysis (ROI)

Return-on-Investment Analysis technique compares the lifetime profitability of alternative solutions or projects. The ROI for a project is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. The ROI for a potential project is calculated by using the data from Table H.11. as follows:

$$\text{ROI} = \frac{(\text{Estimated lifetime benefits} - \text{Estimated lifetime costs})}{\text{Estimated lifetime costs}}$$

$$\text{ROI} = ((7,535,930.94 - 6,042,158.82) / 6,042,158.82) \times 100$$

$$= 0.2472 \times 100$$

$$= 24.72\%$$

Therefore, the lifetime ROI is 24.72 percent. Simple division by the lifetime of the system yields an average ROI of 4.12 percent per year.

### H.3 Cost/Benefit Analysis for Candidate 3

#### (1) Cost of Candidate 3 Computerized System

Table H.12. Computerized System Cost Analysis for Candidate 3, in Baht.

Cost items		Years				
		1	2	3	4	5
<b>Fixed Cost</b>						
Hardware Cost:						
Computer Server Cost	1 unit @ 70,000	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00
Client Machine Cost	5 units @ 30,000	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00
Printer	3 units @ 15,000	9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
UPS 1000 VA	3 units @ 3,000	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00
Total Hardware Cost		54,800.00	54,800.00	54,800.00	54,800.00	54,800.00
Software Cost:						
MS Window XP	1 unit @ 12,000	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00
Windows 2000 Professional	1 unit @ 20,000	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
MS SQL Server	1 unit @ 18,000	3,600.00	3,600.00	3,600.00	3,600.00	3,600.00
MS Office 2000	5 units @ 10,000	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Total Software Cost		20,000.00	20,000.00	20,000.00	20,000.00	20,000.00
Implementation Cost:						
Software Development Cost		200,000.00	-	-	-	-
Training Cost		100,000.00	-	-	-	-
Document Cost		50,000.00	-	-	-	-
Total Implementation Cost		350,000.00	-	-	-	-
Maintenance Cost		-	25,000.00	27,500.00	30,250.00	33,275.00
Total Fixed Cost		424,800.00	99,800.00	102,300.00	105,050.00	108,075.00
<b>Operating Cost</b>						
Salary Cost:						
Managing Director	1 person @ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Operation Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Marketing Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Procurement Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Accounting Manager	1 person @ 10,000	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Stored Clerks	2 persons @ 7,000	14,000.00	15,400.00	16,940.00	18,634.00	20,497.40
Total Monthly Salary Cost		74,000.00	81,400.00	89,540.00	98,494.00	108,343.40
Total Annual Salary Cost		888,000.00	976,800.00	1,074,480.00	1,181,928.00	1,300,120.80



Table H.12. Computerized System Cost Analysis for Candidate 3, in Baht (Continued).

Cost items		Years				
		1	2	3	4	5
Office Supplies and Miscellaneous Cost:						
Stationary	Per Annual	10,000.00	11,000.00	12,100.00	13,310.00	14,641.00
Paper	Per Annual	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Utility	Per Annual	30,000.00	33,000.00	36,300.00	39,930.00	43,923.00
Miscellaneous	Per Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Annual Office Supplies & Miscellaneous Cost		75,000.00	82,500.00	90,750.00	99,825.00	109,807.50
Total Operating Cost		963,000.00	1,059,300.00	1,165,230.00	1,281,753.00	1,409,928.30
Total Computerized System Cost		1,387,800.00	1,159,100.00	1,267,530.00	1,386,803.00	1,518,003.30

Table H.13. Five Years Accumulated Cost for Candidate 3, in Baht.

Year	Computerized System Cost	Accumulated Cost
1	1,387,800.00	1,387,800.00
2	1,159,100.00	2,546,900.00
3	1,267,530.00	3,814,430.00
4	1,386,803.00	5,201,233.00
5	1,518,003.30	6,719,236.30
Total	6,719,236.30	-

## (2) Cost Comparison and Breakeven Analysis for Candidate 3.

Table H.14. The Comparison of system Cost for Candidate 3, in Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,239,600.00	1,387,800.00
2	2,602,700.00	2,546,900.00
3	4,099,250.00	3,814,430.00
4	5,747,635.00	5,201,233.00
5	7,560,398.50	6,719,236.30

Accumulated Cost, Baht

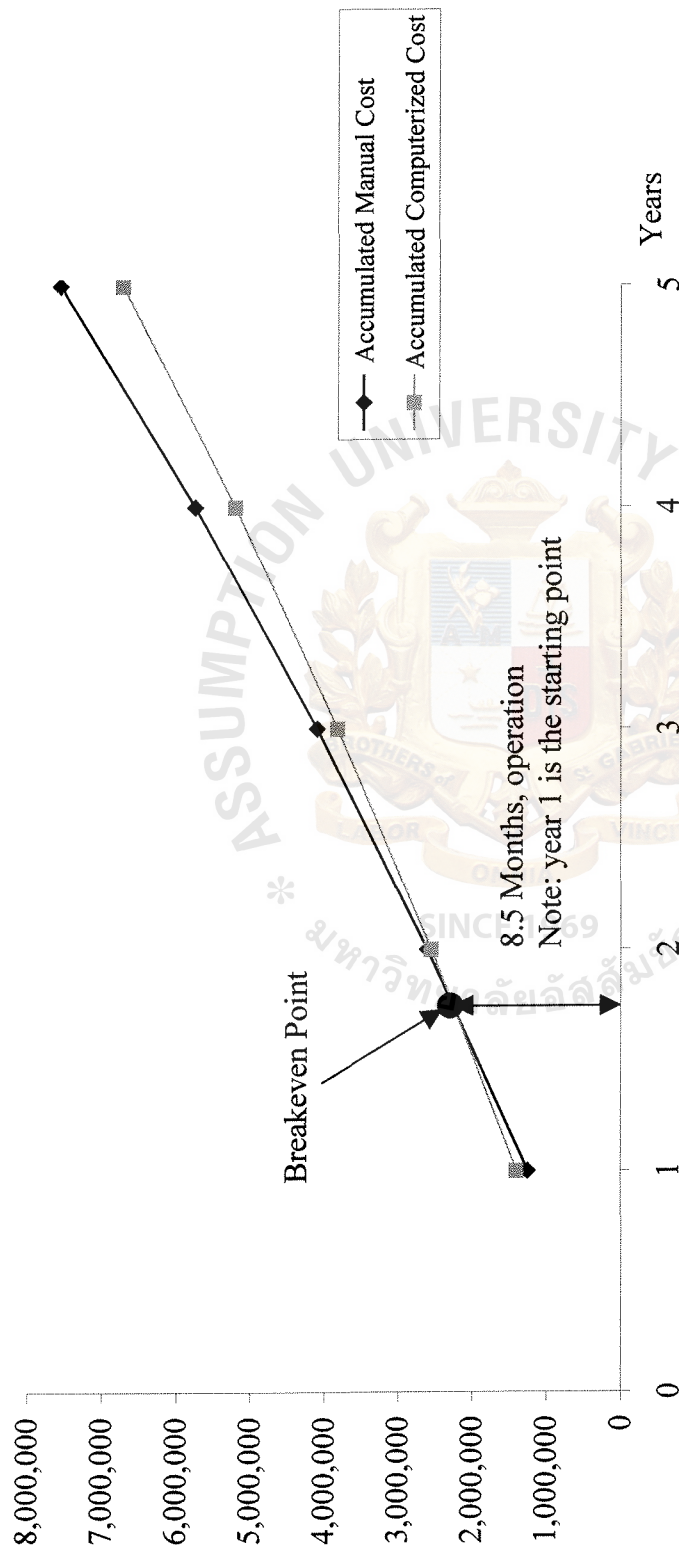


Figure H.5. Cost Comparison between the Manual and Proposed System for Candidate 3.

### (3) Payback Analysis

The following cost items are required, as shown in Table H.15.

#### Investment Cost:

Hardware Cost	274,000 Baht
Software Cost	100,000 Baht
Software Development Cost	200,000 Baht
Training Cost	100,000 Baht
Document Cost	50,000 Baht
Total Investment Cost	724,000 Baht

#### Annual Operating Cost:

People-ware cost	888,000 Baht
Office Supplies & Miscellaneous cost	75,000 Baht
Total Annual Operating Cost	963,000 Baht

#### Annual Cost:

The formula of annual cost of the Computerized system is

$$\begin{aligned}\text{Annual Cost} &= \text{Investment Cost/Estimated System Life) +} \\ &\quad \text{Annual Operating Cost} \\ &= (724,000/5) + 963,000 \\ &= 1,107,800 \text{ Baht}\end{aligned}$$

#### Saving:

Staff	252,000 Baht
Office Supplies & Miscellaneous	20,000 Baht
Opportunity cost & Intangible Benefits	1,000,000 Baht
Total Saving	1,272,000 Baht

Table H.15. Payback Period for Candidate 3, in Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development Cost	724,000.00						
Operation and maintenance cost		963,000.00	1,059,300.00	1,165,230.00	1,281,753.00	1,409,928.30	1,550,921.13
Discount factors for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
The adjusted cost (adjusted to present value)	724,000.00	875,367.00	874,981.80	875,087.73	875,437.30	875,565.47	874,719.52
Cumulative time-adjusted costs over lifetime	724,000.00	1,599,367.00	2,474,348.80	3,349,436.53	4,224,873.83	5,100,439.30	5,975,158.82
Benefit derived from operation of new system	-	1,272,000.00	1,399,200.00	1,539,120.00	1,693,032.00	1,862,335.20	2,048,568.72
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621	0.564
Time adjusted benefits (current of present value)	-	1,156,248.00	1,155,739.20	1,155,879.12	1,156,340.86	1,156,510.16	1,155,392.76
Cumulative time-adjusted benefits over lifetime	-	1,156,248.00	2,311,987.20	3,467,866.32	4,624,207.18	5,780,717.34	6,936,110.10
Cumulative lifetime-adjusted costs benefits	-724,000.00	-443,119.00	-162,361.60	118,429.79	399,333.35	680,278.04	960,951.28

Payback period is the commonly used technique to assess the value of investment. Generally, payback period is the period that cash inflows can recover the initial investment within a specified period. To reflect the real value of money, the time value of money concept is also applied in this analysis. The discount rate is required to calculate discount value of all costs and benefits after the first year to the present value at the present year. Then the Payback period is calculated to judge the profitability of the system as shown in Table H.15. and Figure H.6.

Cumulative Cost, Baht

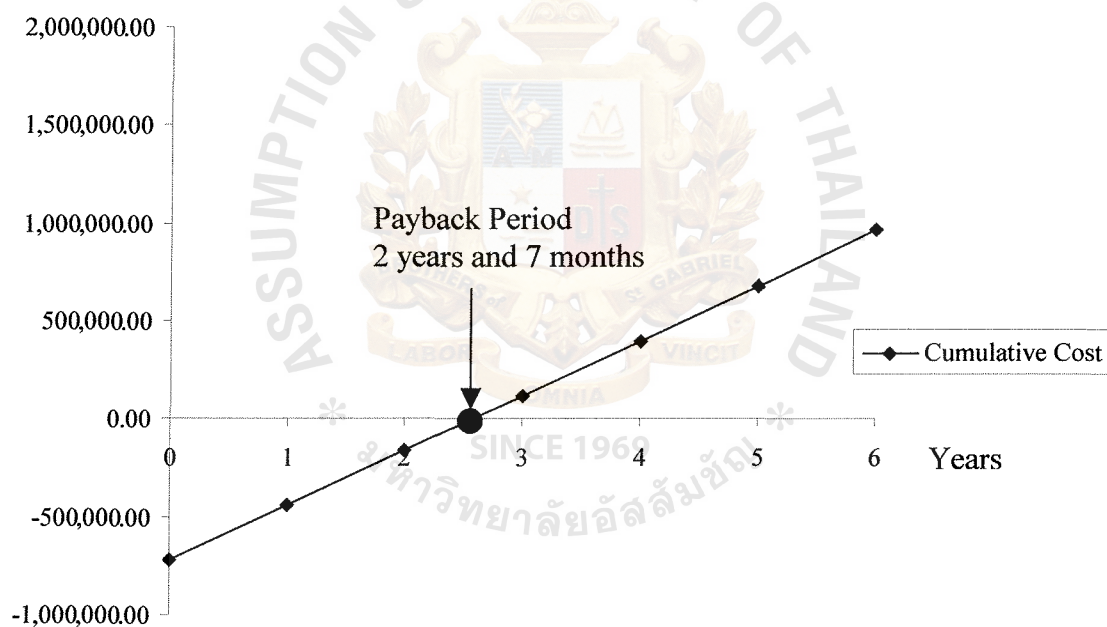


Figure H.6. Payback Period for Candidate 3.



As in Figure H.6. the graph of cumulative cost of computerized system crosses x-axis at 2.58 years or the payback period of the computerized system is 2 years and 7 months.

Moreover, the payback period can be calculated by the formula as follows:

$$P = \frac{\text{Last year of negative Cash flow difference}}{\text{Cumulative different last negative year Absolute value of cumulate difference (last negative plus first year positive year)}}$$

Where P = Payback Period

$$\begin{aligned} P &= 2 + \{(162,361.60 / (162,361.60 + 118,429.79)\} \\ &= 2.58 \text{ years or 2 years and 7 months} \end{aligned}$$

#### (4) Return-on-Investment Analysis (ROI)

Return-on-Investment Analysis technique compares the lifetime profitability of alternative solutions or projects. The ROI for a project is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. The ROI for a potential project is calculated by using the data from Table H.15. as follows:

$$\begin{aligned} \text{ROI} &= \frac{(\text{Estimated lifetime benefits} - \text{Estimated lifetime costs})}{\text{Estimated lifetime costs}} \\ \text{ROI} &= ((6,936,110.10 - 5,975,158.82) / 5,975,158.82) \times 100 \\ &= 0.1608 \times 100 \\ &= 16.08\% \end{aligned}$$

Therefore, the lifetime ROI is 16.08 percent. Simple division by the lifetime of the system yields an average ROI of 2.68 percent per year.

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