CHAPTER 4

System Analysis

4.1 Introduction

System analysis is important as it studies users need and tries to implement it to ease user's daily routine. A study was conducted on current systems which are available in the market as mentioned in Chapter 2. During the system analysis phase, system requirements were determined. Besides that, hardware and software requirements during system run-time and development phase were also determined. It is essential to know the system requirements before proceeding to design the Intelligent Bank Management System. During this research, system analysis is carried out to determine all the requirements for an Intelligent Bank Management system. This chapter explains in detail the requirements for the Intelligent Bank Management System.

4.2 Importance of Requirement Analysis in the Designing of the System

Software architecture is the bridge between the system requirements and implementation. Designing of software architecture comes after the domain analysis, requirement analysis and risk analysis but before the design, coding, integration and testing phase. It is very essential for the requirement analysis phase to be completed before proceeding to the designing of application. Anyway,

we have to keep in mind that requirements that have been determined during the requirement analysis phase may change or need to add new requirements at anytime. Hence, later tasks will certainly have impact on the architecture too.

A study was also done on other similar system such as Bank President and Real Money Simulation System as been elaborated in the Literature Review.

4.3 Requirement Analysis Procedure

4.3.1 Interviewing and Listening

Formal interviews and survey are one of the primary ways used to gather the requirement of Intelligent Bank Management System. The survey was conducted on twenty-four people from six different banks by distributing the survey forms to the participants. Interviews were conducted on six bank executives from six different banks. Many issues need to be considered such as what kind of services the users need and expect. In order to learn in detail about the types of users and their capability, an interview is essential. Hence, interviews were held with bank officers from the banks listed in Table 4.1.

Table 4.1
List of Banks and Bank Executives been Interviewed

Bank Name	Executive Name
MayBank Seremban	Mr.Tham
Hong Leong Bank, Seremban	Mr.Kensington Oh
Southern Bank, Subang Jaya	Pn. Azrumuda
Affin Bank, Subang Jaya	Pn. Jamila
Public Bank, Seremban	Mr.Pillai
RHB Bank, Subang Jaya	Mr.Chong

Most of the officers had cooperated and agreed to be interviewed regarding this issue. Interviews with the users were essential because they know what they want in the new Intelligent Bank Management System. The bank officers are one of the target users of the system; hence their expectations are very important and need to be considered when determining the requirements.

The interviews with the officers clearly show that in the bank officers' point of view, simulation based training system will be very useful for them as an e-learning tool which can be accessed from anywhere at anytime. This is because the trainees do not need to be in the same location every time to play the game.

Interviews with the users showed that most of them are computer literate. According to Mr.Kensington from Hong Leong Bank, the development of internet

banking and other computerization issues will determine the development in the banking sector.

At the same time, the users showed their eagerness to know more about their bank's stability and the economics. They wanted to know what, why and how to manage a particular situation. For example, a team of participants may be facing a risk of gaining less deposit from the local economy for a certain period of time. This could be because of some improper strategy being applied. Subsequently, the team has an opportunity to create the strategy, maybe by increasing the interest rates. The users are actually training themselves to be prepared for real time situations. Currently, according to Pn. Jamila from Affin Bank, Subang Jaya, the current training focus on the banking strategies, report writing, financial analysis, bank management and other technical and marketing strategy related to interest rates.

Table 4.2 below shows the results of the interviews conducted with all the bank officers. As some of the officers do not intend to have their names written, the results of the interview with all the officers are compiled in the table shown below:

Table 4.2
List of Questions and Feedback

No.	Questions	Answers
1	Training - Type of training - Training Method - Training Location	- Most of the training are class room training (CRT) - For each training they will be sent to the Head Quarters in Kuala Lumpur which is tiring - One trainer for 20 -30 trainees - Training Method : Using presentation tools and workbook; workshops
2	Technological Issue and Usage -Use of new technology -User feedback on the new system	- Some systems are outdated especially the reporting system - Most of them are shifting towards new technology - Introduction to some of the new technology such as Linux are complicating their work as it is not user-friendly even after undergoing an intensive training - All the banks are moving towards internet banking - Some of the banks are facing difficulties in installing the new system as it is very expensive. - All banks provide training for their staffs
3	Performance of Malaysian Banks - Competitiveness - Deregulation - Weaknesses of local banks	- Malaysian banks are locally very competitive but compared to foreign banks, there is a lot of development that needs to be done - Lack of international banking exposure in terms of strategies and management - The banks will achieve their objective in meeting the customer needs and as an international player while the government imposes certain regulations on the foreign banks in Malaysia.
4	Computer Based Training System - Comparison between Class Room Training	- CBT is a good approach towards technology and knowledgeable worker - Some recommended to have CRT and CBT for more interaction

	(CRT) and Computer Based Training(CBT) - Recommendations	- CBT will speed the training period - It depends on the type of training as some of the training need to have interaction with trainer
5	Simulation based Training System - Opinion on simulation training system	- It is a very productive approach - The simulation system will be accepted if it could create the real environment - This approach should be taken as a long term planning - The simulation system need to have specialization and be separated for: 1. Loan Department 2. Business Plan Development 3. Marketing Department - Some of the users still prefer the old method
6	About Intelligent Bank Management Training System - How the system needs to be developed? - How the game should look like? - Recommendations	- The system need to be very practical and not boring - Should be able to accommodate all the macro factors - The system needs to be realistic such as the approach used in managing the bank and the reporting method - The game should not be too lengthy - Need to be efficient and simple to use - The system should be able to build their banking skills or expose them to the banking system - It should follow the Malaysian banking system as it differs from the United States of Americas' banking system

According to Mr.Kensington from Hong Leong Bank, in order to be managing a bank well, the executives must have the following criterias:-

1. Technical Knowledge
2. Analytical Thinking
3. Strategic Decision Making
4. Problem Recognition
5. Financial Management

6. Marketing Strategy

7. Dynamism

Table 4.3 describes these criterias in detail in accordance to the interview results with Mr.Kensington and Mr.Pillai.

Table 4.3
Management Criteria

No	Criteria	Details of Interview
1	Technical Knowledge	1. Asset-Liability Management: - Determine and measure interest rate 2. Managing Bank's Duration gap - Value and time weighted measure of maturity that consider the timing of all cash inflows from earning assets and all cash outflows associated with liabilities 3. Financial and Banking Structure 4. Regulatory Information 5. Managing the bank Investment Portfolio and Liquidity Position 6. Understanding of the complex rules and regulations
2	Analytical Thinking	1. Interest Rate Analysis 2. Risk Analysis 3. Financial Analysis 4. Able to analyze the macroeconomics scale
3	Strategic Decision Making	1. Operating Efficiency 2. Determine the bank's long range objective 3. Liability Management Strategy 4. Asset Management Strategy 5. Fund Management 6. Decision on interest rate 7. Investment in securities 8. Action plans to address and mitigate risk with clear steps

4	Problem Recognition	1. Non Performing Loan 2. Competition 3. Drop in Loan Sales 4. Foreign bank penetration of Domestic Markets
5	Financial Management	1. Financial flow and stocks 2. Financial Statement 3. Measure risk in banking 4. Expenses 5. Measuring the adequacy of earnings 6. Money Management skill 7. Annual Report
6	Marketing Strategy	1. Monitor customer feedback 2. Facilities offered 3. Introduction of new packages for customer (eg: loan package) 4. Credit Card
7	Dynamism	1. Able to change the strategy according to current economy 2. Able to comply with the Central Bank 3. Change the banking structure according to current banking trend 4. Technological innovation

4.3.2 Survey

A survey was conducted in order to gather information about the Malaysian Banking system. This information is very important in developing a simulation system that suits the banker's requirement in terms of bank management. An example of the survey form is included in the Appendix. The forms have been distributed to four bank executives from each bank as listed in Table 4.1. The questions focused on the type of training being provided, components to be included in Intelligent Bank

Management Simulation training system and trends affecting the banks. The result is shown in Figure 4.1.

According to survey on the type of training being conducted in the local banks, 75% of the training use class room training only while 16.67% have said that the banks provide both class room training (CRT) and computer based training (CBT). The survey was done randomly without recognizing the bank's name as was requested by the bank executives.

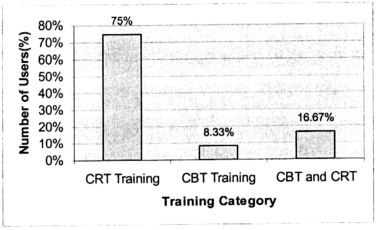

Figure 4.1: Number of users for each type of training provided for bank executives

According to a bank executive, the current training programs are held in different locations which are sometimes far from their bank branch. Some of them complained that the trainings are boring and it depends on the trainer's credibility.

According to Figure 4.2, 50% of the bank executives have rated the current training system as average and 16.67% of them have rated the training as good.

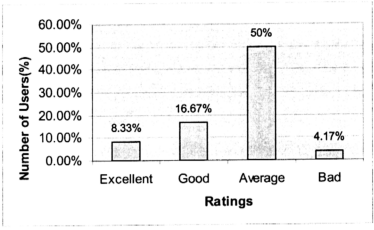

Figure 4.2: Ratings on the Trainings provided by Local Banks

The same bank executives were asked to rate simulation based training system and according to the survey as shown in Figure 4.3, 70.83% of them rate it as good while 16.67% rate it as average. This shows that most of them prefer to have a simulation based training system.

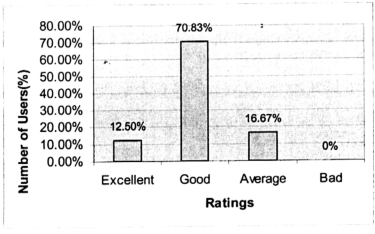

Figure 4.3: Rating by user on Simulation Based Training System

The users were asked to indicate the components which reflect the bank performance. As indicated in Figure 4.4, all of them have chosen GDP growth as an indicator to the performance of the banks while 83.33% have chosen interest rate as one of the indicator. The others are management strategy, skillful workers and advertisement.

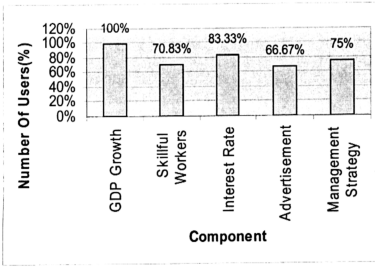

Figure 4.4: User Selection on the Components that indicate the Bank Performance

The result is shown in Figure 4.5 to identify the methods of participation preferred by bank executives. According to the survey, 83.33% prefer to play the game in groups. According to Mr. Kensington from Hong Leong Bank, the reason they choose to have it in groups is to build team work and cooperation among them, which is considered as a very important aspect in their daily business routine.

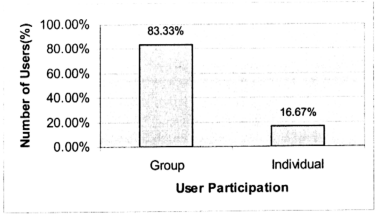

Figure 4.5: Preferred Type of Participation by the Users

Figure 4.6 shows the trends affecting banks performance. The bank executives were asked to list down the trends and 83.33% of them have indicated that the rising competition among the banks is their biggest threat and it affects their banks. The second highest trend will be knowledgeable and demanding customer. According to the graph, 68.98% have indicated that globalization could affect the bank as well.

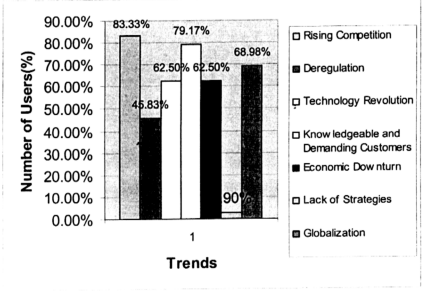

Figure 4.6: Trends that Affect the Bank Performance according to a Survey

4.3.3 Analyzing Procedures and Documents

Analysis of documents was done as another way of determining system requirements. These documents were very useful in deciding the important data needed by the participants of the IBMS. Through a detailed study on the bank records, less important data are ignored. The important data is inclusive of data which are needed by the game instructor to give fast and effective strategies to the participants, as the main aim of the system is to give benefit to both the players and the instructors. Besides that, it helped in understanding the establishment of a bank and the procedures to be followed in the banking sector.

The main documents which were useful for this project are

1. Malaysian Economic Statistic
2. Malaysian Central Bank Reports
3. Bank Annual Report

4.3.4 Malaysian Economic Statistic

The previous six years details of Malaysian economic statistics have been analyzed to understand the total amount of deposits available in a specific year in Malaysia. Table 4.4 shows the GDP growth, total GDP and Consumer Price Indices (CPI) from year 1997 to 2002.

According to the report, the data in Table 4.4 are the economic indicators of the country and the performance of banks depends on these economic indicators. These data will be shown to the Instructor and the participants to respond to the current economic situation and to manage the bank according to the economic situation.

Table 4.4
Yearly Growth Rate (Malaysian Central Bank Report)

Year	GDP Annual Growth (%)	GDP(RM billion)	CPI(Annual Change)
1997			
Quarter 1	7.6	46.0	4.0
Quarter 2	8.4	48.0	5.1
Quarter 3	7.2	50.8	5.2
Quarter 4	6.1	50.7	5.2
1998			
Quarter 1	-1.5	45.7	3.5
Quarter 2	-5.9	46.0	5.0
Quarter 3	-10.2	45.8	6.2
Quarter 4	-11.2	45.8	5.4
1999			
Quarter 1	-1.0	45.0	5.2
Quarter 2	4.8	48.0	3.0
Quarter 3	9.1	49.8	2.5
Quarter 4	11.7	51.0	2.1
2000			
Quarter 1	11.5	50.0	1.7
Quarter 2	8.3	52.5	1.5
Quarter 3	8.1	53.0	1.3
Quarter 4	2.9	54.0	2.0
2001			
Quarter 1	6.7	52.6	1.5
Quarter 2	0.4	52.5	1.5
Quarter 3	-1.0	53.0	1.4
Quarter 4	-0.8	53.5	1.0
2002			
Quarter 1	1.3	52.5	1.1
Quarter 2	4.0	54.0	2.0
Quarter 3	5.8	56.5	2.1
Quarter 4	5.4	56.5	1.8

4.3.5 Malaysian Central Bank's Statistics on Interest Rate

Referring to the Malaysian Central Bank's statistics and guidelines, the total liabilities and equity of IBMS were categorized as in Table 4.5 below:

Table 4.5
Categories of Liabilities and Equity

Liabilities Category	Allocation (%)
Deposit	90%
Central Bank Reserve	0%
Capital	6%
Equity	4%
TOTAL	100%

The deposits were categorized into checking deposit, savings deposit and time deposit as shown in Table 4.6.

Table 4.6
Allocation of Deposits in IBMS

Deposits Category	Allocation (%) from the Deposit Allocation
Checking Deposit	40%
Savings Deposit	30%
Time Deposit	30%
TOTAL	100%

The categories of assets are shown in Table 4.7.

Table 4.7
Categories of Assets and its Allocation

Assets Category	Allocation (%)
Loan	70%
Securities	20%
Cash	8%
Building	2%
TOTAL	100%

The loans were categorized into bridging loan, housing loan, syndicated loan and personal loan as shown in Table 4.8.

Table 4.8
Loan Allocation for IBMS

Loan Category	Allocation (%) from the Loan Allocation
Bridging Loan	45%
Housing Loan	10%
Syndicated Loan	13%
Personal Loan	32%
TOTAL	100%

The cash were categorized into vault cash, reserves and float as shown in Table 4.9.

Table 4.9
Cash Allocation for different type of Categories

Cash Category	Allocation (%) from the Cash Allocation
Vault Cash	20%
Reserves	40%
Float	40%
TOTAL	100%

In order for the participants to play the game, the data on interest rate need to be collected. The participants need to configure the interest rate for deposit and loans according to their managements' capability. Once the interest rate is entered and submitted, the IBMS will start to compare the interest rate with the real interest rate of Malaysian Banks as shown in Table 4.7 and Table 4.8. The data from Table 4.7 and Table 4.8 were collected from Central Bank of Malaysia and the interest rates were considered as the most effective rates for banks in accordance to the economic situation. The IBMS will automatically do a comparison between the Central Banks' rate and the participant's interest rate. The data will be evaluated according to Table 4.5 for deposits and Table 4.6 for loan. The IBMS will automatically release the amount as was stated in Table 4.10.

Table 4.10
Interest Regulator for Deposit

Rate	Interest Rate (IR)	Amount Released from Total Deposit
A	(IR – 5) to (IR + 5)	45%
B	Less than (IR – 5)	30%
C	More than (IR + 5)	15%

The table shown above was created after careful study and interview with the bank officer. According to the bank officers, Mr. Kensington from Hong Leong Bank and Mr.Tham from Maybank, as long as the interest rate is in between (IR – 5) and (IR + 5) it will be rated as 'A'. As these interest rates are attractive and acceptable in accordance to the economic situation, 45% of the total deposit will be released to the participant's bank automatically.

If the participant's interest rates is less than the (IR – 5), it will be rated as 'B' and 30% of the total amount of deposit will be released to the participant's bank. If the interest rate is more than (IR + 5), the system will automatically release 15% from the total amount of deposit available at a time in the country. The rules stated in Table 4.5 is applicable for all types

of deposits offered in IBMS such as checking deposit, savings deposit and time deposit.

The total amount of loan to be released will be decided through the interest rate stated by the participants and the marketing strategies established to promote their loan which will be evaluated by the Instructor. This concludes that the total loan to be provided by the banks will be decided by IBMS and the Instructor. Table 4.11 shows the total loan to be released by a bank according to the rates.

The rules stated in Table 4.11 is applicable to all types of loan offered in IBMS such as housing loan, personal loan, syndicated loan and bridging loan.

Table 4.11
Loan Allocated in accordance to the Interest Rate

Rate	Interest Rate (IR)	Amount Released from Total Loan Allocated
A	(IR – 5) to (IR + 5)	50%
B	Less than (IR – 5)	30%
C	More than (IR + 5)	15%

In accordance to the table shown above, 50% of the total loan will be allocated if the interest rate is in between (IR – 5) and (IR + 5). But if the

interest rate is less than (IR – 5), 30% of the total loan will be released for the bank. If the interest rate is more than (IR + 5), IBMS will automatically release 15% of the allocated loan.

Table 4.12 shows the details of deposit and interest rate in accordance to the Malaysian Central Bank report. Deposit allocation for IBMS were implemented according to the historical data shown in Table 4.12. Table 4.13 shows the details of loan available for each year and the interest rate in accordance to the Malaysian Central Bank report. The loan data were used in allocating loan for IBMS. The users data will be compared with the data in Table 4.12 and Table 4.13 to release the amount of loan and deposit in IBMS for every quarter.

Table 4.12
Details of Deposit and Interest Rate
(Malaysian Central Bank Report)

Year	Deposit (RM mil)	Interest Rate for Checking Deposit	Interest Rate for Savings Deposit	Interest Rate for Time Deposit (3 months)
1997				
Quarter 1	243, 811	8.81	3.90	4.83
Quarter 2		9.21	4.10	4.40
Quarter 3		9.27	4.19	4.45
Quarter 4		9.33	4.23	4.50
1998				
Quarter 1	307, 440	5.82	3.94	4.85
Quarter 2		5.83	3.96	4.86
Quarter 3		5.76	3.90	4.80
Quarter 4		5.74	3.87	4.78
1999				
Quarter 1	339, 708	3.24	2.50	3.80
Quarter 2		3.33	2.58	3.85
Quarter 3		3.68	2.67	3.90
Quarter 4		3.95	2.76	4.00
2000				
Quarter 1	362, 968	3.48	2.60	3.80
Quarter 2		3.50	2.64	3.85
Quarter 3		3.70	2.68	3.90
Quarter 4		4.24	2.73	3.87
2001				
Quarter 1	364, 724	3.21	2.48	3.78
Quarter 2		3.22	2.50	3.80
Quarter 3		3.34	2.58	3.85
Quarter 4		4.00	2.69	3.90
2002				
Quarter 1	366, 844	3.21	2.49	3.78
Quarter 2		3.22	2.50	3.81
Quarter 3		3.31	2.60	3.80
Quarter 4		4.00	2.70	3.85

Table 4.13
Details of Loan and Interest Rate
(Malaysian Central Bank Report)

Year	Total Loan (RM mil)	Interest Rate for Housing Loan	Interest Rate on Personal Loan	Interest Rate on Syndicated Loan	Interest Rate on Bridging Loan
1997					
Quarter 1		9.80	5.80	7.80	10.15
Quarter 2	276, 117	9.95	6.45	8.90	10.30
Quarter 3		9.90	6.30	8.85	8.40
Quarter 4		9.60	6.00	8.70	8.20
1998					
Quarter 1		8.80	6.00	8.80	8.40
Quarter 2	283, 160	8.85	5.80	8.90	8.20
Quarter 3		8.70	5.80	8.90	8.40
Quarter 4		8.65	6.00	8.85	8.40
1999					
Quarter 1		8.65	6.00	8.80	8.45
Quarter 2	285, 160	8.65	6.50	8.80	8.35
Quarter 3		8.70	6.35	8.70	8.30
Quarter 4		8.72	6.40	8.75	8.30
2000					
Quarter 1		8.70	6.30	8.70	8.25
Quarter 2	303, 528	8.65	6.35	8.75	8.20
Quarter 3		8.60	6.30	8.70	8.20
Quarter 4		8.50	6.25	8.65	8.15
2001					
Quarter 1		8.50	6.20	8.65	8.20
Quarter 2	304, 677	8.45	6.18	8.60	8.20
Quarter 3		8.40	6.20	8.65	8.25
Quarter 4		8.40	6.25	8.70	8.30
2002					
Quarter 1		8.45	6.20	8.75	8.35
Quarter 2	305, 707	8.50	6.25	8.70	8.40
Quarter 3		8.50	6.30	8.65	8.45
Quarter 4		8.55	6.32	8.62	8.40

4.3.6 Income

According to the income statement in the annual reports of Maybank, Hong Leong Bank and Public Bank Berhad, the net income can be calculated as shown below:

> Net Income = (Interest Revenue – Interest Expenses) +
> Fee Income – (Non Interest Expenses + Taxes)

Interest Revenue are the interest collected from the loan that have been released to the customers. The interest expenses are the interest being given to the customer according to the deposit being allocated to the participant's bank.

4.3.7 Bank Annual Report

The bank annual report is a very important source in recognizing the structure, format and important data that need to be declared at the end of each year. As for IBMS, a report will be generated at the end of each quarter.

The bank reports that have been analyzed are:

i. Maybank Annual Report 2000

ii. Hong Leong Bank Annual Report for the year 2000

iii. Public Bank Annual Report for the year 2000

iv. RHB Bank Annual Report for the year 2000

v. Bank Bumiputra Annual Report for the year 2000

In accordance to the Maybank Annual Report, the bank is managed by six divisional groups called as:

1. Main Group

   The Main Group is headed by the Chairman and the board of directors. The main task of the group is to administer both the international and local bank branches.

2. Operational Group

   The Operational Group is headed by the CEO and the main task of this group is to manage the banking activities for both local and international banks. According to Mr.Tham form Maybank this group is regarded as the most important group as it determines the operational effectiveness and efficiency of a bank.

3. Marketing Group

   The Marketing Group will be headed by the Marketing Director. The task of this group is to establish marketing strategies for the banks in all areas especially for deposit, loans and credit card.

4. Investment Group

   This group is called as the investment arm of Maybank Berhad. The group will determine the type of investment to be done by Maybank.

5. Risk Management Group

   The Risk Management Group will be involved more towards assisting the management in minimizing the risk factors

Table 4.14 shows the content of the bank annual report. Generally all the banks have the contents as shown in the Table 4.14 of the bank annual report.

Table 4.14
Contents of Bank Annual Report

Index	Contents
1	Notice of AGM
2	Financial Highlights
3	Financial Summary
4	Corporate Information
5	Statement of Corporate Governance
6	Audit Committee
7	Consumer Financial Services
8	Risk Management
9	Human Resource Management and Development
10	Management's Discussion and Analysis on Financial Position
11	Financial Information
12	Group Corporate Highlights

4.4 IBMS System Requirements

4.4.1 Functional Requirements

The Intelligent Bank Management Simulation System involves two type of user:

1. Instructor
2. Participants

The use case diagrams below (Figures 4.7 until 4.11) shows the task of the instructor and participants in using the system.

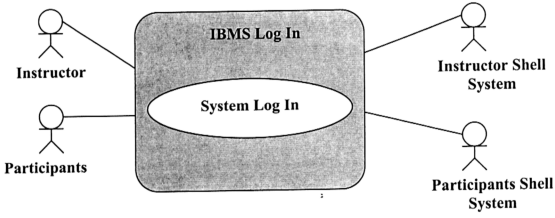

Figure 4.7: Use Case Diagram 1

Use Case: *IBMS Log In*

Primary Actors: Instructor

Pre-conditions:

1. Instructor goes to IBMS Homepage
2. Instructor clicks "Register" option to register as an Instructor
3. Instructor enter specified details in the Registration page
4. Instructor submit the Registration form
5. The system will prompt the user with message for successful completion of registration
6. System identified user through user name and password

Post-conditions:

1. User name and password validated and approves to go to the Instructor Main Page

Scenarios:

1. Instructor clicks the log in option in the IBMS Home page
2. System presents the Instructor log in page for the user
3. Instructor enters groupid, username and password
4. Instructor clicks the log in button
5. System validate the specified details
6. System presents the Instructor Main Page

Alternative Scenarios:

*a. At any time system fails:

1a. Invalid log in:

1. System prompt message to re-enter again

2a. Invalid log in after three attempts:

1. System prompt user to register before using the system

Figure 4.8: Use Case Description for IBMS Log in - Instructor

Use Case: IBMS Log In

Primary Actors: Participant

Pre-conditions:

1. Participant goes to IBMS Homepage
2. Participant clicks "Register" option to register as an Instructor
3. Participant enter specified details in the Registration page
4. Participant submit the Registration form
5. The system will prompt the user with message for successful completion of registration
6. System identified user through user name and password

Post-conditions:

1. User name and password validated and approves to go to the Participant Main Page

Scenarios:

7. Participant clicks the log in option in the IBMS Home page
8. System presents the Instructor log in page for the user
9. Participant enters groupid, username and password
10. Participant clicks the log in button
11. System validate the specified details
12. System presents the Participant Main Page

Alternative Scenarios:

At any time system fails:

1a. Invalid log in:

7. System prompt message to re-enter again

1b. Invalid log in after three attempts:

1. System prompt user to register before using the system

Figure 4.9: Use Case Description for IBMS Log in - Participant

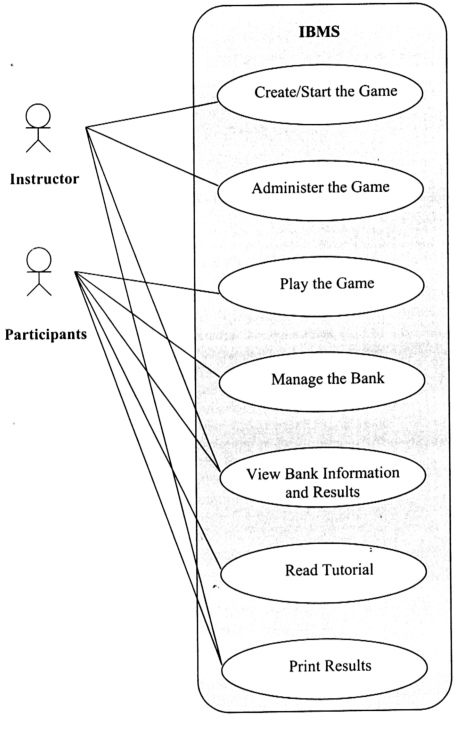

Figure 4.10: Use Case Diagram 2

Use Case : IBMS

Primary Actors: Instructor, Participants

Pre-conditions:

1. Instructor goes to IBMS Homepage
2. Instructor clicks "Register" option to register as an Instructor
3. Instructor enter specified details in the Registration page
4. Instructor submit the Registration form
5. The system will prompt the user with message for successful completion of registration
6. System identified user through user name and password

Post-conditions:

2. Instructor create a new game, configure the regulatory environment and administer the game played by the participants

Scenarios:

1. Instructor log in to the system
2. System presents Instructor Main Page
3. Instructor click "Create a New Game" option
4. System presents the New Game form
5. Instructor fill in the form with details
6. Instructor press submit button to save the details
7. System prompts user for successful submission
8. Instructor click "Regulatory Environment" from the main page
9. System presents the Regulatory page
10. Instructor enters the specified details
11. Instructor press submit button to save the details
12. System prompts user for successful submission
13. Participant log in to the system
14. System presents Participant Main Page
15. Participant read tutorial
16. Participant click "Set up Bank" option
17. System presents the Corporate Page
18. Participant enters the specified details
19. Participant click submit button to save the details
20. System displays Objective Page
21. Participant enters the specified details
22. Participant click submit button to save the details
23. System displays Operational Page

Figure 4.11: Use Case Description for IBMS

Scenarios:

29. Participant manage the bank for quarter 1
30. Participant view default information
31. Participant press submit button to end quarter N
32. Instructor view the results for the quarter N form Instructor Main Page
33. Instructor evaluate the performance
34. Instructor press submit button after evaluation
35. System will disburse loan and deposit amount after evaluation
36. System generate report for quarter N
37. Participant and Instructor view results for quarter N
38. Participant and Instructor print results: Income statement and balance sheet

*The scenario will be used for four quarters only.

Alternative Scenarios:

*a. At any time system fails:
1a. Game Creation Fails:
    2. System prompt message to re-enter details and
2a. Invalid Configuration:
    1. System prompt user to fill in all the details
3a. Invalid Submission
    1. System prompt user to fill in corporate details again

Figure 4.11, continued

4.4.2 Non-functional Requirements

Non-functional requirements represent a wide range of performance. Non-functional requirements are the constraints under which a system must operate and the standards which must be met by the delivered system. These requirements are very important and essential to make sure that IBMS does not only fulfill the user's needs but also fulfills the operational standards, procedures, rules and regulations. The operational requirements for IBMS are:

1. Hardware and software requirements – the hardware and software used by the IBMS to perform its tasks during run time.
2. User interface (UI) which is easy to use and easy to understand – UI should be easy to use and understand as UI is the communication tool between IBMS and the users
3. Reliability – IBMS should not produce dangerous and costly failures when it is used in a reasonable manner.
4. Understandability – in terms of the coding method used, allows other programmers to understand the logic of program flows. Hence, modifications can be done easily without effecting other part of the programs
5. Security Requirement – Whenever a user registers as a participant, they will be provided with the username and password.

6. Confidentiality – when dealing with banking strategy information's, confidentialities plays a major role as only the user concern are allowed to view the records.
7. Maintainability – IBMS can be easily maintained and changes can be done with ease
8. Number of Users – The minimum number of group at a time is one and the maximum numbers of groups are four. Each group consist of six members
9. Response time – The response time should be less than 8 second as been suggested for web based system by www.websiteoptimization.
10. Availability Restrictions – 24 hours a day
11. Connectivity needed from user sites – PC users connected on a dial-up lines or on a TCP/IP LAN

4.5 IBMS Hardware Requirements

4.5.1 Server Side

4.5.1.1 Web Server

The list below shows the system requirements required to set up a web server for the Web based Intelligent Bank Management System (IBMS):

1. 133 MHz or higher Pentium compatible CPU
2. 256 MB of RAM recommended

3. 4 GB hard disk with a minimum of 1 GB of free space
4. Windows 2000 server supports up to 4 CPUs on one machine
5. Network Interface Card

4.5.1.2 Web Database

The list below shows the system requirements required to set up a database management system (DBMS) for the IBMS:

1. Personal computer with an Intel Pentium or compatible 166 MHz or higher processor
2. 128 MB of RAM is recommended
3. 95 to 270 MB of available hard disk space for server, 250 MB free hard disk space for typical installation
4. Network Interface Card

4.5.2 Client Side

4.5.2.1 Personal Computer

The list below shows the system requirements required to set up a client PC to be able to use the Intelligent Bank Management System (IBMS):

1. 166 MHz or higher processor

2. At least 32 MB of RAM
3. Hard disk requirements vary based on the system configuration and the application and the features chosen to be installed
4. Additional memory may be required depending on operating system requirements
5. Network connection through existing network configuration or modem (recommended at least 28.8 Kbps)

.6 IBMS Software Requirements

4.6.1 Server Side

4.6.1.1 Web Server (Microsoft Windows 2000 Server with IIS 5.0)

Microsoft Windows 2000 Server operating system and its built-in web server, Internet Information Service 5.0 (IIS 5.0) is used to set up the Web Server. Windows 2000 Server operating system can help build the Internet into every part of an organization. From hosting a simple Web site to building a sophisticated e-commerce application, the Web and application services in windows 2000 provide the foundation to take full advantage of the Internet. Building on the strength of the services in the Microsoft Windows NT 4.0 operating system, Windows 2000 was designed with the internet very much in mind. The heart of the Windows 2000 Web and Application service is the built-in Web Server, Internet

Information Services 5.0. The full featured server enables to host web sites that can take advantage of interactive applications.

IIS supports the latest Internet standard, so that can take full advantage of the full scope of Internet technologies. IIS 5.0 features increased reliability, scalability and performance. IIS 5.0 includes enhanced version of Active Server Pages (ASP) server scripting environment. IIS 5.0 makes it easier to restart services, and it can even automatically restart itself if a bad Web application does cause a crash. In addition, IIS 5.0 supports an improved application protection model to help make sure that bad applications could not crash the Web Server.

4.6.1.2 Web Database (Microsoft Windows 2000 Server and MySQL Server)

Microsoft Windows 2000 Server operating system and Microsoft MySQL Server are used to set up the web database for the web based IBMS. MySQL Server running on Windows 2000 Server can achieve high performance.

MySQL Server 2000 is optimized to take advantage of many new features in Windows 2000 Server. It will also run on Windows NT and Microsoft Windows 98. By using SQL Server with Windows

2000 Server, the management of the database systems is improved through the Active Directory Services available in the Windows 2000 Server. Active Directory stores properties about each database such as description, alias, version, database size and the date of last database backup.

4.6.2 Client Side

4.6.2.1 Personal computers (Microsoft Windows OS and Web Browser)

A client PC should have a Windows operating system such as Windows 95, Windows 98, Windows NT 4.0 or Windows 2000 and a web browser, Internet Explorer 5.0 or above.

4.7 Workstation Hardware Requirements

A separate workstation is needed for the development of IBMS. By avoiding the development tasks being done on the server or the run time hardware, any crash caused by coding or testing will not affect the server or other related hardware. The list below shows the system requirements required to set up a workstation to carry out development tasks for the IBMS:

1. Personal computer with an Intel Pentium or compatible 166 MHz or higher processor

2. 32 MB of RAM
3. 4 GB hard disk is recommended.
4. Network connection through existing network configuration or modem.
5. Other standard computer peripherals

4.8 Workstation Software Requirements

4.8.1 Microsoft Visual Interdev 6.0

Microsoft Visual Interdev 6.0 will be used as the software development tool in this project. It is a comprehensive web based application development tool. It also provides an integrated environment that brings together various technologies to work towards a common goal of building robust and dynamic applications for the web. Microsoft Visual Interdev 6.0 development system now provides the comprehensive resources necessary for the successful Windows 2000 development.

It is needed for building e-commerce web solutions that take advantage of the new Windows 2000 clustering technologies, such as network and component load balancing, to scalable data-driven business application. It also provides a rapid application development (RAD) environment that lets developers design, build, debug and deploy data-driven Web applications faster than ever before. Visual InterDev 6.0 simplifies the process of integrating databases into a web application. Visual InterDev 6.0 ensures that the programming model is consistent for applications that

target either down-level browser or the latest version of Dynamic HTML browsers. It also offers the best possible tool for developers working on diverse teams.

4.9 Conclusion

The system requirements are the key input to the software architecture design. As was discussed earlier, the requirement analysis only capture the functional, operational, management or organizational, hardware and software requirements. During the designing phases, many more issues will be considered such as the layers, numbers of tiers and the infrastructure. Besides that, during the software architecture designing phase, the requirements are likely to change and this is normal as the purpose of the software architecture is to develop a formal specification that enables implementers to build applications which is operable.