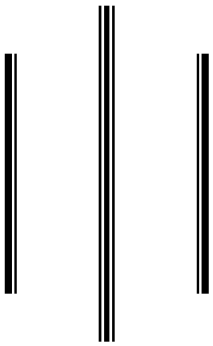
MIS in Nepal Rastra Bank

(An approach towards Integrated Financial Management Information System)



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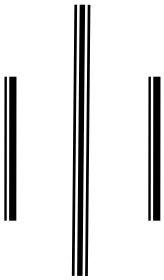

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RECOMMENDATION

This is to certify that the thesis

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has been prepared as approved by this Department in the prescribed format of Faculty of Management, Tribhuvan University. This thesis is forwarded for examination.

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VIVA - VOCE SHEET

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and found the thesis to be the original work of the student and written according to the prescribed format. We recommend the thesis to be accepted as partial fulfillment of the requirement for the degree of

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Shubhash Chandra Ghimire

DECLARATION

I hereby declare that the work reported in this thesis entitled "*MIS in Nepal Rastra Bank"* submitted to Shanker Dev Campus, Faculty of Management, Tribhuvan University, Kathmandu, Nepal is my original work done for the partial fulfillment of the requirement for the Masters degree in Business Studies (MBS) under the supervision of Er. Shankar Nath Adhikari, Lecturer of Tribhuvan University, Shanker Dev Campus.

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ABBREVIATION

NRB	Nepal Rastra Bank
MIS	Management Information System
TPS	Transaction Processing System
DSS	Decision Support System
IT	Information Technology
IS	Information System
ICT	Information Communication Technology
DOS	Disk Operating System
IMF	International Monetary Fund
ADB	Asian Development Bank
PCS	Process Control Systen
OAS	Office Automation System
EIS	Executive Information System
ESS	Executive Support System
CEO	Chief Executive Officer
SME	Subject Matter Expert
DFD	Data Flow Diagram
ERD	Entity Relationship Diagram
SA	South Africa
LAN	Local Area Network
WAN	Wide Area Network
LC	Letter of Credit
QC	Quality Circle
NBL	Nepal Bank Limited
BOP	Balance of Payment
RBB	Rastriya Banijya Bank

UTP	Unshielded Twisted Pair
UPS	Uninterrupted Power Supply
HTML	Hypertext Markup Language
PC	Personal Computer
QA	Quality Assurance
CD	Compact Disc
RFID	Radio Frequency Identification Data
UAT	User Acceptance Testing
IFMIS	Integrated Financial Management Information System
FC	Foreign Currency
SGL	Subsidiary General Ledger
ERP	Enterprise Resource Planning
GDP	Gross Domestic Product
MICR	Magnetic Ink Character Recognition
RDBMS	Relational Database Management System

CHAPTER - 1

INTRODUCTION

1.1 Background

1.1.1 Background of the Study

Information is critical resource in the operation and management of any organizations. Timely availability of relevant information is vital for effective performance of managerial functions such as planning, organizing, leading, and control. An information system in organization is like the nervous system in the human body: it is the link that connects all the organization's components together and provides better operation and survival in a competitive environment.

The term information system refers to "An organized combination of people, hardware, software, networks and data resources that collect, transforms, and disseminates information in the organization." Information system in organizations thus provides information support for decision makers. An organization can have different information system based on its functional areas.

Management Information Systems (MIS) is the term given to the discipline focused on the integration of different computer systems with the aims and objectives of an organization. MIS is a planned system of collecting, processing, storing and disseminating data in the form of information needed to carry out the functions of planning, controlling, and decision making by providing routine summary and exception reports.

1.1.2 Background Information of Nepal Rastra Bank

Nepal Rastra Bank (NRB), the central bank of Nepal established in 1956 under the Nepal Rastra Bank Act 1955 is an entity responsible for monetary policy of the country. Its primary responsibility as a Central Bank is for the stability of the national currency and money supply, including interest rates; and acting as a lender of last resort to the banking

sector and the national financial system as a whole. It also has supervisory powers to ensure that banks and other financial institutions do not behave recklessly or fraudulently.

The objectives of the bank are:

- To formulate necessary monetary and foreign exchange policies in order to maintain the stability of price and balance of payments for sustainable development of economy, and manage it
- To promote stability and liquidity required in banking and financial sector
- To develop a secure, healthy, and efficient system of payment
- To regulate, inspect, supervise and monitor the banking and financial system
- To promote entire banking and financial system of the Nepal and to enhance its public credibility.

In order to achieve the above mentioned objectives the bank performs the following functions and duties:

- Issue bank notes and coins
- Formulate necessary monetary policies and implement or cause to implement them
- Formulate foreign exchange policies and implement or cause to implement them
- Determine the system of foreign exchange rate
- Manage and operate foreign exchange reserve
- Issue license to commercial banks and financial institutions to carry on banking and financial business and regulate, inspect, supervise, and monitor such transactions
- Act as a banker, advisor and financial agent of Government of Nepal
- Act as the banker of commercial banks and financial institutions and function as the lender of last resort
- Establish and promote the system of payment, clearing and settlement and regulate those activities
- Implement or cause to implement any other necessary functions which the bank has to carry out in order to achieve the objectives of the bank

The vision of NRB is to evolve it as a modern, dynamic, credible, and effective Central Bank capable of delivering core central banking responsibilities.

The mission of NRB is to maintain macro-economic stability through sound and effective monetary, foreign exchange, and financial sector policies.

The core values of the NRB are credibility, responsibility, efficiency, accountability, transparency, and effectiveness.

Information needs of the NRB include:

a) Price stability and inflation e.g. savings and investment analysis.
b) Interest rate analysis – This can be in terms of monitoring demand of supply of funds of different maturities.
c) Safeguarding integrity of financial sector e.g. capital adequacy, assets classification etc.

Information must be channeled to the concerned in a hierarchical manner i.e. it must come from the detailed history, first level summary, aggregate level, derived data then to the Governor/Deputy Governor level. Information needs to be managed like all other corporate resources.

A sophisticated management information system provides following value benefits for central bank:

a) Provide online access to data on financial markets, banks, a sophisticated mechanism, which analyzes information using internal/external source for policy making and assets impact of policy decision and refine the composition of macro parameter.
b) Give total capacity which can facilitate coordinated action across banks and financial institutions being supervised, helps improve currency management function, monitor effectiveness of monetary policy initiatives, effective open market operations and enhance better banking service to government.

ICT has a strategic role because it is a key part of the corporate strategy, therefore, Central Bank cannot afford to leave it behind. ICT projects must also be managed for delivery of corporate objectives and as it is a core competency outsource, it must be secured.

1.2 Focus of Study

This study will be focused on review of various types of existing information systems used by the Nepal Rastra Bank developed in different platforms, hardware and networking infrastructure, security measures, and analysis of existing manual system for designing improved integrated financial management information system.

The study will be divided into different phases, which includes:

I. Review of Existing Software Systems

Those software systems developed by the IT department and currently in use will be reviewed. This review will be focused on an initial assessment of the primary underlying issues:

- Functionality Assessment
- Scalability Review
- Vulnerability Assessment
- Interoperability Capability
- Robustness of the Software
- Software Documentation
- IT Department systems support capability
- Software Process Management

II. Review of Networking Infrastructure and Hardware

A limited review of hardware and networking infrastructure will be conducted to identify the capability, limitation, sufficiency and efficiency of existing hardware and networking infrastructure.

III. Review of Security Measures

A limited review of security measures for protecting information assets of the bank will be conducted.

III. Review of Manual Systems

Although there are a lot of systems for automating different functions of the bank, there are areas which are still not automated. A limited review of those areas will be done for incorporating in the improved system.

1.3 Statement of the Problem

Evolutionary nature of the financial services along with the need to formulate and implement monetary, financial and external sector policies effectively in real time demands wider use of modern information and communication technology (ICT). Being a monetary authority and regulatory/supervisory body of the banks and financial institutions, the bank should utilize ICT optimally for its efficiency and effectiveness. The ICT strategy should be geared to develop ICT capability for facilitating the bank to carry out central banking operations effectively and efficiently and promote and encourage paperless environment.

Most of the software applications currently in use at NRB are developed in DOS based dBase IV and a few in Visual Basic (with Microsoft Access database support) which presents numerous problems associated with lack of: scalability (supporting increasing numbers of users), interoperability (interfacing with other modern IT systems), robustness (reliability), security (from hackers or malicious software agents), and usability (user-friendly features that encourage technology adoption). Having number of stand-alone software applications encourages reports reconciliation problems, particularly as all of these systems are largely dependent on manual data entry and the accuracy (or lack of accuracy) of the data entry operators. Having multiple stand-alone applications (with multiple data entry needs) also affects timeliness and causes many delays associated with data entry, data aggregation/analysis and reporting.

There is a lack of complete functionality (form a user requirements perspective) in many of existing software applications. After using these software applications, users from various departments then have to resort to manual processes and/or office productivity

tools (such as Microsoft Excel) to complete their tasks. Due to the lack of audit trail features ensuring data integrity becomes very difficult.

Similarly, NRB needs to interact and be cognizant of other systems used at Commercial Banks in Nepal. This is particularly important when NRB collects data and perform its compliance monitoring functions.

To achieve the objectives set by the bank it is necessary to utilize modern information and communication technology which can facilitate policy decisions and enhance operational efficiency.

So, the researcher has made an attempt to study the status of present systems used in the Bank. This study will help in-depth understanding of present systems, which will be a key to make significance improvement in present information systems, or designing and implementing a new centralized software system to meet industry best management practices that support a "single data entry" oriented data model, in-built audit control logs (audit trail features), in-built user access administration tools and other features associated with modern accounting, financial management and MIS systems.

The main problems under which research will be carried out are:

1. What is the present status of information system and information technology in Nepal Rastra Bank?
2. How effective and efficient is the current MIS towards meeting the objectives set by the Central Bank?
3. What are the limitations, problems, and inconveniences of present information management system?
4. What are the hardware and network infrastructure currently in use?
5. What are the confidentiality, integrity, and availability issues?
6. Does the system require any modification?

1.4 Objective of Study

Maintaining macro-economic stability through sound and effective monetary, foreign, exchange, and financial sector policies demands wider use of modern information and communication technology.

Central Banks contribute to a large proportion of financial-related output and play an important role in key activities for the functioning of the national economy. The acquisition and the treatment of information is a central activity of the bank and the impact of innovations in IT plays a significant role in central banking operations.

Development of a sound and adequate information system has become a necessity to meet the objectives set by the central bank.

The specific objectives of the study are to:

1. Study and analyze the present status of information systems used by the bank.
2. Study the hardware and network infrastructure of the bank.
3. Study the confidentiality, integrity, and availability issues for safekeeping of information and communication infrastructure and information assets.
4. Find out problems faced by bank in implementing information and communication technology.
5. Find out the dependency of bank on information System.
6. To provide suggestions and recommendations based on findings for improved integrated financial management information system.

1.5 Rationale of study

This study is concerned with the analysis of existing status of Management Information System, Hardware and Network infrastructure, security and confidentiality issues in central banking operations. This study will identifies the major problems in existing information systems and provide suggestions and recommendations based on findings for improved integrated financial management information system. The ultimate goal of integrated financial management information system is a gradual transformation towards paperless environment and to leverage technology to achieve operational excellence.

Since the output of the study will help to improve the existing management information system to meet the objectives set by the central bank, it will be beneficial to following entities:

a. Nepal Rastra Bank
b. Banks and Financial Institutions
c. Nepal Government
d. General Public
e. International agencies like IMF, World Bank, ADB etc.

1.6 Limitation of Study

Like any other thesis, this will also have some limitations as the study also takes data from secondary sources and that data will be assumed valid. The major limitations can be pointed as:

1. Both primary and secondary data will be utilized in study and to draw conclusions
2. Due to security and confidentiality issues of the central bank all the internal information may not be acquired
3. The study will analyze the existing information systems and recommends for a improved solution so the study itself does not provide a solution
4. Since the study is a part of academic requirement, it may not cover all the issues due to resource constraints

1.7 Organization of Study

The study has been organized in to five chapters each devoted to some aspects of the study of the Management Information System in Nepal Rastra Bank.

The chapters one to five consists of introduction, review of literature, research methodology, presentation and analysis of the secondary data and primary data, and summary, conclusions and recommendations. To follow the simple research methodology, it is rational behind this kind of organization of the study as:

Chapter one: It contains the "Introduction" of the study, where it deals with general background, statement of the problems, objective of the study, limitation of the study and organization of the study and other introductory framework.

Chapter Two: It consists of "Review of literature". This deal with the review of different literature which are closely related to this study such as review of the related books, journals, articles and the published and unpublished research works as well as thesis. Such review provides a strong base for next chapters.

Chapter Three: It describes the "Research Methodology". To find the result of research, some methodology should be followed, which helps to meet the objectives set in the chapter one.

Chapter Four: This focuses on the "Data Presentation and Analysis". This chapter is the major part of the whole study in which all collected relevant data are analyzed and interpreted with the help of different tools. In this chapter major findings of the study are explained in detail.

Chapter Five: This is the last chapter of the thesis. This stated the "Conclusions and Recommendations".

CHAPTER -2

REVIEW OF LITERATURE

This chapter concentrates mainly on the extensive review of the available books, reports and various papers relating to the information system. Review of literature helps the researcher to build a strong foundation and creates guidelines through which researcher's future research work is molded and prepared. The existing data and theories need not be studied again and the same could be used in the research, which reduces the duplication of the work and reduces the overhead of the researcher allowing him to be focused and concentrated on other critical research work.

The review of literature is divided into two sections: conceptual framework and review of related studies. Conceptual framework deals with the core concepts and theories based on which research work is carried out. Only after acquiring the in-depth theory based conceptual knowledge, one could be crystal clear on related field and could carry out practical oriented researches. Review of related studies is required to analyze the past researches done by other researchers. This helps the researcher in making his vision clear on what previous researcher has accomplished in his research, under what circumstances he has completed his research work and what kind of difficulties the former researcher had faced. Lessons learned from previous researcher's study could be used as guidelines to avoid similar adverse situation and complete the research with less overhead and difficulties. Review of related studies is further divided into Review of journals and Review of master degree thesis.

2.1 Conceptual Review

2.1.1 Banking and Information Technology

2.1.1.1 Bank

Bank is "a business establishment, in which money is kept for saving or commercial purpose, or is invested, supplied for loans or exchanged." [The American Heritage Dictionary of English Language].

The history of modern commercial banking industry dates back to 1937 A.D in which year Nepal Bank Ltd. was incorporated. Till 1984, financial sector was closed to private sector and foreign investors. Government of Nepal started to liberalize the financial sector in the first half of the 1980s. But it speeded up this process only in early 1990s. Private sector rushed into the finance industries especially after the restoration of multiparty democracy in 1990. Most of the commercial banks came into operation during the decade of 1990s.

2.1.1.2 Central Bank

The Central Bank is a financial institution charged with several different functions, the most important of which is managing a country's monetary policy. In addition, central banks typically manage a government's debt, they participate in the formulation of exchange rate policy, together with the government, and in many countries they are the principal regulator for the financial sector. Modern central banks were first developed during the late seventeenth century, most notably with the foundation of the Bank of England in 1694. While many major central banks before 1945 were privately owned, today central banks operate as agencies of government.

Functions of a central bank (not all functions are carried out by all banks):

- Implementing monetary policy
- Determining Interest rates
- Controlling the nation's entire money supply
- Government's banker and the bankers' bank ("lender of last resort")
- Managing the country's foreign exchange and gold reserves and the Government's stock register
- Regulating and supervising the banking industry
- Setting the official interest rate – used to manage both inflation and the country's exchange rate – and ensuring that this rate takes effect via a variety of policy mechanisms

Nepal Rastra Bank (NRB), the Central Bank of Nepal, was established in 1956 under the Nepal Rastra Bank Act, 1955, to discharge the central banking responsibilities including guiding the development of the embryonic domestic financial sector. Since inception, there has been a significant growth in both the number and the activities of the domestic financial institutions.

To reflect this dynamic environment, the functions and objectives of the Bank have been recast by the new NRB Act of 2002, the preamble of which lays down the primary functions of the Bank as:

- To formulate necessary monetary and foreign exchange policies to maintain the stability in price and consolidate the balance of payments for sustainable development of the economy of Nepal;
- To develop a secure, healthy and efficient system of payments;
- To make appropriate supervision of the banking and financial system in order To maintain its stability and foster its healthy development; and
- To further enhance the public confidence in Nepal's entire banking and financial system.

2.1.1.3 Technology investments in Banking Industry

More than most other industries, financial institutions rely on gathering, processing, analyzing, and providing information in order to meet the needs of customers. Given the importance of information in banking, it is not surprising that banks were among the earliest adopters of automated information processing technology. The technological revolution in banking actually began in the 1950s, well before it began in most other industries, when the first automated bookkeeping machines were installed at a few US banks. Automation in banking became common over the following decade as bankers quickly realized that much of their labor-intensive, information-handling processes could be automated on the computer. A second revolution occurred in the 1970s with the advent of electronic payments technology. Recognizing the importance of information security, the financial services industry during the late 1970s and early 1980s was also the first to implement encryption technologies on a widespread basis. The euphoria

surrounding the Internet today seems very similar to that era, when the first nationwide credit card and electronic funds transfer systems were built. As we could in earlier decades, we can identify three main reasons financial institutions are investing in technology. First, as in the 1950s and 1960s, they anticipate reductions in operating costs through such efficiencies as the streamlining back-office processing and the elimination of error-prone manual input of data. Second, institutions see opportunities to serve their current customers and attract new customers by offering new products and services as well as enhancing the convenience and value of existing products and services. Third, with more powerful data storage and analysis technologies, institutions are able to develop and implement sophisticated risk- and information-management systems and techniques.

2.1.2 Management

Management is the process of getting activities completed efficiently and effectively with and through other people. Major management functions are classified as: Planning, Organizing, Staffing, Directing, Coordinating, Reporting, and Budgeting.

Planning: Planning is selecting priorities and results (goals, objectives, etc.); and how those results will achieved. Planning typically includes identifying goals, objectives, methods, resources needed to carry out methods, responsibilities and dates for completion of tasks. Examples of planning are strategic planning, business planning, project planning, staffing planning, advertising and promotions planning, etc

Organizing: Organizing is allocating and configuring resources for accomplish the preferred goals and objectives established during the planning processes.

Leading: Simply put, leading is establishing direction and influencing people to follow that direction.

Coordinating: Simply put, coordinating is monitoring and adjusting resources and processes to achieve goals and objectives in a highly effective and efficient fashion.

Management Levels

Strategic Planning Level

The strategic planning level involves mangers at the top of the organizational hierarchy. The term **strategic** indicates the long-term impact of top managers' decisions on the entire organization. The term **executive** is often used to describe a manager on the strategic planning level.

Management Control Level

Middle-level managers include regional managers, product directors, and division heads. Their level is called "management control level" due to their responsibility of putting plans into action and ensuring the accomplishment of goals.

Operational Control Level

Lower level managers are persons responsible for carrying out the plans specified by managers on upper levels. Their level is called the "operational control level" because this is where the firm's operations occur.

When designing information systems, it is important to consider the manager's level. Such levels can influence both the source of information and how it is presented. Managers on the strategic level place greater emphasis on environmental information than do managers on the lower levels. Managers on the operational control level regard internal information as vital. Strategic planning-level managers prefer information in a summary format, whereas operational control-level managers prefer detail.

Management Knowledge

Computer literacy

This knowledge includes an understanding of computer terminology, recognition of its strengths and weaknesses, an ability to use the computer etc.

Information literacy

A manager should also have information literacy which consists of understanding how to use information at each step of the problem solving process, where this information can be obtained from, and how to share information with others.

Information literacy is not dependent on computer literacy. A manager can be information literate but computer illiterate.

2.1.3 Information

Information is a meaningful form of processed data, which has real or perceived value in the current or the prospective actions of the recipient.

Information has a value (or utility) within a given context (domain of the utility function relevant to task at hand). The value of information may change with time within a given context and its value may differ in different context even at the same time instant. Information value also depends on the relationship with other information. The information is people oriented and it varies with the nature of the people who are looking it.

According to levels of management information can be classified as: strategic, tactical, and operational. Strategic information is primarily utilized by high level management for strategic decision making. Tactical information is utilized by middle level management for short term decision making. Operation information is crucial for day to day operations of the organization and is primarily utilized by the lower level management.

Desirable characteristics of the information are:

Subjectivity: The value and usefulness of information are highly subjective, because what is information for one person may not be for another.

Relevance: Information is good only if it is relevant- that is, pertinent and meaningful to the decision maker.

Timeliness: Information must be delivered at the right time and the right place to the right person. Many organizations produce large volumes of reports without regards to when the information is needed; this greatly diminishes the value of their reports.

Accuracy: Information must be free of errors, because erroneous information can result in poor decisions and erode the confidence of users. However, accuracy is a relative concept; its meaning varies from context to context.

Correct information format: Information must be in the right format to be useful to the decision maker. The format should be such that it can be applied directly to the problem at hand without further processing.

Completeness: Information is said to be complete if the decision maker can satisfactorily solve the problem at hand using that information. Although completeness of information is highly described, often complete information is not available. Managers are compelled to make decisions even when their information is incomplete: this is practically true for problems that require intuition and judgment. How ever, if most, though not all, of the essential information necessary to make a decision is available, the decision maker may view the information as essentially complete.

Accessibility: Information is useless if it is not readily accessible to decision makers, in the desired format, when it is needed. Advances technology has made information more accessible today then ever before; however there is also a downside to this development. Sometimes managers feel overwhelmed by the large volumes of information that are readily available to them. Also, if information is easily accessible, it may fall into the wrong hands: this can seriously jeopardize the company. Hence there should be a balance between accessibility and security; we discuss some methods for achieving information security in an organization.

The transformation of data into information is performed by an information processor.

2.1.4 System

A system is a collection of parts (or subsystems) integrated to accomplish an overall goal (a system of people is an organization). Systems have input, processes, and outputs with ongoing feedback among these various parts.

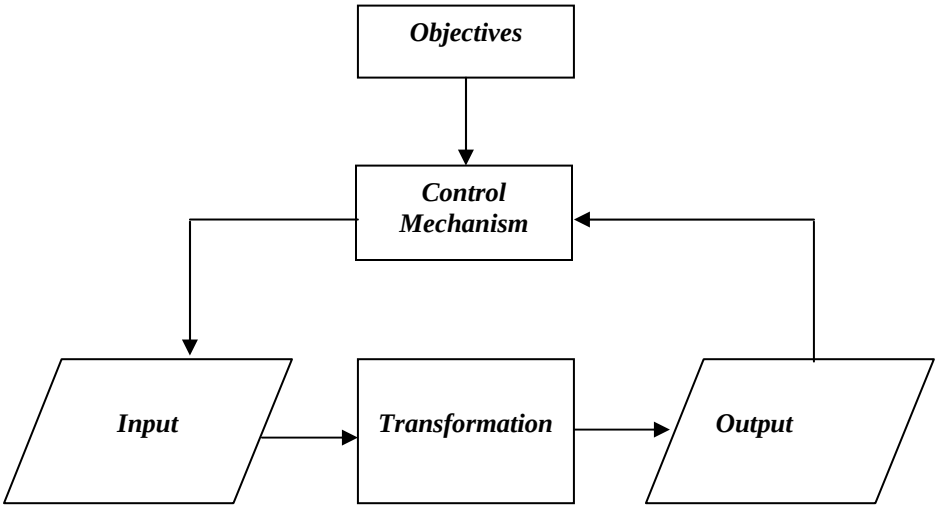

Figure 1: Basic configuration of system

Input resources are transformed into output resources. The resources flow from the input element, through the transformation element, and to the output element. A control mechanism monitors the transformation process to ensure that the system meets its objectives. The control mechanism is connected to the resource flow by means of a feedback loop, which obtains information from the system output and makes it available to the control mechanism. The control mechanism compares the feedback signals to the objectives and directs signals to the input element when it is necessary to change the system operation.

If one part of the system is removed, the nature of the system is changed as well. As important is any subsystem is the relationships between the subsystems.

System approach to Management

Manager has to use variety of tools, techniques, and skill while executing the management process of planning, organizing, staffing, coordinating and controlling. Manager could handle these processes effectively if they treat the organization as a system.

System approach to management is the wholestic approach which provides total figure of organization. It includes and shows the relationship between factors that affects organization's operations and goal achievement directly and indirectly. It takes management as transformation process of organization.

An organization system is a unified system composed of interrelated and interacting subsystems or parts (e.g. marketing, operation, human resource, finance) to achieve organization objectives. Organization is a dynamic social system consisting of input, processing, input, and feedback. Since organization is an open system, components of internal and external environment continuously affect its performance directly and indirectly.

Features of system approach

- It comprehensively includes all interrelated and interacting parts.
- As an open system, it accepts continuous interaction with the environment. Organization get required resources and support from its environment
- It defines and describes the boundary of the organization
- It shows how an organization tries to maintain in equilibrium by taking corrective actions.

2.1.5 Information System

Information system is an organized combination of people, hardware, software, networks and data resources that collect, transform, and disseminate information in the organization." (James O'Brien 1998).

An information system collects, processes, stores, analyses, and disseminates information for a specific purpose. Information system turns data into information.

2.1.5.1 Information System Resources

An information system consists of five major resources:

People Resources: People are required for the operation of all information systems. These people resources include end users and IS specialists. End users use information system or the IS products. They can be customers, salespersons, clerk, accountants, or managers. IS specialists develop and operate information systems. They include systems analyst, programmer, technician, engineer, network manager etc.

Hardware Resources: Hardware resources include all physical devices and materials used in information processing. It includes not only machines, such as computers and other equipments, but also all data media that is tangible objects on which data are recorded; from sheets of paper to magnetic or optical disks.

Software Resources: Software resources are comprised of all sets of information processing instructions. It includes not only the set of operating instructions called programs, which direct and control computer hardware, but also the sets of information processing instructions called procedures that people need.

Network Resources: Communication technologies and networks are a fundamental resource component of information systems. Network Resources included communication media, communication processors, network access and control software.

Data Resources: Managers and information systems professionals consider data as valuable organizational resources. Data can be in many forms, like alphanumeric data, textual data, image data, graphic data, audio data, video data etc. Data are the raw, unorganized, discrete (separate, isolated) potentially-useful facts and figures that are later processed (manipulated) to produce information.

2.1.5.2 Role of Information Systems in Organizations

Information Systems are critical to the success of organization at all managerial levels. Information Systems can play a *strategic role* in an organization if they are used effectively throughout the company. Two ways to do that are through beating the competition and adding value to products or services.

IS provides both tangible and intangible benefits to organization. Examples of tangible benefits are:

- Increased productivity
- Low operating costs
- Reduced work force
- Lower computer expenses
- Lower supplier costs
- Lower clerical/professional costs
- Reduced growth of expenses
- Reduced facility costs
- More efficient business services

Examples of intangible benefits are:

- Improved asset use; resource control; planning
- Increased flexibility
- More timely information
- Increased learning
- Attain legal requirements
- Enhanced employee goodwill, job satisfaction, decision making, operations
- Higher customer satisfaction
- Better corporate image

2.1.5.3 Types of Information Systems

Information systems can be classified as either operations support systems or management support systems.

Operation Support System

Operation support system produces a variety of information products for internal and external use. These information products do not fulfill specific need of the managers and require further processing by management support systems. The role of business firm's operations support systems is to efficiently process business transactions, control industrial processes, support enterprise communications and collaborations, and update corporate databases. Different types of operational support systems are: TPS, PCS, and OAS.

Transaction Processing System

Transaction processing systems (TPS) is an information system that is used at the operational level of the organization to record the routine transactions that take place in everyday operations. TPS combine data in various ways to fulfill the hundreds of information needs a company requires to be successful. The data are very detailed at this level.

A TPS is a basic business system. It:

- Serves the most elementary day-to-day activities of an organization;
- Supports the operational level of the business;
- Supplies data for higher-level management decisions.
- Is often critical to survival of the organization
- Mostly for predefined, structured tasks
- Can have strategic consequences (e.g. airline reservation system)
- Usually has high volumes of input and output
- Provides data which is summarized into information by systems used by higher levels of management
- Need to be fault-tolerant.

Process Control System

Process control system monitors and control the physical processes. Example includes petroleum refining, power generation etc.

Office Automation Systems (OAS)

Office automation systems are designed to increase the productivity of data workers. They support general office work for handling and managing documents and facilitating communication. OAS provides individuals' effective ways to process personal and organizational data, perform calculations, and create documents. Spreadsheets, presentation packages like PowerPoint, personal database systems and note-taking systems (appointment book, notepad, card file) are part of OAS. In addition, OAS include communication systems for transmitting messages and documents (*e-mail*) and teleconferencing capabilities.

Management Support Systems

Management Support Systems are information systems focusing on providing information and support for effective decision making by managers. Conceptually, different types of management support systems help a variety of decision making responsibilities. Different types of management support systems are MIS, DSS, and EIS.

Management Information Systems

Management Information Systems converts TPS data into information for monitoring performance and managing an organization. Transactions recorded in a TPS are analyzed and reported by an MIS. MIS is a computer-based information system that provides flexible and speedy access to accurate data at the management level of an organization that serves the functions of planning, controlling, and decision making by providing routine summary and exception reports

Decision Support systems (DSS)

Decision Support System also serves the management level of an organization but in a somewhat different way than an MIS. An MIS uses internal data to supply useful information. A DSS uses internal data also but combines it with external data to help analyze various decisions management must make. Analyzing complex, interactive decisions is the primary reason for a company to use a DSS.

Characteristics of Decision-Support Systems

- DSS offer users flexibility, adaptability, and a quick response.
- DSS operate with little or no assistance from professional programmers.
- DSS provide support for decisions and problems whose solutions cannot be specified in advance.
- DSS use sophisticated data analysis and modelling tools.

Executive Support Systems (ESS)

Also known as an Executive Information System (EIS), ESS provides executives information in a readily accessible, interactive format. They are MIS for executive use. An EIS/ESS usually allows summary over the entire organization and also allows drilling down to specific levels of detail. ESS is used by top level (strategic) management. They let the CEO of an organization tie in to all levels of the organization. They are very expensive to run and require extensive staff support to operate.

2.1.6 Management Information System

A management information system (MIS) is a system or process that provides the information necessary to manage an organization effectively. MIS and the information it generates are generally considered essential components of prudent and reasonable business decisions.

The importance of maintaining a consistent approach to the development, use, and review of MIS systems within the institution must be an ongoing concern of bank management.

MIS should have a clearly defined framework of guidelines, policies or practices, standards, and procedures for the organization. These should be followed throughout the institution in the development, maintenance, and use of all MIS.

MIS is viewed and used at many levels by management. It should be supportive of the institution's longer term strategic goals and objectives. To the other extreme it is also those everyday financial accounting systems that are used to ensure basic control is maintained over financial recordkeeping activities.

Financial accounting systems and subsystems are just one type of institutional MIS. Financial accounting systems are an important functional element or part of the total MIS structure. However, they are more narrowly focused on the internal balancing of an institution's books to the general ledger and other financial accounting subsystems. For example, accrual adjustments, reconciling and correcting entries used to reconcile the financial systems to the general ledger are not always immediately entered into other MIS systems. Accordingly, although MIS and accounting reconcilement totals for related listings and activities should be similar, they may not necessarily balance. An institution's MIS should be designed to achieve the following goals:

- Enhance communication among employees.
- Deliver complex material throughout the institution.
- Provide an objective system for recording and aggregating information.
- Reduce expenses related to labor-intensive manual activities.
- Support the organization's strategic goals and direction.

Because MIS supplies decision makers with facts, it supports and enhances the overall decision making process. MIS also enhances job performance throughout an institution. At the most senior levels, it provides the data and information to help the board and management make strategic decisions. At other levels, MIS provides the means through which the institution's activities are monitored and information is distributed to management, employees, and customers.

Effective MIS should ensure the appropriate presentation formats and time frames required by operations and senior management are met. MIS can be maintained and developed by either manual or automated systems or a combination of both. It should always be sufficient to meet an institution's unique business goals and objectives. The effective deliveries of an institution's products and services are supported by the MIS. These systems should be accessible and useable at all appropriate levels of the organization.

MIS is a critical component of the institution's overall risk management strategy. MIS supports management's ability to perform such reviews. MIS should be used to recognize, monitor, measure, limit, and manage risks. Risk management involves four main elements:

- Policies or practices
- Operational processes
- Staff and management
- Feedback devices

Frequently, operational processes and feedback devices are intertwined and cannot easily be viewed separately. The most efficient and useable MIS should be both operational and informational. As such, management can use MIS to measure performance, manage resources, and help an institution comply with regulatory requirements. One example of this would be the managing and reporting of loans to insiders. MIS can also be used by management to provide feedback on the effectiveness of risk controls. Controls are developed to support the proper management of risk through the institution's policies or practices, operational processes, and the assignment of duties and responsibilities to staff and managers.

Technology advances have increased both the availability and volume of information management and the directors have available for both planning and decision making. Correspondingly, technology also increases the potential for inaccurate reporting and flawed decision making. Because data can be extracted from many financial and transaction systems, appropriate control procedures must be set up to ensure that

information is correct and relevant. In addition, since MIS often originates from multiple equipment platforms including mainframes, minicomputers, and microcomputers, controls must ensure that systems on smaller computers have processing controls that are as well defined and as effective as those commonly found on the traditionally larger mainframe systems.

All institutions must set up a framework of sound fundamental principles that identify risk, establish controls, and provide for effective MIS review and monitoring systems throughout the organization.

Sound fundamental principles for MIS review include proper internal controls, operating procedures and safeguards, and audit coverage.

2.1.6.1 Risks Associated With MIS

Risk reflects the potential, the likelihood, or the expectation of events that could adversely affect earnings or capital. Management uses MIS to help in the assessment of risk within an institution. Management decisions based upon ineffective, inaccurate, or incomplete MIS may increase risk in a number of areas such as credit quality, liquidity, market/pricing, interest rate, or foreign currency. A flawed MIS causes operational risks and can adversely affect an organization's monitoring of its fiduciary, consumer, fair lending, Bank Secrecy Act, or other compliance-related activities. Since management requires information to assess and monitor performance at all levels of the organization, MIS risk can extend to all levels of the operations. Additionally, poorly programmed or non-secure systems in which data can be manipulated and/or systems requiring ongoing repairs can easily disrupt routine work flow and can lead to incorrect decisions or impaired planning.

Assessing Vulnerability to MIS Risk

To function effectively as an interacting, interrelated, and interdependent feedback tool for management and staff, MIS must be "useable." The five elements of a useable MIS system are: timeliness, accuracy, consistency, completeness, and relevance. The usefulness of MIS is hindered whenever one or more of these elements are compromised:

Timeliness

To simplify prompt decision making, an institution's MIS should be capable of providing and distributing *current* information to appropriate users. Information systems should be designed to expedite reporting of information. The system should be able to quickly collect and edit data, summarize results, and be able to adjust and correct errors promptly.

Accuracy

A sound system of automated and manual internal controls must exist throughout all information systems processing activities. Information should receive appropriate editing, balancing, and internal control checks. A comprehensive internal and external audit program should be employed to ensure the adequacy of internal controls.

Consistency

To be reliable, data should be processed and compiled consistently and uniformly. Variations in how data is collected and reported can distort information and trend analysis. In addition, because data collection and reporting processes will change over time, management must establish sound procedures to allow for systems changes. These procedures should be well defined and documented, clearly communicated to appropriate employees, and should include an effective monitoring system.

Completeness

Decision makers need complete and pertinent information in a summarized form. Reports should be designed to eliminate clutter and voluminous detail, thereby avoiding "information overload."

Relevance

Information provided to management must be relevant. Information that is inappropriate, unnecessary, or too detailed for effective decision making has no value. MIS must be appropriate to support the management level using it. The relevance and level of detail provided through MIS systems directly correlate to what is needed by the board of

directors, executive management, departmental or area mid-level managers, etc. in the performance of their jobs.

2.1.6.2 Achieving Sound MIS

The development of sound MIS is the result of the development and enforcement of a culture of system ownership. An "owner" is a system user who knows current customer and constituent needs and also has budget authority to fund new projects. Building "ownership" promotes pride in institution processes and helps ensure accountability.

Although MIS does not necessarily reduce expenses, the development of meaningful systems, and their proper use, will lessen the probability that erroneous decisions will be made because of inaccurate or untimely information. Erroneous decisions invariably misallocate and/or waste resources. This may result in an adverse impact on earnings and/or capital.

MIS which meets the five elements of usability is a critical ingredient to an institution's short- and long-range planning efforts. To achieve sound MIS, the organization's planning process should include consideration of MIS needs at both the tactical and strategic levels. For example, at a tactical level MIS systems and report output should support the annual operating plan and budgetary processes. They should also be used in support of the long term strategic MIS and business planning initiatives. Without the development of an effective MIS, it is more difficult for management to measure and monitor the success of new initiatives and the progress of ongoing projects. Two common examples of this would be the management of mergers and acquisitions or the continuing development and the introduction of new products and services.

Management needs to ensure that MIS systems are developed according to a sound methodology that encompasses the following phases:

- Appropriate analysis of system alternatives, approval points as the system is developed or acquired, and task organization.
- Program development and negotiation of contracts with equipment and software vendors.

- Development of user instructions, training, and testing of the system.
- Installation and maintenance of the system.

Management should also consider use of "project management techniques" to monitor progress as the MIS system is being developed. Internal controls must be woven into the processes and periodically reviewed by auditors. Management also should ensure that managers and staff receive initial and ongoing training in MIS. In addition, user manuals should be available and provide the following information:

- A brief description of the application or system.
- Input instructions, including collection points and times to send updated information.
- Balancing and reconciliation procedures.
- A complete listing of output reports, including samples.

Depending on the size and complexity of its MIS system, an institution may need to use different manuals for different users such as first-level users, unit managers, and programmers.

2.1.6.3 MIS Reviews

By its very nature, management information is designed to meet the unique needs of individual institutions. As a result, MIS requirements will vary depending on the size and complexity of the operations. For example, systems suitable for community sized institutions will not necessarily be adequate for larger institutions. However, basic information needs or requirements are similar in all financial institutions regardless of size. The complexity of the operations and/or activities, together with institution size, point to the need for MIS of varying degrees of complexity to support the decision-making processes. Examiners should base MIS reviews on an evaluation of whether the system(s) provide management and directors with the information necessary to guide operations, support timely decision making, and help management monitor progress toward reaching institutional goals and objectives. Although examiners should encourage

management to develop sound information systems, they also should be reasonable in their expectations about what constitutes suitable MIS.

Examiner MIS reviews are normally focused on a specific area of activity, on a clearly identifiable departmental or functional basis, or as a part of the activity being examined within a larger department. During the examination, the MIS review should occur at both a macro (big picture) level and also at the micro (functional/product oriented view of the business) level. The examiner-in-charge of the MIS-review program should look at the usability and effectiveness of the corporate-wide MIS structure. The examiner should also collect MIS related observations and information from the examiners-in-charge of the other areas under review. It would be very difficult for one examiner to attempt to perform a detailed MIS review for all of an organization's functional and operational areas of activity. It is practical and reasonable, however, to have this lead examiner coordinate and consolidate the MIS reviews from the other examination areas. The MIS related feedback received from other area examiners provides important and practical input to the MIS review examiner. The consolidation, coordination, and analysis of this MIS feedback can be used to reach supportable macro level conclusions and recommendations for corporate-wide MIS activities. MIS reviews in the functional or product review areas generally should be performed by an examiner who is considered to be a subject matter expert (SME) in the area of activities or operations that are being supported by the MIS systems or processes under review. The SME must have a thorough and complete understanding of the baseline "business" supported by the MIS system(s) under review. A solid understanding of the business is fundamental to the completion of a meaningful MIS review. The decision regarding the overall quality and effectiveness of MIS generally should be made by the SME for the area under review. The SME for each area where MIS is under review must subsequently communicate MIS related findings, conclusions, and opinions to the examiner charged with the responsibility for the complete MIS review work program at that examination. This is clearly a collaborative effort among area SMEs and the examiner charged with the responsibility for this area of review. The examiner coordinating the overall MIS review program should be a commercial examiner with broad experience and understanding which covers many areas of organizational operations and activity. Alternatively, a bank

information systems (BIS) examiner could serve in this capacity. BIS examiners should be consulted whenever there are questions, issues, or concerns surrounding the use of information systems (IS) or electronic data processing (EDP) technology or the effectiveness of MIS-related internal controls in any automated area of the organization's activities.

2.1.6.4 Objective of MIS

Main objectives of any type of MIS can be described as:

- To Facilitate the decision making process
- Provide requisite information at each level of management to carry out their functions
- Helps in highlighting the critical factors
- Provide a complete system for querying, documentation, storing, retrieving & transmitting information to the user
- Support decision making in both structured and unstructured problem environments

2.1.6.5 Characteristics of MIS

Main characteristics of MIS can be enlisted as:

- MIS support structured decisions at the operational and management control levels. However, they are also useful for planning purposes of senior management staff.
- MIS are generally reporting and control oriented. They are designed to report on existing operations and therefore to help provide day-to-day control of operations.
- MIS rely on existing corporate data-and data flows.
- MIS have little analytical capability.
- MIS generally aid in decision making using past and present data.
- MIS are relatively flexible and easy to use.
- MIS have an internal rather than an external orientation.

2.1.6.6 Limitation of MIS

- Cannot replace managerial judgment in decision making.
- Quality of output in directly related with quality of input and processes.
- MIS cannot provide tailor made information packages. It is required to analyze the available information before decision making
- Not applicable for fast changing organization
- Only Quantitative analysis
- MIS less active if no database
- Less effective in organizations where information is not being shared with others
- Less useful for unstructured decisions

2.1.6.7 MIS factors for success and failure

Many organization use MIS successfully, others do not. Though the hardware and software is the latest and has appropriate technology, its use is more for the collection and storage of data and its elementary processing. There are some factors, which makes the MIS a success, and some others, which make it a failure.

Factors to contribute for success of MIS

MIS to be successful need all the following features:

- The MIS is integrated into the management function. It sets clear objectives to ensure the MIS focus on the major issues of the business.
- An appropriate information processing technology to meet the data processing and analysis needs of the user.
- Viable user requirement and operation
- Clear integrated picture
- MIS focus results and goals
- Recognize human behavioral aspects in the process of management
- User friendly design and capability to quickly meet newer and newer needs of an information

Factors contribute to fail MIS

The common factors, which are responsible for failure of MIS are listed as follows:

- MIS is used as data processing and not as information processing system
- Complexity and frequently changing requirements
- Insufficient control on input parameters
- Development of MIS without sufficient understanding of business processes
- Lack of training and application
- Thinking MIS can solve all the problems and control
- Lack of administrative discipline in following the standardized systems and procedures
- Not meeting certain critical and key factors-response time, user friendliness, timeliness
- Does not give perfect information to all the users in the organization. Any attempts towards such a goal will be unsuccessful because every users has a human ingenuity, bias and certain assumptions not known to the designer

2.1.7 System Development Life Cycle

The activities that go into producing an information solution to an organizational problem or opportunity are called system development. System development is a structured kind of problem solving with distinct activities. Most software lifecycles are phased processes with clearly identifiable goals, milestones and tasks, which can be summarized to following general activities:

- system analysis
- system design
- coding
- testing
- conversion / implementation
- maintenance
- documentation

Some of the system development activities may to be repeated or some may be taking place simultaneously, depending on the approach to system building that is being employed.

System Analysis

System analysis is done in order to understand the problem which the software system is to solve. For example, problem could be automating an existing manual process, or developing a completely new automated system or a combination of two. For large system which have a large number of features, and that need to perform many different tasks, understanding the requirement of the system is a major task. The emphasis on system analysis is on identifying what is needed from the system, and how the system will achieve its goal.

Once the problem is analyzed and essentials understood, the requirement must be specified in the requirement specification document. The requirement's document must specify all the functional and performance requirement, the formats of input, outputs and any required standards, and all design constraints that exist due to political, economic, environmental and security reasons.

System Design

The purpose of the design phase is to plan a solution of the problem specified by the requirement analysis document. This phase is the first step in moving from the problem domain to the solution domain. The design of a system is perhaps the most critical factor affecting the quality of the software, and has a major impact on the later phases, particularly testing and maintenance. The output of this phase is the design document. The system design activities often divided into two separate phases:

System Design: Which is sometime also called top-level design. The main aim is to identify the modules that should be in the system, the specification of these modules and how they interact with each other to produce the desired result.

Detailed Design: Detailed design includes the internal logic of each of the module. Logic of the module is usually specified in a high level design description language which is independent of the target language in which the software will eventually be implemented. For system design, various tools such as Flow Chart, E-R Diagram and DFD (Data Flow Diagram) etc. are used.

Coding

Once the design is complete, the coding phase starts. The goal of the coding phase is to translate the design of the system into code in a given programming language. For a given design, the aim of this phase is to implement the design in best possible manner. The coding phase affects both testing and maintenance profoundly. A well-written code can reduce the testing and maintenance. Since the testing and maintenance is much higher than the coding cost. So the goal coding should be to reduce the maintenance cost.

Testing

Testing is the major quality control measure employed during software development. Its basic function is to detect errors in the system. During system analysis and design phase, the output is a document i.e., usually textual and non-executable. After the coding phase, computer programs are available that can be executed for testing purposes. This implies that testing not only has to uncover errors introduced during coding but also errors introduced during the previous. Thus, the goal of testing is to uncover requirement, design or coding errors in the programs.
Testing is extremely critical and time consuming activity. It requires proper planning of the overall testing process.

Conversion / Implementation

Conversion is the process of changing from the old system to the new system. Four major conversion strategies can be employed:

Parallel Strategy: In a parallel both the old system and new system are run together for a time until everyone is assured that the new one functions correctly. This is safest conversion approach; however, this approach is very expensive.

Direct Cutover: The direct cutover strategy replaces the old system entirely with the new system on an appointed day. It is very risky approach that can potentially be more costly than parallel strategy, if serious problem with the new system is found.

Pilot Study: The pilot strategy introduces the new system to only a limited area of the organization, such as a single department or operating unit. When this pilot version is complete and working smoothly, it is installed throughout the rest of the organization.

Phased approach: This strategy introduces the new system in stages either by functions or organization units.

Maintenance

Maintenance is an extremely important activity after the system is developed. Maintenance includes all the activities after the installation of software that is performed to keep the system operations. There are two major forms of maintenance:

Adaptive maintenance: Maintenance is also needed due to a change in the environment or the requirements of a system (while changing the s/w from one system to other system).

Corrective maintenance: Maintenance activities related to fixing of errors fall under corrective maintenance. Sometimes error on software may be seen after a long duration of implementation. Such unseen errors need to be maintained immediately once it is shown.

Documentation

This is ongoing process that runs parallel to each of the above phases. Beside documents such as requirement specification document and design document, it is important to keep track of everything that goes into designing any system. Documentation includes code snippets and explanation, user manuals, training manuals etc.

2.1.8 Information Security

Computer security is the protection of personal or confidential information and/or computer resources from individuals or organizations that would willfully destroy or use said information for malicious purposes. One important point often overlooked in computer security is that the security does not need to be limited to simply the protection of resources from malicious sources—it could actually involve protection from the application itself. Building a secure computer system also involves designing a robust application that can deal with internal failures; no level of security is useful if the system crashes and is rendered unusable. A truly secure system is not only safe from external forces, but from internal problems as well. The most important point is to remember that any fl aw in a system can be exploited for malicious purposes. Use of cryptography does not guarantee a secure system either; using the strongest cryptography available does not help if someone can simply hack into your machine and steal that data directly from the source. Physical security also needs to be considered. Can a malicious individual gain access to an otherwise protected system by compromising the physical components of the system. Finally, there is the human factor. Social engineering, essentially the profession practiced by con artists, turns out to be a major factor in many computer system security breaches.

2.2 Review of Articles

A. **Panta Bhubanesh (1992)** in his article *"Information Technology and Industrial Sector in Nepal"* has opined that presence of Information Technology and Computer has not guaranteed the improvement in productivity. According to him, this is mainly due to insufficient knowledge about the operation of computer and lack of maximum utilization of the acquired technology. Moreover, another most important cause of this is due to lack of skilled manpower in Nepal. The main problem is not the know how of the installation of the equipment, but the training needs and the depth of the training needs to given to the employee. Another problem is lack of strategy about planning, design and implementation of these technology applications.

B. **Shrestha Prem Shanker(1999)** emphasized the *"Necessity of Systematic Information System for every organization, industries and offices"* to get the right information promptly. He pointed out the function of Information System as follows.

- To get the required information only with specified criteria at time of requirement.
- To keep the information in the database with no duplication i.e. redundancy.
- To update the all the related data at the same time.
- To maintain the integrity of the data.

C. **Simon Mukenge Tshinu and Gerrit Botha** in their article *"An integrated ICT Management Framework for Commercial Banking Organizations in South Africa"* tried to find out the framework for managing ICT in banking sector. According to the article Information and Communication Technology (ICT) infrastructure needs to be regarded as the integration of different components that interact with one another directly and indirectly for sustainability of organization's objectives. For the organizations that rely intensely on ICT, such as in the banking industry, it is a necessity to develop practices and tools such as integrated ICT Management Framework that collects best practices found in different ICT Management Frameworks and combine them to business objectives that direct ICT strategies, technologies, and management practices for better management of ICT infrastructure. The main points of their article are:

There is diversification in the use of ICT Management Frameworks to manage ICT infrastructures in the South African banking industry.

A minority of organizations operating in the SA banking industry think of the integration of best practices found in different frameworks into a single framework for integrated management of ICT infrastructure.

2.3 Review of Related research studies

A. Bhattarai A.P. (2003) carried out the study on "*Performance of MIS at Kumari Bank"*. He carried out the study with the following objectives.

- To identify the factors affecting the performance of the MIS of the bank.
- To examine the existing expertise and situation of software personnel at the bank.
- To study the training provided to the end users regarding the software and security and its effects on the performance of the employee and the software.

Bhattarai concluded that Bank has installed latest banking software to meet their information needs. However, the update and support of the software is always needed which becomes costly as the bank does not have expertise to update and support the software. According to him the management of the organization should always be acutely be aware of various factors which affect the performance of the MIS and take corrective actions promptly. He further said various factors such as training to software personnel, training to the operating staffs, good communication link have the direct link to the performance of the software.

B. Khadka, Ashis (2004) has conducted a research study entitled "*MIS and its application in HMG/DANIDA)"*. He carried out the study with the following main objectives:

- To study and examine the present practices and prevalence of management information system in DANIDA/NARMSAP.
- To examine practice of maintaining information system in DANIDA/NARMSAP
- To analyze the effectiveness of MIS implementation
- To identify need and importance of MIS in DANIDA/NARMSAP
- To provide recommendation for the betterment of MIS if it is needed

His major findings are as follows:

- The information system in DANIDA/NARMSAP is based on both manual as well as computer based information system
- There is effective use of computer in each and every organizational function as well as departments
- Almost all the department use computer based information system
- All the departments have been keeping detain information about their transaction performance

The researcher is successful in finding out the objective mentioned in his study. However, it lacks the appropriate recommendation for further improvement of the system.

C. **Raghuvanshi, Keshab (2006),** carried out the study on "*MIS in Cable Television Organization".* He carried out the study with the following objectives.

- To study existing performance of subscriber information system
- To examine the software and hardware environment of subscriber information system of STN
- To evaluate effectiveness of subscriber information system
- To develop a useful Decision Support System (DSS) module for effective decisions
- To provide useful suggestion and recommendation to STN on its subscriber information system and management on the basis of the findings.

Raghuvanshi has concluded that the study has found following limitation related to information management within the organization:

- Modification and enhancement in the system after implementation is lacking
- Training to the user is not available
- Proper integration of information system to all areas is not available

The researcher is successful in finding out the objective mentioned in his study.

2.4 Research Gap

Nepal Rastra Bank being a Central Bank of the country is an entity responsible for monetary policy of the country, stability of the national currency and money supply, including interest rates; and acting as a lender of last resort to the banking sector and the national financial system as a whole. It also has supervisory powers to ensure that banks and other financial institutions do not behave recklessly or fraudulently. To meet the above mentioned objectives information system of NRB must be strengthened. The development of Information Technology brings a lot of changes and upgrades in our modern business environment. The use of information technology in service sector has changed from supporting factor to driving factor. Central Bank business is also being transformed and modernized by recent IT innovation:

- All Banking and Financial payment transaction information are sent to Central Bank in real time
- Central Bank can analyze the health of National Economy through computerized system
- DSS (Decision Support System) helps Decision Maker to make quick and exact decision

Since no research has been done with the objective of central bank automation, this research is carried out with the objective to analyze the existing information processing system of the Nepal Rastra Bank so that it will be a milestone for central bank automation.

CHAPTER - 3

RESEARCH METHODOLOGY

In this chapter, the methodology used for collecting and analyzing data will be discussed. Every research study can reach towards the proper conclusions adopting the proper methodology regarding the subject matter of study. A research study can produce the fruitful results if an appropriate methodology is taken under consideration to highlight and evaluate the different aspect of the study. Being a novice researcher, it should be kept under considerations that the wings of methodology should not be misdirected. The methodology should be adopted in such a way that the leakages and errors of the study could be minimized. Thus, the quality of the study depends upon the methodology used by researcher.

3.1 Research Design

Any research work cannot be done without the collection of required information. Those required information are generally collected from different resources. A research design is the condition for the collection and analysis of the data in a manner that aims to combine the relevance to the research purpose with economy in procedure.

A research design is the specification of methods and procedures for acquiring the information needed. It is the overall operational pattern of framework, of the project that stipulates what information to be collected from which sources and using what procedures. If it is a good design, it will ensure that the research obtained is relevant to the research questions and that it was collected by objective and economical procedures.

Research design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variances. The plan is to over all scheme or program of research. It includes an outline of what the investigator will do from writing the hypothesis and their operational implementation to the final analysis of data. The essential of good Research Design includes:

- A plan that specifies the sources and types of information relevant to the research question.
- A strategy specifying which approach will be used for gathering and analyzing the data.
- Both time and cost budget.

Generally, research design has two purposes: First is to answer the research questions or test the research hypothesis. Second is to control variance.

A research design basically focuses on

- Sample Design
- Observation design
- Statistical design

Sampling design deals with the method of selecting the subjects to be observed in a given study. Observation design relates to the conditions under which observation are to be made. Statistical design deals with the question or how many subjects are to be observed and how many are to be analyzed.

3.1.1 Population size and sampling procedure

Population refers to the target group on which research was carried out. Sampling is the process of selecting the sample from the given population. The method of selecting a sample usually depends upon the nature of the investigation. On my sampling a judgmental sampling has been used.

3.2 Sources of Data

Both primary and secondary data is used for data analysis and investigation of this thesis. As this type of research has not been conducted before, primarily the primary source of data is used in this research.

3.2.1 Primary Data

Primary data has been directly collected from different departments of Nepal Rastra Bank. This type of data includes the data collected by direct interview, formal and informal interview with related personalities or information discussion with the staff of the concerned organization. Some of the methods used by this researcher to collect primary data are as follows.

a) Interview

This researcher has conducted interview with key personalities of the Information Technology Department and other departments where the software systems are being used. They were primarily Head of Department, System developer, System support officers, System users, and other supporting staff the department. Such interview was very much fruitful to make clear some misunderstanding and technical details followed by the organization.

b) Observation

Some of the data was collected by direct observation of the work places. This researcher has observed the architecture of the data base, location of the networking hardware etc. The observation was fair and without prejudice as far as possible.

c) Questionnaire

To collect the precise technical data, questionnaire method was used. The questionnaire was submitted to the head and concerned staff of different departments, System developer and the System support staffs. (*See Appendix I for Questionnaire Sample*)

3.2.2 Secondary Data

Secondary data was collected by reviewing the policy, documentation, Strategic Plan, Consultant system study report etc that were available in hard copy and soft copy form, computer data bank, data services etc. The sources of data and information are:

- Nepal Rastra Bank's Strategic Plan (2006-2010)
- Organization's office record concerned with computer maintenance.
- Organization's official forms such as maintenance record form, monitoring and evaluation forms etc.
- Organizations' transaction records and log books
- Manuals provided by hardware and software vendors
- IT consultant Report

3.3 Analytical tools and techniques

With reference to the research methodology, different tools and techniques have been used to present and analyze the existing system. Since the research is descriptive and declarative type, to present the survey findings comprehensively, this researcher has primarily used tables and charts. To make the system more understandable this researcher has used flow chart and data flow diagram (DFD). Following are the brief descriptions of the tools used in this research.

3.3.1 Tables and figures

A table is presentation of data in column and row form. Typically table is used to present data and information more clearly.

3.3.2 Data Flow Diagram (DFD)

DFD is a graphical tool that is used to show how data moves and get transformed in an information system in top-down fashion. It is a logical model or essential model of an information system in a simple, direct way. DFDs are most appropriately used for analyzing business information system because these systems are predominantly data driven. DFDs are not used to show the logics of the program or any detailed processing.

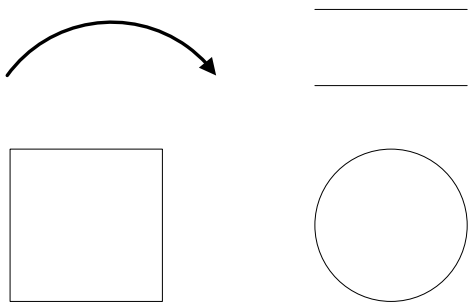

Figure 2: DFD Symbols (Yourdon)

Process Symbol: A circle or bubble; A process modifies or changes data from one form to another. Details of process are not shown in the DFD. The details are documented in description.

Data Flow Symbol

A line with arrowhead in the direction of the flow; Data flow is the pathway by which data moves from one part of the IS to another part.

Data Store Symbol

Two horizontally parallel lines; Data source is the repository. we use data store in a DFD when we must store the data so that it can be used by some other process. A data store must be connected to a data flow with a process at the other end of the process.

External Entity Symbol

A rectangle symbol; It is a person, department, outside organization, or other information system that provides data to the system or receives data from the system. External entities are also called terminators. An external entity that supply the data is called origin or source and that receives data is called destination or sink.

Level of DFD

Context Diagram or 0 Levels DFD

The first set of DFD of a system is context diagram. It shows data flow between the system and the external entities. Thus, it shows the boundaries of the system and gives top –level view of the system. In this diagram only one process is used to represent entire system and there will be no data store in it.

Lower Level Diagrams

The lower level diagrams shows more detailed data flow of the system. A single process of the Context diagram is exploded to sub process and shows the data flow in detail. To say it in other words, in First level explosion of the process 0, the process 0 is expanded or exploded or decomposed in other major sub process. We include all the entities and data flows that appeal in the context diagram of the system.

3.3.3 Flow Chart

A flowchart is a diagrammatic representation that illustrates the sequence of operations to be performed to get the solution of a problem. Flowcharts are generally drawn in the early state of formulating computer solutions. Flowchart facilitates communication between programmers and business people. These flowcharts play a vital role in the programming of a problem and are quite helpful in understanding the logic of complicated and lengthy problems. Once the flowchart is drawn, it becomes easy to write the program in any high level language. often we see how flowcharts are helping in explaining the programs to others. Hence, it is correct to say that a flowchart is a must for the better documentation of a complex program.

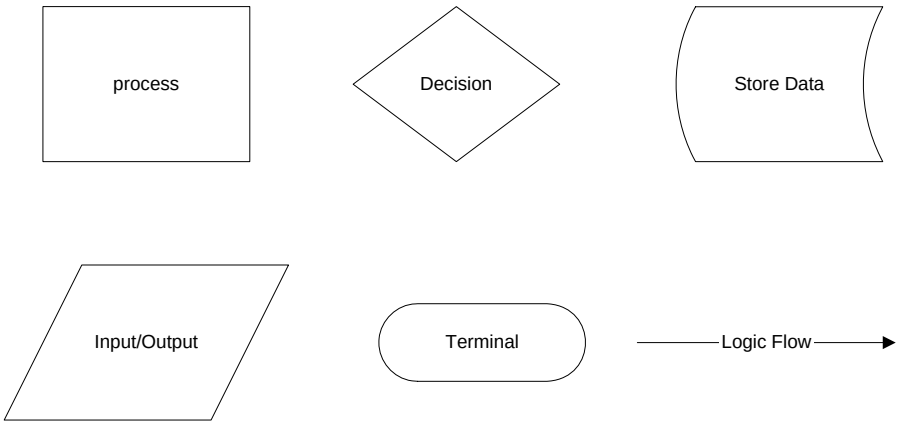

Figure 3: Flowchart Symbols

Terminal: The terminal symbol is used to indicate beginning or ending in the program logic flow. It is the first symbol and the last symbol in the program logic.

Processing: A process symbol is used to represent arithmetic, manipulation and data movement instructions. The logical process of moving data from one location of the main memory to another is also denoted by this symbol. When more than one instruction is to be executed consecutively, they are normally placed in a single processing box and they are assumed to be executed in the order of their appearance.

Decision: The decision symbol is used in a flowchart to indicate a point at which a decision has be made and a branch to one or more alternatives points is possible. The criteria for making decision should be clearly indicated within the decision box. Moreover; the condition upon which each of the possible exit paths will be executed should be identified and all possible paths should be accounted for. During execution, appropriate path is followed depending upon the result of the decision.

Input/Output: The input/output symbol is used to denote any function of an input/output device in the program.

Flow lines: Flow lines with arrowheads are used to indicate flow of operation. Hence, flow lines indicate the exact sequence in which the instructions are to be executed. The normal flow of flowchart is from top to bottom and from left to right. Flow lines should not cross each other and such intersection should be avoided whenever possible.

CHAPTER - 4

SYSTEM ANALYSIS DESIGN AND DATA PRESENTATION

4.1 Existing Structure of Organization

4.1.1 Organization structure

Nepal Rastra Bank has total 17 departments at central office and including Kathmandu banking office and 7 branches in the district. All the IT related issues are handled by Information Technology department of the NRB (Figure 4).

The typical organization chart of Information technology department is shown in the figure 5. This shows that IT department is headed by Director. Currently the current IT department consists of four divisions, the Administration/Repair & Maintenance Division, Operations Division, Systems Division & Software Division each unit headed by deputy director. The Administration/Repair & Maintenance Division has two sections. The Administration Section performs activities related to internal administration: keeps records of all IT departments' hardware and related inventory; monitors the use of the off-the-shelf software packages required by other departments and district offices of NRB; and schedules user training sessions. The Computer Repairing and Maintenance Section maintain and repairs all the computers, LAN and addresses connectivity issues between branches/Commercial Banks and the NRB head-office. The Operations Division installs and maintains software for the various NRB Departments. This division collects and distributes data obtained from the district offices/Commercial Banks; manages user access rights; manages the local area network, Internet/Intranet and associated infrastructure security. The Systems Division is responsible for reviewing and improving current IT systems, interacting with users to design and develop new software systems, prepare user's manuals and systems documentation; and inspect and approve new IT systems. Based on the recommendation of the Systems Division, the Software Division develops software code for new software systems and in upgrading existing software systems. This division is also responsible for designing the NRB official website and periodic update of the website information. Each unit consists of number of Engineers and Overseers for achieving the specified goals of the units.

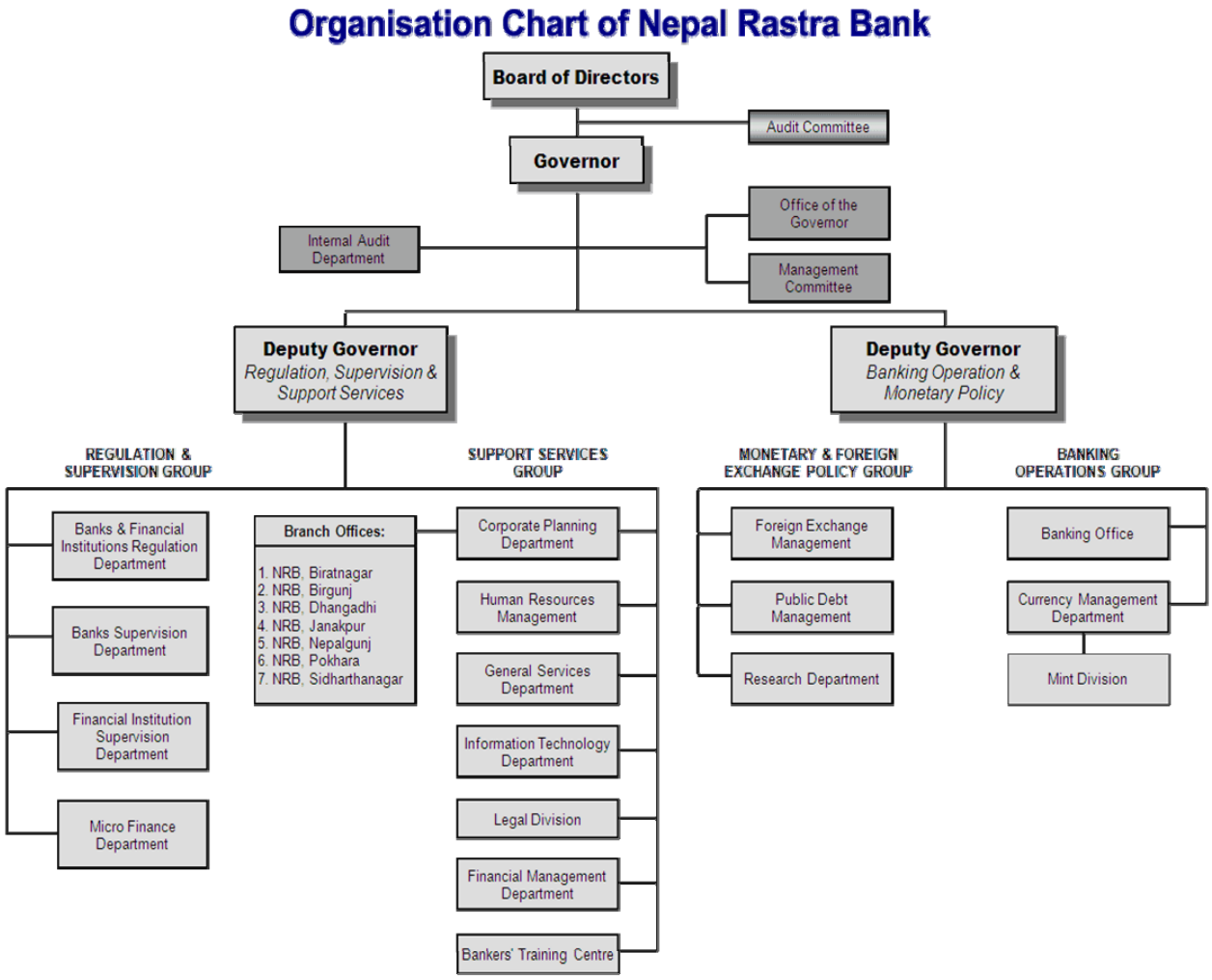

Figure 4: Organization Structure of Nepal Rastra Bank

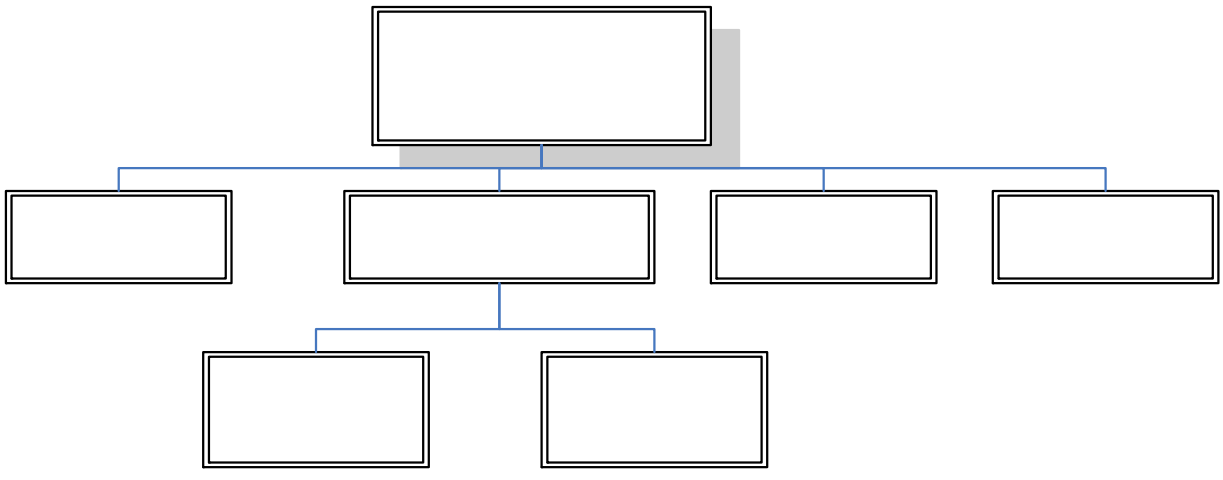

Figure 5: Typical Organization Structure of IT Department

4.2 Sources of information

The information presented in this report are obtained primarily from the different departments of Nepal Rastra Bank by interview, direct observation and questionnaire method. Some information was obtained from the strategic plan of the NRB and previous study reports.

4.3 DFD of Present System

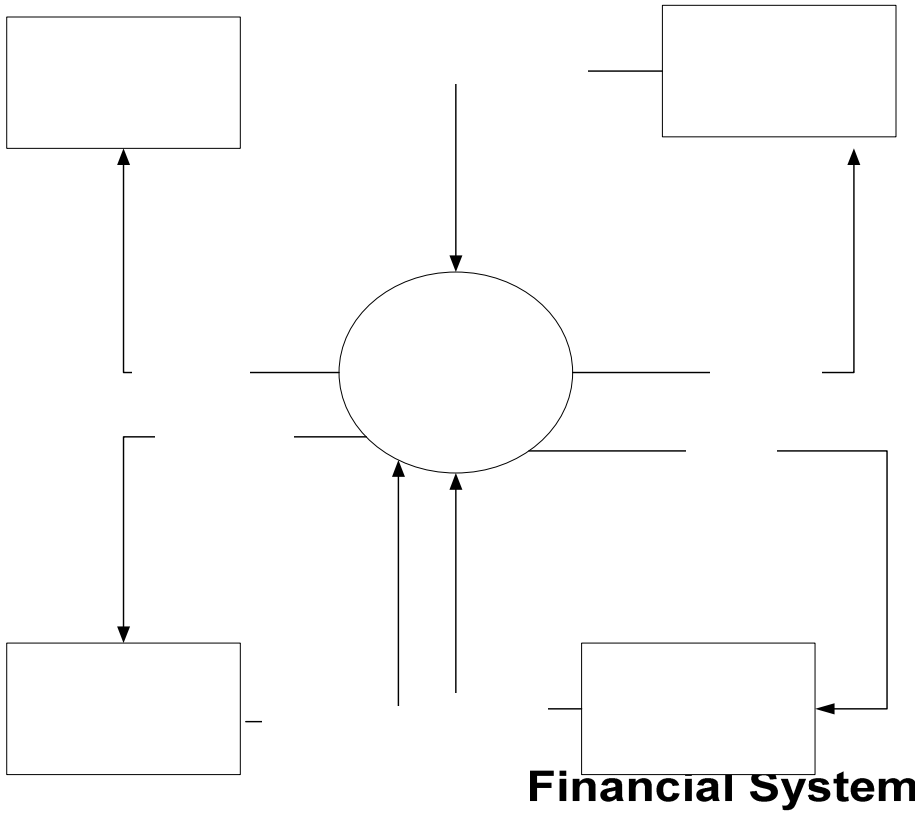

Figure 6: Context Level diagram for Inventory System

Cash Flow

Provide Item

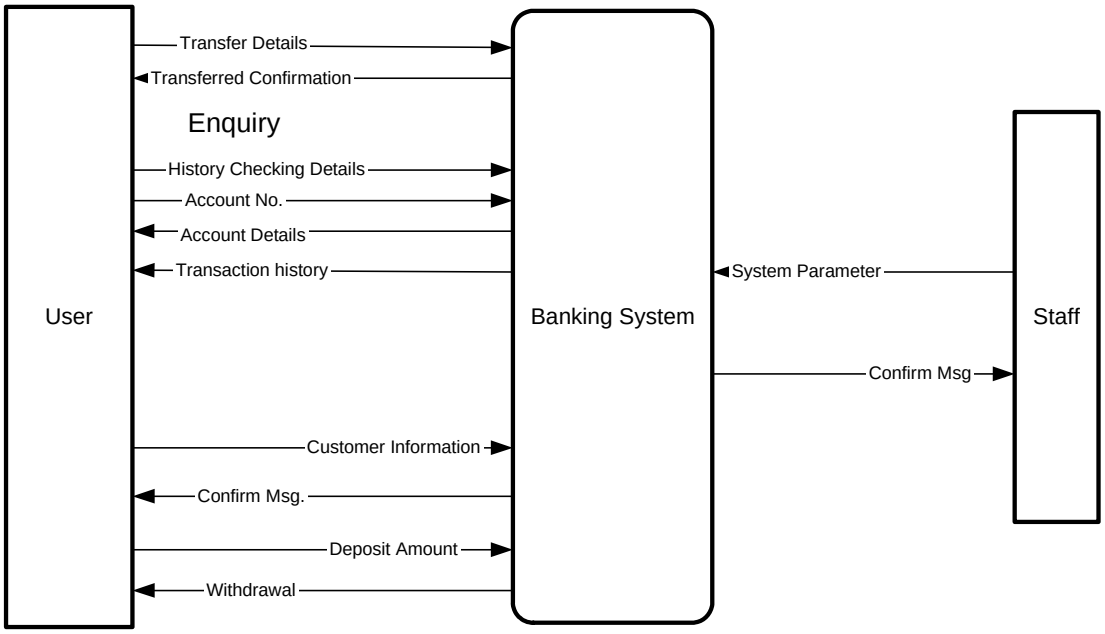

Figure 7: Context Level Diagram for Banking System

a) Fund Transfer Module

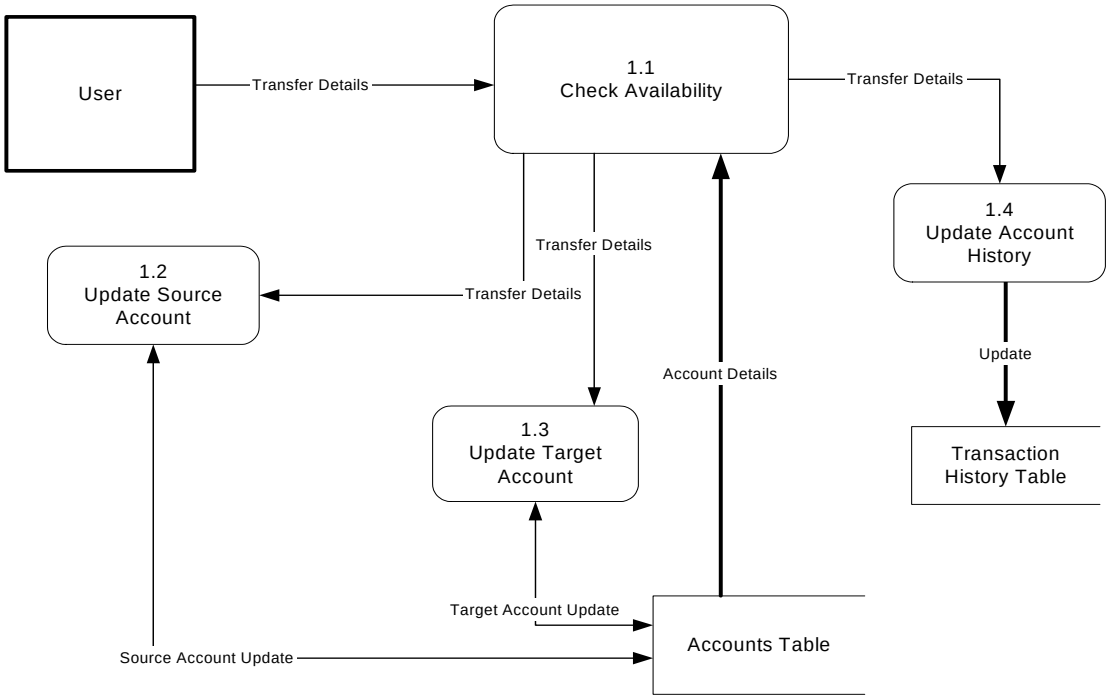

Figure 8: System Level DFD - Fund Transfer Module

Process Name	Process Description
Check Availability	To check the availability of the source account for the transfer
Update Source Account	Update the new balance of Source Account
Update Target Account	Update the new balance of Target Account
Update Account History	Update History of the Source Account

Table 1: System Level DFD - Fund Transfer Module

b) Inquiry Module

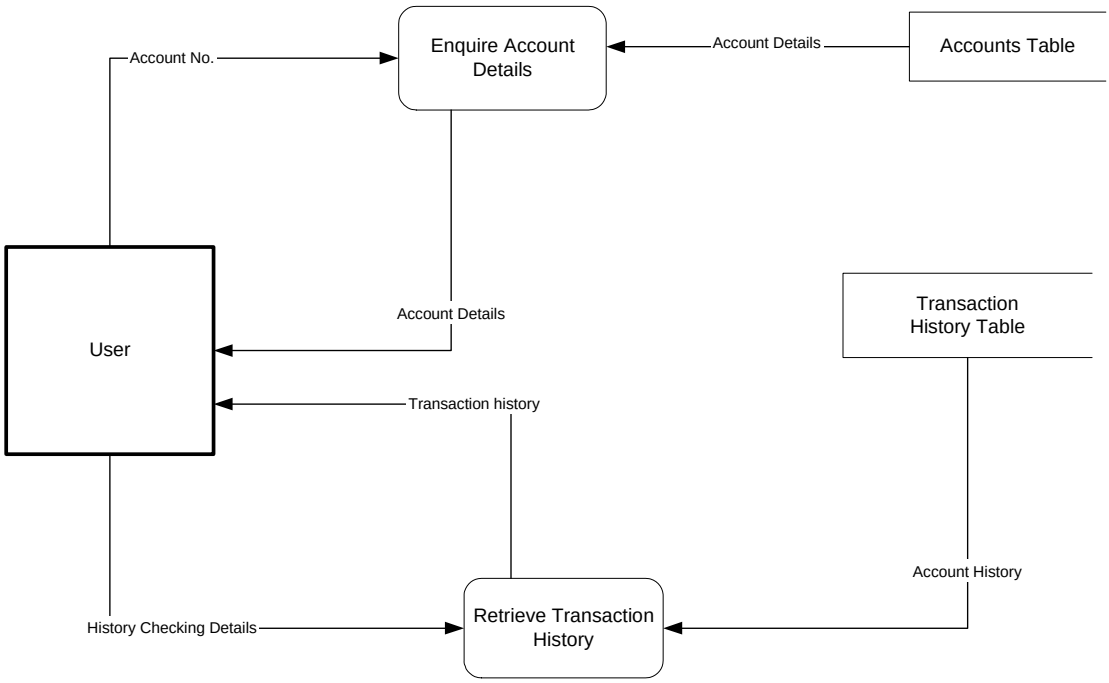

Figure 9: Inquiry Module

Process Name	Process Description
Enquire Account Details	Get Account Details for the user.
Retrieve Transaction History	Check Account transaction history

Table 2: Inquiry Module

c) Deposit Module

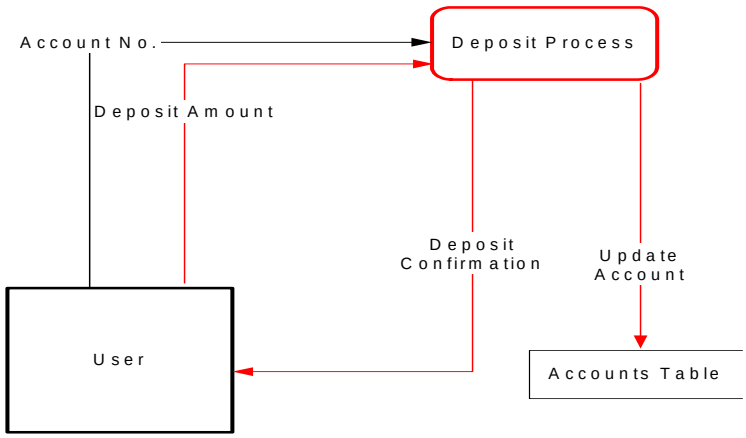

Figure 10: Deposit Module

Process Name	Process Description
Deposit Process	Deposit requested amount to the user's account

Table 3: Deposit Module

d) Withdrawal Module

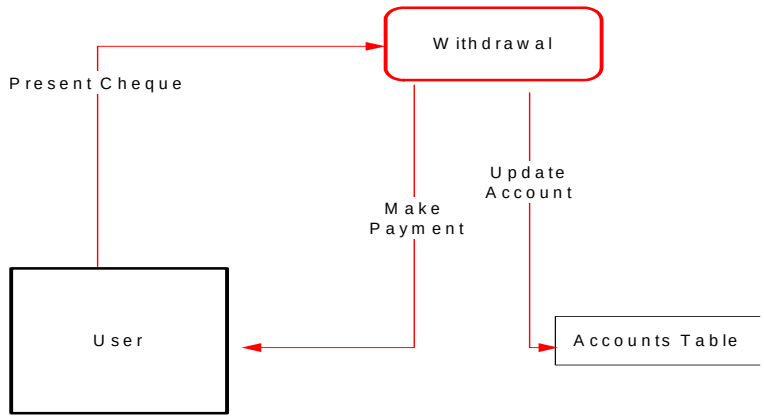

Figure 11: Withdrawal Module

Process Name	Process Description
Withdrawal	Withdraw requested amount from the user's account

Table 4: Withdrawal Module

4.4 Analysis of Existing Technology

4.4.1 Review of Existing Software Systems

Software systems being used in NRB are categorized into five different layers based on their use and purpose. First layer includes internal information systems used by NRB; second layer includes statistical information system of banking sectors like balance of payments, price index, foreign exchange management, currency management and monetary policy system; third layer includes information system of national and settlement institutions like clearing house and central securities depositories; fourth layer includes commercial banks and financial institutions regulatory information system; and fifth layer includes information system for government agencies and offices. All the software systems in use are developed by the IT department of the Nepal Rastra Bank. The review focused on an initial assessment of the primary underlying issues of the systems in use:

- Functionality Assessment
- Scalability Review
- Vulnerability Assessment
- Interoperability Capability
- Robustness of the Software
- Software Documentation
- IT Department systems support capability
- Software Process Management

KBOSYS (Banking System for Kathmandu Banking Office, Thapathali) & SIGNET (Signature Verification System)

This system is a DOS based dbase IV application. This system is used in conjunction (through a Daily Manual Reconciliation process) with Manual Voucher based data entry and Excel spreadsheets. This system is designed to address the banking operations of the Banking Office of NRB. KBOSYS holds information about different types of accounts of NRB in a set of ledgers:

- Government Revenue with information about 92 accounts such as Import duty, Excise Fund, Export Duty etc;
- Central Government Account with information about 40 accounts such as Domestic Debt Account, Foreign Debt account etc;
- Nichep Division with information about 21 accounts such as Government Regular, Government Development etc;
- Internal Administration Division with information about 37 accounts such as Sundry Creditors, Staff Welfare Fund Account etc;
- Bills Division with information about 31 accounts such as Exchange Equalization fund, CSI investment security fund etc.
- Remittance Division with information about 12 accounts such as Letter of Credit (LC) account, Bills Collection (Foreign) etc;
- Cash Division with information about the Cash Balance account.

There is a second allied system used with KBOSYS – the Signature verification System (called "SIGNET") which was developed in Visual Basic. However as the Visual Basic program is Windows based and KBOSYS is DOS based, this necessitates the use of two computers (with two operators) at each banking teller workstation in the Kathmandu Banking Office in Thapathali.

BANKSYS (Banking System for Branches) & LEDCHECK (Banking QC Utility Software)

This system manages all the banking operations of all branch offices of NRB. The system essentially holds the same information as the above described Banking System for the Banking Office.

The branches have also been provided a Utility software program developed in-house to help Quality Control. This program also developed in dBase IV is called "LEDCHECK" offers functions designed to do Balance Checking, Maintenance & Balance Adjustment.

CHS (Clearing House System)

This system is a DOS based dbase IV application. The Banking Office and district

offices located at Biratnagar, Siddharthanagar, Janakpur, Birgunj, Pokhara, Nepalgunj, and Dhangadi use this Clearing House System in which cheques from different commercial banks are settled daily. Upon receiving the cheques, corresponding postings are done in the Clearing house System. The system then produces a daily report which provides the debit and credit information for every individual Commercial Bank. The system also prints ledgers, advices and vouchers, control charts of daily transactions and an annual transactions report showing monthly transactions details for each office. The largest transactions are at the Kathmandu Banking Office Clearinghouse where around 3,000 cheques are cleared everyday. Clearinghouse procedures are followed for both domestic currency (Nepalese Rupees) cheques and foreign exchange transactions (usually in US dollars).

CENTACC (Central Accounting System)

This system is a DOS based dbase IV application. NRB maintains Nepal Government's Central Account. The Central Accounts Division of the Banking Office maintains all the revenues payable to Government of Nepal and Government's expenses in the Central Account. The necessary data are collected daily from NRB's district offices of NRB and some Commercial Banks:

- Kathmandu Banking Office, NRB;
- Seven District Offices, NRB;
- Designated (around 68) branches of Rastriya Banijya Bank (RBB);
- Designated (around 44) branches of Nepal Bank Ltd (NBL);
- Nepal Bangladesh Bank, Tatopani.

This system is operated by various users such as the Central Accounts Division and the Financial Management Division before reports are generated for reporting purposes such as submittals to the Auditor General's Office. It is relevant to note that much of the data entered in this software application is already available (through a data entry effort) in other applications such as the General Accounting and Banking System applications.

LCS (LC System)

This system is a DOS based dbase IV application. The LC System keeps a record of all the LCs opened by importers in the Commercial Banks. When the Commercial Bank is given permission to open a LC account, NRB Central Office hands over a data entry module to the respective Commercial Bank which all the data related to the LCs opened in their branches in this module. The data are then sent to NRB IT Department through email, floppy disk or direct file transfer. The IT Department uses the data collection module to compile all the LC data received from different Commercial Banks, posts the compiled data in the LAN and sends a copy to the Commerce Department of Government of Nepal. The LC Section of the Foreign Exchange Management Department uses the data made available in the LAN and uses the report module of the system to generate the required reports. The Commerce Department also forwards the reports to the Calcutta Port Authority which then validates the import transactions.

BOP Trade (Trade Statistics System)

This system is a DOS based dbase IV application. The Trade Statistics System provides information on the country's foreign trade statistics and calculates the trade surplus or deficit (current situation and trend analysis). All the records of exports and imports are maintained in this system. The Balance of Payment Division of the Research Department makes entries on a weekly basis for the seven main custom offices and on a monthly basis for the other 21 custom offices. (Manual) Entries are performed in the following five forms.

- Standard International Trade Classification;
- Export from India;
- Import from India;
- Export to Other Countries
- Import from Other Countries

The Foreign Trade Statistics Report is issued based on summarizations created through this software application. It is relevant to note that several customs points (reportedly 7

out of 9) are already computerized and use the ASICODA system. Currently, NRB personnel at each customs point manually enter the data into this BOP Trade system based on reports generated through ASICODA.

CPI (Urban Consumer Price Index System)

This system is a Visual Basic application. Periodically, 21 collection centers under the NRB eight branch offices collect information on the prices of several selected household commodities throughout the urban regions of the country. The branch offices use a data collection module and send the collected data to the Price Division at the NRB Central Office. The Price Division uses a *computation* module to compute the National Urban Consumer Price Index and the National Urban Wholesale price Index. There are two different modules of CPI: one used by the Central Office and one by the NRB branches around the country.

STPRO (System for Foreign Currency Exchange by Nepalese Students)

This system is a DOS based dbase IV application. NRB grants permission for the exchange of foreign currency to all Nepalese students wishing to pursue higher education abroad. The Foreign Exchange Management Department uses this system to maintain a record of all the students applying for the exchange of foreign currency. A separate record of all the personal and academic information is maintained for every student. The system is updated each time that students request for currency exchange for their new academic semester or year.

PUBDEBT (Public Debt Management System) and CSDRMS (Commonwealth Securities Data Reporting Management System)

The PUBDEBT system is a DOS based dbase IV application created and used by the Public Debt Management Department. On the request of Government of Nepal, NRB issues four kinds of public debt: Saving Bond, Citizen Bond, Development Bond and Special Bond. The Public Debt Management Department uses this system to keep records of all the individuals buying the issued bonds. The interest ledger of the system is updated each time the applicant receives interest from the bond. The individual buying

the bond can also collect the interest from different Commercial Banks. Every day the interest ledger is updated using information received from the Commercial Banks.

The System is also used to register and track bonds sold through other Commercial banks (who act in essence as "Market Makers") that distribute them to their retail banking customers. However, Short-term T-Bills are not yet incorporated in this or other systems.

It is also important to note that the Public Debt Management Department is already embarked on a separate initiative to use a new application called CSDRMS (Commonwealth Securities Data Reporting Management System). This COTS (Commercial Off The Shelf) software application has been recently installed through an initiative with the Asian Development Bank. CSDRMS is an Oracle based system that has reportedly good capabilities for recording and analysis but limited features dealing with secondary market transactions.

Notekosh (Currency Management System)

This system is a DOS based dbase IV application. The Currency Management System assists the Currency Management Department in its daily management of all the accounts representing the bank notes in stock in designated branches (vaults) of NRB, accounts of transaction of notes with all designated branches (vaults) of RBB and NBL, accounts of notes in circulation and accounts of defective or old notes being burned. The inputs in the system are manual and are based on the vouchers received by fax from different branches of NRB and various branches of RBB and NBL, and on data provided by the vault. Daily reports include notes in and out of NRB, RBB and NBL. A daily Trial Balance is generated to check the correctness of the maintained ledgers.

BOP (Balance of Payment System)

This system is a DOS based dbase IV application. The Balance of Payment Division under the Research Department collects various data on a monthly basis from Financial Institutions such as Commercial Banks, Development Banks, moneychangers, insurance companies and their branch offices. Statistical reports are generated monthly for overall income and expenditure. It keeps an account of the Nepali Rupees equivalent of Indian

Rupees and other foreign currency transactions.

SIS (Stock Inventory System)

This system is a DOS based dbase IV application. The Stock Inventory System is used to keep the records of all the non-consumable goods (and depreciated value) of the Central Office and the seven district offices of NRB. The goods are divided into different categories such as office materials, fixtures, miscellaneous, vehicles, electric fittings, tools and equipment, machines and machinery. The General Services Department of the Central Office and the Internal Administration Section of the district offices use this system.

NRBRSYS (NRB Reporting System)

This system is a Visual Basic application with a Microsoft Access database backend. Banks disclose financial information to NRB periodically on a weekly, monthly or quarterly basis. Banks are provided this module and provided a short introductory training session (about half an hour) upon request. There are a total of 13 forms in NRBSYS (such as Statement of Assets and Liabilities, Profit and Loss Accounts, Statement of Deposits etc.) under which information is reported to NRB by the various Commercial Banks. This system has been primarily developed for the Banks Supervision Department in order to assist the supervision team while they are conducting their compliance monitoring activities.

However, it is important to note that this system merely produces reports based on the input of data. It does not perform any compliance audit functions, trends analysis or generate exception reports.

ACCSYS (General Accounting System for Central Office)

This system is a DOS based dbase IV application. ACCSY currently serves as the default General Ledger and Internal Management Information System for NRB and has been designed for use primarily by the Financial Management Department. The General Accounting System keeps track of about 120 different ledgers which are organized into

ten different groups. Ledgers relate to staff related accounts (e.g. staff loans, staff funds, sundry, medical benefits), Profit and loss accounts, fund ledgers, Foreign Exchange etc. The system is used by the Staff Ledger Section to generate and record vouchers. The Balance Sheet Section of the Financial Management Department the uses this General Accounting System to generate daily trial balances (after posting/review/adjustments of transactions to ledgers). Through the reporting functions of ACCSYS, reports such as Profit and Loss Account summaries and Balance Sheets are generated. The system also incorporates the transactions related to foreign exchange activities, which are also used by the Foreign Exchange Management Department. Since this system contains about 120 ledgers, User Access Rights are set through directory access rights (which are in-turn setup on a LAN basis through Novell Netware, the current Networking Management tool used by the IT department at NRB)

BALSHEET (Balance Sheet System)

BALSHEET, the Balance Sheet System produces the merged balance sheet of NRB. The different district offices, the Central Office, Banking Office, Currency Management Department and Mint Department, all produce their respective balance sheet. Three different commercial banks RBB, NBL and Nepal Bangladesh Bank also report information related to Central Bank transactions in locations where no NRB branches are located. The Balance Sheet Division of the Financial Management Department of the Central Office and all the district offices use this system every month to prepare the merged balance sheet from all the individual balances received. The system also generates reports of the liabilities and assets of the individual district offices, Central Office, Currency Management Department and Mint Department. The system also shows the profit and loss status of the district or branch offices.

It is important to note that the Foreign Exchange Report generated by the Balance Sheet Section of the Financial Management Department by using this system often has reconciliation problems with the reports of the Foreign Exchange Department.

PAYROLL (Payroll System)

This system is a DOS based dbase IV application. The Payroll System keeps all the

necessary information concerning the monthly remuneration of all the employees of the respective district offices and departments of NRB. The system is linked to the Accounting System, the Banking System for Banking Office, and the Banking System for Branches for the preparation of the pay-slips, pay-charts and deduction list. From the moment of the recruitment of new employees, entries are made in the payroll system. The Payroll System also generates the pay chart for sick leave payments, clothing and anniversary allowances, annual closing allowances and annual leave benefits. The system assists the Staff Expenditure Section of the Financial Management Department, the Internal Administration Department of 7 district offices, the Mint & the Currency Management Departments in generating monthly pay slips, pay charts & deduction lists.

PENSION (Pension System)

This system is a DOS based dbase IV application. The Pension System keeps the records and necessary information of all of the about 1840 pensioners of NRB. The Pension System generates the eligible pensioner list every month along with the necessary pension amounts to be disbursed. The list and system generated pension-slips are distributed to the seven district offices and Banking Office, Thapathali, The Staff Expenditure division of the Financial Management Department of the Central Office uses the system.

SPFS (Staff Provident Fund System) & SWPFS (Staff Welfare Provident Fund System)

These systems are DOS based dbase IV applications. NRB offers a Provident Find and a Welfare provident fund for the current staff. The SPFS and SWPFS systems calculate interest on a half-yearly basis. The Financial Management Department as user of the system generates two types of reports, detailed statement and summary statement. Both these systems are essentially similar in nature from a database and application design standpoint.

ILRS (Insured Loan Recording System)

This system is a DOS based dbase IV application. All the employees of NRB are entitled to various loan facilities such as insured staff loan, house loan and vehicle loan. The

Facility Section of the Financial Management Department uses the Insured Loan Recording System to keep track of the loan statistics of the employees and generates various reports. Entries are made in this system whenever an employee wishes to utilize the loan facility. Corresponding entries are also made in the ledger of the Accounting System and changes in the Payroll System. Five forms are maintained in the system:

- Group Endowment Policy;
- Individual Endowment Policy;
- Insured Staff Loan;
- Insured Home Loan;
- Insured Vehicle Loan.

DISP (Dispensary Inventory Control & Billing System)

This system is a DOS based dbase IV application. All the current and retired staff of NRB is entitled to the medical facility provided by NRB. The Dispensary Section of the Human Resources Management Department uses the system to keep the inventory of all the dispensary items of the Central Office and Banking Office, Thapathali and to record the dispensary related transactions by the current staff and retired staff. The system is updated each time NRB procures medical products for the dispensary. Whenever an employee uses the medical facility, necessary information is posted in the system. The system also generates bills if required. The Dispensary Inventory & Billing System also generates the report of the inventory of the dispensary items in different formats.

PAYORDER (Pay Order Reconciliation System)

This system is a DOS based dbase IV application. NRB issues a pay order whenever it needs to pay certain amount for services rendered by its staff and external parties (vendors). The Central Office issues the payment order and the Banking Office pays the relevant amount. The Pay Order Reconciliation System helps the Reconciliation Section of the Financial Management Department in reconciling the pay order process. It checks the consistency of the issue statement against the payment statement. The system produces three types of reports: the reconciled report, the un-reconciled report and the outstanding report.

PRS (Personnel Record System)

This system is a DOS based dbase IV application. This system stores all the personal and official information about employees of NRB. The system processes and generates different formats of official reports indicating the official status, achievements and other records of the employees. Personal information such as name, address, education, date of birth, family information like father's name, grandfather's name along with official information such as date of entry, appointment date etc are posted for every staff. Similarly, the system is updated for each foreign training-course taken, transfer records, promotion/demotion, grade/salary increment, award/punishment achieved, medals received etc. The Personnel and Training Division of the Human Resource Management Department of the Central Office use this system.

4.4.2 Review of Networking Infrastructure and Hardware

A limited review of hardware and networking infrastructure has been conducted by the researcher.

The computerized systems at the NRB Central Office consist of a large Local Area Network (LAN) of shared resources. A central server, with Novell as network Operating System (OS), acts as central database and network controller. Computers are linked to the central server through hubs and switches, working at 10 to 100 Mega bit per second (Mbps). Cabling is standard Unshielded Twisted Pair (UTP) category five.

All seven NRB branches have a small LAN installed with around 15 computers in each branch. Other locations with computers under supervision of the IT Department are the Banking Office, the Currency Management Department and the Mint. NRB office at Baluwatar is Connected with banking office at Thapathali through a WAN but all the office located outside the valley are not linked on-line to the systems at the Central Office. Connectivity with outside internal users, such as branches, and outside external users, such as Commercial Banks is organized through e-mail or a dial-up direct communication link.

A Linux Internet server has been installed with firewall protection, giving monitored

access to all NRB users connected to the LAN. The mail server is located in the NRB server room. The website of NRB is hosted on a server in the United States. Altogether there are 18 live servers in NRB. Among them 9 servers are located at central office, 2 servers are located at banking office, and 7 servers at each district offices. In the NRB central office there are main file servers, database server, network controller, data back-up server with Netware Directory Services (NDS) replication from the first server, Internet server, MIS server. All data written to the main server are backed up at the day-end. Data base files collected from the branch offices are copied on a weekly basis. Around 740 workstations and 60 laptops are in use.

Most network connectivity equipment at the NRB Central Office consists of 100 Mbps switches with some hubs at 10 or 100 Mbps still in use as well.

The bulk of the workstations in use are non-brand, locally assembled computers. They range from old 386 processor computers to new Pentium IV computers. Most of the computers are protected by an Uninterrupted Power Supply (UPS) system.

NRB is providing corporate email service to all of its employees. There are three types of connectivity in NRB:

- LAN: The workstations at each geographical location are connected to each other and the server through LAN
- WAN: Central office at Baluwatar and Banking office at Thapathali are connected by WAN
- Internet: Central office at Baluwatar and Banking office at Thapathali are connected to Internet through Nepal Telecom's lease connection and all the district offices have either dial-up connection or lease connection for Internet connectivity

4.4.3 Review of Capabilities of the IT Department

Currently the current IT department consists of four divisions, the Administration/Repair & Maintenance Division, Operations Division, and System Division & Software Division.

The Administration/Repair & Maintenance Division has two sections. The Administration Section performs activities related to internal administration: Keeps records of all IT departments' hardware and related inventory; monitors the use of the off-the-shelf software packages required by other departments and district offices of NRB; and schedules user training sessions. The Computer Repairing and Maintenance Section maintain and repairs all the computers, LAN and addresses connectivity issues between branches/Commercial Banks and the NRB head-office. The Operations Division installs and maintains software for the various NRB Departments. This division collects and distributes data obtained from the district offices/Commercial Banks; manages user access rights; manages the local area network, Internet/Intranet and associated infrastructure security. The Systems Division is responsible for reviewing and improving current IT systems, interacting with users to design and develop new software systems, prepare users manuals and systems documentation; and inspect and approve new IT systems (for new Commercial banks as a part of the NRB regulatory review process). Based on the recommendation of the Systems Division, the Software Division develops software code for new software systems and in upgrading existing software systems. This division is also responsible for designing the NRB official website and in periodically updating website information.

There are 25 peoples working under IT department of NRB. Out of which 19 are technical and others are non-technical. Out of 19 technical employees 4 are at Deputy Director level, 9 are at Assistant Director level and 6 at Head Assistant level.

4.4.4 Review of Security Management System of NRB

4.4.4.1 Physical and Environment Security

Physical security mechanisms protect people, data, equipment, systems, facilities, and a long list of company assets. Information security without proper physical security could be a waste of time. For physical security, generally control is placed to protect from external and internal intruders, data centre where the critical hardware of the banks are placed are secured against water, fire etc. A back up of electricity is placed which not only helps to operate the system when the power is out, it also prevents the hardware

from malfunctioning due to frequent power outage. Physical and environmental security status of NRB is described below:

a. Although physical entry to NRB premises by outside peoples are controlled by implementing different mechanisms like issuing log based visitor card, physical scan using metal detector, monitoring and storing the activities by means of CCTV etc., there are no strong access control mechanisms for physical access to data center and other critical areas. Lack of automatic card based door lock system, CCTV monitoring and other types of physical access control and monitoring system in data center and server rooms have increased the level of risk. Access control mechanism implemented by NRB in its data center and other critical areas are not found to be sufficient to protect against internal and external intruders.
b. To protect from terrorist, natural disasters or accidental damage of the server and data centre, NRB has placed its data center above the ground floor in secured location.
c. Protecting the electronic equipment is essential to secure the data stored in electronic media. The electronic media and the data stored in it will be damaged when power goes out abruptly. So securing the data and equipment against power outage is important means of physical security. NRB is using UPS and Generator for power back up. Although UPS with long hour back-up and separate generator are being used for data center, power back up is not sufficient to keep all system running at all time in case of power failure. With the implementation of new system, power back up capacity of NRB need to be further strengthened.
d. Automatic detector and logger are very important to detect and trace the events in data centre. The commonly used detectors are smoke and humid detector. Smoke detector detects any smoke generated in the room. If it detects the smoke, an alarm will ring and necessary step will be taken by the security administrator. Moisture absorber absorbs the excess humidity in the data centre and thus protects the equipment from damage. To trace what

4.4.4.2 Logical Security

a. Password Security

Weak Passwords can be compromised and must be protected. A password is generally called weak if it contains only few characters, is a dictionary word, is phone number, cell number, name of the place, name of the events etc. To make the password strong it should have contained a mixture of characters, number and special characters and it should not be a dictionary word. Moreover to make the password strong, users can be periodically forced changed, or one time password can be set. From the study it is found that there is no written password policy of the bank and no track have been maintained whether the passwords are using properly or not. Further, since workstations are not in the domain and there is no password based access control system in each workstations, there is a high risk of tapping out the confidential information.

b. Virus Security

A virus is a program that requests the operating system of a computer to append it to other programs. In this way the virus propagates to other program. Virus can be easily transmitted such as a file. A virus can be deleterious which makes the system in operative, deletes program and files. Some virus can send data to unintended party via network. So virus protection is very much important in mission critical systems such as banking system. NRB is following preventive, detective, and corrective measures for preventing the system from malicious program. Since, all computers are not connected to the LAN and there is no centralized antivirus server for automatic update, virus definitions in all the workstations are not up to date. Virus security mechanism of NRB is not satisfactory.

c. Firewall Protection

A firewall is a hardware or software that screens incoming network traffic and allows or disallows the traffic based on a set of rules. Firewalls normally sit at the perimeter of an organization's network, protecting it from the Internet, business partners, or other less secure network segments. But firewall is also kept at the point of connectivity of server and the branch network. Firewall is also used to protect from virus and other malicious programs. It is found that NRB have used CISCO PIX firewall to protect the corporate network from public access.

4.5 Limitations of Existing Systems

i. Limitations in Software Systems

- Since most of the software applications are developed in DOS based dBase IV and few in Visual Basic (with Microsoft Access database support), there are numerous problems related to scalability and interoperability
- DOS based dBase applications are not user friendly and are difficult to operate
- Strong security features are not implemented in the system
- Having stand alone software application encourages report reconciliation problem
- Having multiple stand-alone applications with multiple data entry needs also affects timeliness and causes many delays associated with data entry, data aggregation/analysis and reporting.
- Most of the systems require manual data entry
- Although some business processes are automated but there are number of areas that are still to be automated.
- Duplication of work i.e. same set of data are being entered in the different department due to lack of integration
- Complete functionality is missing in the developed system
- No audit trail features, difficult to ensure data integrity
- Lack of user support documentation
- Most systems are used as database system rather than information system
- Difficulty in coordination with other agencies

ii. Limitations in Networking infrastructure and hardware Systems

- Most of the PCs are assembled computers and have not been certified through industry standard quality assurance protocols
- Most of the PCs have limited computing power
- Hardware capability is being underutilized due to lack of appropriate system to run on it
- Only limited bandwidth is available for connectivity
- There is no provision of backup link to avoid failure
- There are no network connectivity linkages between the NRB Head Office and the NRB branches in various districts

iii. Limitations in Security Mechanism

- No Information Security plan and polices are prepared
- Lack of Information Risk assessment and Risk management practice
- No information security audit methodology
- Lack of certified security personnel
- Lack of disaster recovery site and disaster recovery plan which may delay the resumption of the operations in case of disaster
- Physical and logical security are not carefully implemented

iv. Limitations in the capability of IT Department

- IT department is headed by non-technical people, which may put difficulty in making IT related decisions

4.6 Major Findings of the Existing Systems

a) Software Systems

The various software applications reviewed above addresses NRB's operational and compliance needs as well as NRB's internal administration needs. The generic shortcomings and issues related to all the software applications are listed below:

- Most of the software applications are developed in DOS based dBase IV and a few in Visual Basic (with Microsoft Access database support). This presents numerous problems associated with lack of:
    - scalability (supporting increasing numbers of users)
    - interoperability (interfacing with other modern IT systems)
    - robustness (reliability)
    - security (from hackers or malicious software agents)
    - Usability (User-friendly features that encourage Technology Adoption)
- Having twenty-six stand-alone software applications encourages reports reconciliation problems, particularly as all of these systems are largely dependent on manual data entry and the accuracy (or lack of accuracy) of the data entry operators
- Having multiple stand-alone applications (with multiple data entry needs) also affects timeliness and causes many delays associated with data entry, data aggregation/analysis and reporting.
- There is a lack of complete functionality (form a user requirements perspective) in many of these software applications. After using these software applications, users from various departments then have to resort to manual processes and/or office productivity tools (such as Microsoft Excel) to complete their tasks.
- There are few inbuilt Quality Assurance (QA) functions in the software. These relate to both data entry type QA checks as well as analytical QA tools that look at exception reporting or trends analysis.
- There are no Audit-Trail features in any of the software applications. As a result, it is possible to change the data with little effort and ensuring data integrity becomes very difficult.
- Some departments do not have any type of software systems and all processes are based on manual systems.
- Few standalone applications address only part of the departmental users' needs. For example, the L/C application addresses only imports, but not exports & the Public Debt Management Application addresses only bonds but not treasury bills.

- There is a lack of software documentation associated with most of the software applications. Knowledge of the intricacies and underlying software code of these systems are with a handful of programmers. Consequently, modifications in the software applications cannot be carried out efficiently, especially over the long term (when there could be employee turnover).
- There is a lack of user support documentation, such as user manuals, demonstration modules or comprehensive help functions. As a result, users in various departments continue to rely on manual and simple applications like Microsoft Excel.

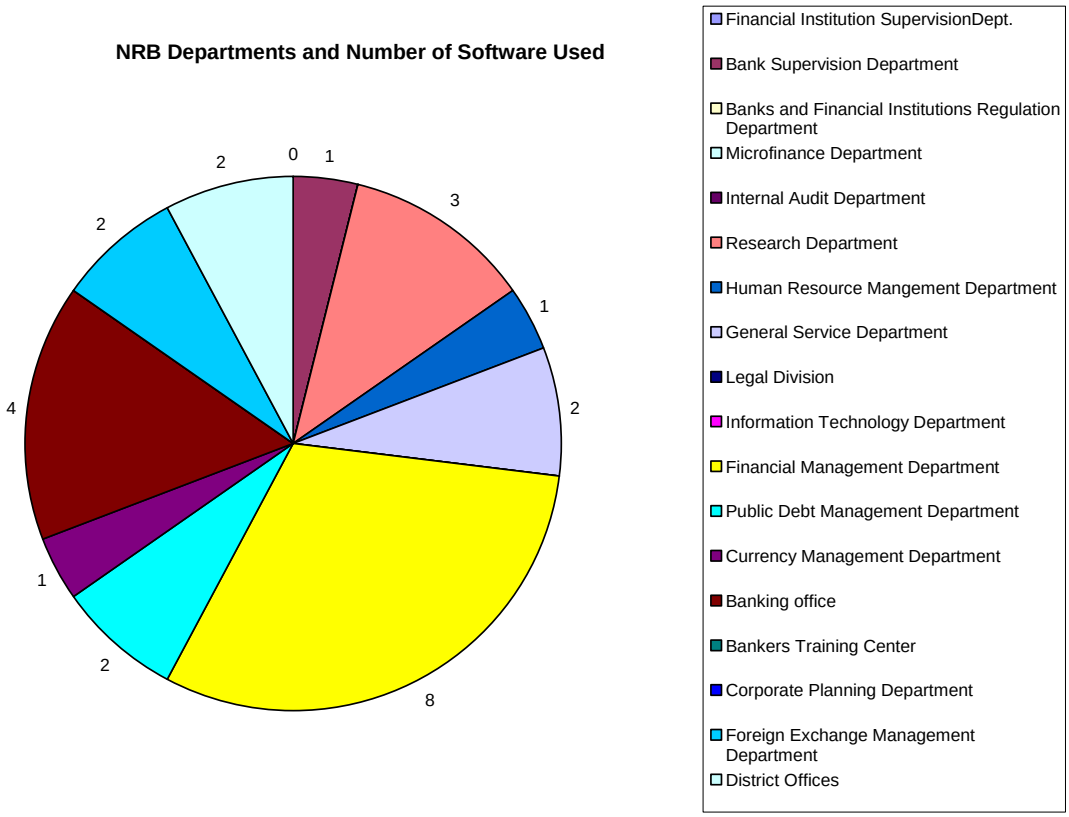

Figure 12: NRB Departments and Number of software used

Figure above shows the number of software used at different departments of NRB. Figure shows that most of the systems are designed to meet the requirements of financial management department and banking office. Also, from the figure it can be concluded that there are number of departments that are still to be automated.

b) Hardware and Networking Infrastructure

- Most of the PC workstations are assembled computers and have not been certified through industry standard quality assurance protocols such as ISO 9001.
- Most of the PC workstations have limited computing power to host applications from modern software.
- There is limited bandwidth available (through a single Nepal Telecom's leased line) at the NRB head office at Baluwatar and Banking office at Thapathali.
- There are no network connectivity linkages between the NRB Head Office and the NRB branches in various districts
- Data backup is done periodically but not on real-time. Data backups are maintained for a limited time only with no data archiving or data warehouse facility. In addition, all the backed data (on storage media such as CDs) are stored at the same location as the servers containing the data. In case of any disasters affecting the site, all the data would be lost.
- There is a lack of common productivity enhancement hardware such as image scanners, digital cameras, cheque scanners, digital cameras, bar code scanners or radio-frequency identification data (RFID) systems.
- There are limited capabilities to protect the network from malicious-ware such as Viruses, Spy-ware, Ad-ware and Trojans.
- Capabilities of the hardware systems are being underutilized.

c) Capabilities of the IT Department

- The IT Staff profile is promising. It has a good mix of graduates who have an educational background in modern client-server architecture and web-based applications as well as experienced people who are well versed in the bank culture and functions.
- However, most of the IT resources expended are to build and support the (typically over 8-9 years) old stand-alone software applications as well as older hardware and networking infrastructure. The focus of the staff on such activities

- There has not been enough training or established skills within the IT department in areas related to software architecture design, software development processes, quality assurance protocols such as user acceptance testing (UAT) and system testing (such as load testing or regression testing), documentation involved with software development, modifications and user's support, Project Management (software, hardware and networking systems), procurement processes and vendor management.
- There is a lack of academically qualified technical manpower at higher levels of management to lead on IT related issues
- There is lack of enough focus from high level management of NRB for expansion and enhancement of IT department

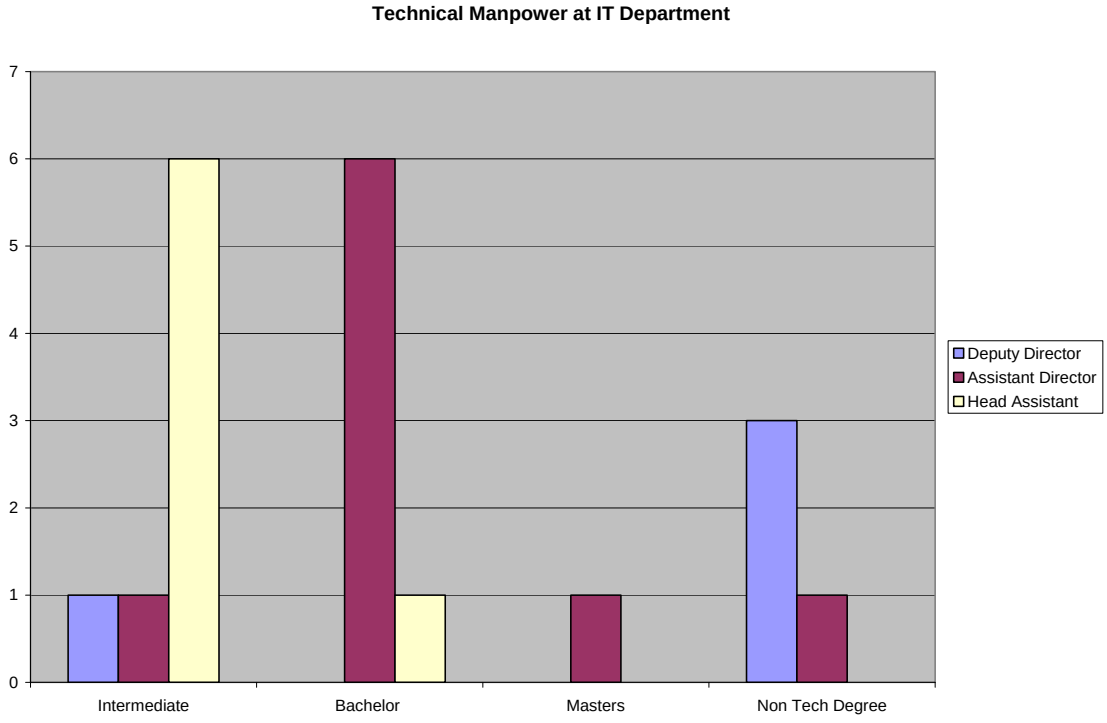

Figure 13: Technical manpower in IT department of NRB

Above chart shows number of technical people at different levels of management along with their level of academic qualification. The chart exhibits, NRB lacks academically qualified technical manpower at upper level.

d) Security Management

Security is critical component of Information System in any organization. Managing IT security involves physical, logical security and process and procedures to do so.

To physically secure the data and hardware equipments, NRB is placing its data center and critical servers in the secured location but the physical access control mechanisms are not adequate to prevent unauthorized access. To protect from humidity, there is no any electronic humid detector and absorber. To protect from power outage and power fluctuations, UPS and generators are being used at NRB.

Although banks have implemented password, firewall, and antivirus for logical security of the system, logical security mechanisms in place are not found to be adequate to protect the system from unauthorized access due to following reasons:

- Bank has not formulated Information Security Policy and necessary guidelines related to IS security.
- Antivirus update mechanism is not satisfactory due to lack of centralized antivirus update server
- Strong password based control mechanisms are not available in all software
- Lack of domain based login system

Summary of Overall IT System of NRB

Based on the overall analysis in different areas like hardware, software, networking infrastructure, strength of technical manpower, and security system, the researcher found the status of overall IT system of NRB as shown below:

Features	Very Poor	Poor	Considerable	Good	Excellent
IT System usage		√			
Software availability			√		
Existing software scalability and manageability		√			
Existing software serviceability and completeness			√		
Existing software security		√			
Existing software expected life	√				
Hardware availability				√	
Existing hardware usability				√	
Network connectivity		√			
IT System management			√		
Technical manpower strength			√		

Table 5: Summary of overall IT System

4.7 Proposed System/Conceptualization of new system

4.7.1 Software Systems

A new centralized Integrated Financial Management Information System (IFMIS) should be designed, procured and implemented. IFMIS should be designed to meet industry best management practices. From a functionality perspective IFMIS should support a "Single Data Entry" oriented data model, in-built audit control logs (audit trail features), in-built User Access Administration tools and other features associated with modern Accounting, Financial Management and MIS systems. Keeping in mind budget and time constraints, the development and introduction of software modules of IFMIS may need to be done based on priorities. However, the design architecture will be flexible and open enough to accommodate future modules.

Most of the existing stand-alone systems need to be phased out of use with the introduction of IFMIS. However, the data from the stand-alone systems needs to be

retrieved and integrated so that IFMIS can benefit from this data, such as development of Exception Reports or Statistical/Monetary Trends Analysis.

New system is conceptualized as to have four main modules:

- Banking Module
- ERP Module
- Nepal Rastra Bank Data Warehouse Module
- Automated Clearing House Module

4.7.1.1 Banking Module

This application will provide a 'front office' system that will enable Tellers, Account Servicing and back office data capture staff to capture entries at the point of presentation. Once these entries are 'captured' the product processing systems (Accounting and General Ledger, Banking etc) will automatically be updated. There will thus no longer be the need for paper to be 'moved' after data capture to these various other departments and manual account ledger and others records maintained. The product processing systems (Banking, Accounting & General Ledger, etc) will maintain all accounts and will produce statements and a consolidated general ledger for the Bank.

The system is to be controlled centrally. Amendments and set-up of new database information must be automatically downloaded, at any time, for use by terminals in the district offices and this data must be consistent at all times throughout the whole system. Provision should be made for database changes to be performed in the district offices by an authorized person if the central system is "off-line". Standard procedures for changes to conditions (interest rates, fees, charges addresses, customers branches, etc.) regardless of product or service; such changes need only to be entered once from a central location and immediately applied to all relevant functions in all the operating systems

Main Characteristics of the Banking System

- The banking application system must provide automated recording and processing facilities for all the business transactions envisaged by the Bank. Functions should be generic and available for a variety of transaction types.

- Transaction types should not be hard coded but defined in the system using parameters and processing rules to allow the system to easily satisfy the present and future business needs of the Bank.
- Fully automated passing of transactions (individual and/or totals) to the Accounting and General Ledger system
- A real-time system is required where a transaction entry updates, as soon as the transaction is input, each applicable customer account as well as updating currency positions and limit utilization; where authorization is considered necessary by the Bank, the transactions should be reflected in the updating, both before and after authorization.
- A real-time system with every amendment to the database automatically updating each applicable file, table and all transactions, including customer transactions, immediately updating relevant customer balances, Nostros accounts and Treasury positions
- Integration of all customer and internal accounting information with unified standards and full compatibility to all other parts of the system
- A fully integrated relational database management system to eliminate data redundancy
- A multi-currency system (major global currencies and currencies of important trading partner countries) with operationally balanced ledgers in each currency; total Bank and branch business reported in any base currency selected, and changed from time to time, by the user; conversion to base currency is at system maintained rates of exchange
- A multi branch structure. The number of system terminals in an branches is expected in the range of 30 – 150

Major application modules that need to be incorporated in the Banking Module are:

Trade Finance

This module will consider:

- Export letters of credit and Negotiations
- Import letters of credit and Negotiations

- Integrated word processing for Letters of Credit

This system will automate all the transactions related to trade financing to generate following specific outputs:

- L/Cs Processed Today
- L/Cs Awaiting Approval
- L/C Approval Requests.
- L/Cs Outstanding by Customer.
- Payments Not Received.
- Missing Negotiation Instructions.
- Outstanding balances by customer
- Expired L/C
- L/C due to expire within a user-defined period
- Acceptances outstanding by any combination of branch, amount, customer and maturity date.

Bank and Government Accounts

This module will be specifically designed for maintaining Current Accounts for Scheduled Banks and Non Bank Financial Institutions

Major Functions of this module are:

- Ability to process automatically credit and debit entries arising from clearing (and possibly direct debit payments)
- Automatic prevention of overdraft caused by the transfers from one deposit account to another
- Generation of domestic payments and some international payments
- Processing accounts in both local and foreign currency
- Entries must be made to customer accounts in the currency of the account regardless of the currency of the transaction
- Processing standing orders (scheduled funds transfer) and possibly direct debit payments facilities
- Ability to maintain cheque books issued records by account

- Automatic transfer of moneys (resulting from the posting of principal or interest) from a current account to another deposit (demand or term), when the account balance exceeds an amount specified on the account level
- Processing of commercial deposits such as cash management accounts and sweep accounts
- Ability to hold part of an account balance on a certain number of days or permanent basis
- Customer statements and interest statements must be produced on a user defined time cycle for each account both during the day, end of day, end of month
- Capability of producing combined account statements when customer has several related accounts
- Current account statements must include transaction narratives, interest effective and accounting dates, details of the fixed deposit and associated credit interest
- Ability to carry out a transaction through any branch of the Bank
- Each account will be assigned to a branch or central account register
- It must be possible to open, close, and amend accounts at any branch. It also should be possible to transfer account from one branch to another branch or central office.
- Automated calculation and posting of charges, commissions, and fees which are defined on an account, product or customer specific level. Also should provide for waiver of fees.
- Fees must be calculated automatically as a percentage of transaction amounts, as well as based on the account balance and number of transactions
- Ability to post fees to an alternative account automatically
- Daily accrual of interest on customer accounts
- Option of automatic daily/monthly interest accrual posting to General Ledger
- Capitalization of interest at various frequencies, plus the option of transferring paid interest to another account

- The system should have provision for recording stoppage of cheques by customers and also its removal including applying charges if any. System should have provision

Loans and Other Lending Activity

This module concerns with the management of loans given to Banks and Government departments by Nepal Rastra Bank.

Major functionalities required for this module are:

- Exposure types and associated limits and commitments should be user definable and accessible by specific transaction type
- History of account retained for life of the loan
- Ability to create user defined standard loan documentation from a library
- Audit trail of payments and prepayments
- Automatic calculation of charges, default interest and costs on non-payment
- Ability to increase or decrease the principal of an account with interest payments posted to account
- Ability to define a loan as non-accrual or to charge-off a non-performing loan
- Ability to restructure problem loans

Cashier/Teller Functions

The goal of the Bank is to offer one-stop service in branches and agencies and may not maintain dedicated cashier positions in all some outlets. The cashiering activities will be combined with customer service activity. It is necessary for a customer service officer to access all the normal input and inquiry functions. Any movement necessary between system components should be automatically triggered by the entry of a transaction type and not by using keys to transfer.

The accounting for all cashier transactions should be fully integrated into the customer and internal accounts accounting, with customer accounts being updated in real-time when the customer transaction is agreed.

Reconciliation Application

Main purpose of this module is to automate the reconciliation of transactions between NRB Offices and Branches. The reconciliation application would essentially reconcile transactions passing through the General Account and the central office and Branches as well as reconcile Remittances between NRB Offices and other concerned offices.

Foreign Exchange Management

Management of Foreign Currency Resources and the exchange rate of Nepalese Rupees are a key element of monetary policy. This application will assist management in controlling reserves, investment of reserves and conservation of reserves. Functional views of the Foreign Exchange Management System would reside in the Foreign Exchange Department with an on-line real-time link with core Accounting System and Foreign Exchange Control System. This link would be needed to expedite reconciliation required by the core Accounting System for effectively transacting in FC and for Loans, Grants and Credit Administration.

Currency Management and Accounts

Currency is a component of money supply control of the circulation of the currency therefore forms part of monetary implementation. This module will be used to control and account for the circulation of currency.

The system will deal with the following areas:

- Maintenance of accounts for the issue of local currency
- Administration of the Issue Department & Currency Museum
- Note design, printing and distribution.
- Minting of coins
- Forged notes – detection, confiscation and destruction
- Reimbursement of centralized notes
- Government Treasury maintenance
- Remittance Clearing and Audit

Treasury and Securities Systems / Module

NRB administers and keeps records for government securities issued to financial institutions and for government securities issued primarily to individuals. All processing is manual and all records are kept in ledgers, with necessary supporting documentation. Existing procedures do not support the development of a secondary market in any of the securities administered. Treasury Bill (Primary and Secondary) and Long Term Government Bonds (National, Citizen, Development and Special Bonds) are sold to banks and other financial institutions. Payment is made by cheque or by letters instructing NRB to debit the purchaser's account at NRB. All issuance is on a primary basis, and securities in physical form are ready to be picked up by purchasers one to two weeks following the purchase. Payment at redemption is made upon delivery of the physical security by the original purchaser, or to a purchaser, as stamped on the security. Payment at redemption is made by the Banking office and the reimbursement of the same is made by PDMD on behalf of Government of Nepal.

The securities application should support the issuance and trading of government securities, including Treasury Bills and Long Term Government Bonds. Settlement of purchases and redemptions are through the Banking system with accounts of the Banks and market makers being updated at NRB. The Banking data capture system must be able to record all necessary details and pass the information through to the Treasury and Securities module. There should also be support for discounting of securities with NRB and for supporting repurchase agreements with NRB and among the commercial banks.

Support for NRB purchase and sale of Treasury Bills should be provided, for open market operations. Execution of transactions will be undertaken centrally.

Public Debt Management Module

The module will maintain records relating to Public Debt used to facilitate open market operations. The module will maintain record of auctions, their results and Subsidiary General Ledger (SGL) accounts: Maintain Authorized Dealers information to facilitate

Repo and Secondary Market Operation and will also calculates Commission due to Commercial banks.

4.7.1.2 ERP Application

Accounting and General Ledger System

The Bank requires an automatically balanced set of multi-currency general ledgers with all records being maintained in the transaction currency. Data from front-end feeder system must be fully integrated to provide automatic entries in the currency of the transaction. The Bank may need to hold several types of 'memorandum' type record accounts, which will not impact internal accounts, as well as maintain subsidiary ledgers to record items such as fixed assets, depreciation and supplier accounts. These subsidiary records need to interface to the General Ledger. The Bank ideally requires this system to be fully integrated into the Banking system, but if the Banking system does not provide the required functionality for Accounting & General Ledger, then a separate system may be proposed. In this circumstance the method of full interface needs to be described with confirmation that this will be achieved. Platform issues need also to be explained, where the Bank expects a minimum number of different platforms to be proposed.

Main Characteristics of the Accounting and General Ledger system

- Will record and process all the internal account transactions of the bank
- A real-time system where transaction and amendment updates, at input, each applicable account and associate information
- A fully integrated relational database management system to eliminate data redundancy
- A multi-currency system double-entry system with operationally balanced ledgers in each currency, with conversion to the base local currency at system maintained exchange rates
- Branch server component should maintain system information, and possibly database fragments, to minimize communication costs

- Branch based transaction handling is to be possible in the event of a break in communication with the main central server. When communication is restored the system must accurately update the stored transaction to the central system

All transactions undertaken in branches will update the central system

Purchasing (Purchase Order Processing)

This system is used to ensure central control of all procurement and purchasing processes. All purchase orders for goods and services should be raised from this module. Purchases include:

- Computers and peripherals
- Vehicles / Transport Pool
- Stationery, Furniture and mechanical equipment
- Telephones (Installation of official, residential, PABX, Direct telephones, Faxes,
- Telexes, Internet and email, and handsets)
- Any other as per NRB's practices

Upon receipt of goods, this should be recorded. There should be an on-line link to the Fixed Assets module to record receipt of goods (in case of capital assets). Upon receipt of invoice from the supplier, this should again be recorded in the module and upon posting the same; this should be automatically recorded in the Accounts Payable Ledger against the particular supplier. At each stage of processing, there should be an on-line record of the status of Purchase Orders

Accounts Payable

The Accounts Payable application would essentially be a Payment Processing System which would process bills initiated by the Purchase Order Processing Module and/or optionally by various departments. This includes a check on availability of a budgetary provision. The application would be used by those departments, which write cheques relating to administrative expenses, following the Purchasing processes. Suppliers Bills / Invoices are the primary sources of input and Payment Vouchers, Cheques, General

Ledger (File), Cash Management (File), Expense Summaries and Comparison with Budget are the main output of the system.

Accounts Receivable

The Accounts Receivable application would essentially be a Receivable Processing System which would process invoices initiated by the Sales / Invoice Processing Module (if implemented) and/or optionally various money recovery processes initiated by various departments. System will take Invoices / Staff Loans, official memo, other receivables from staff etc. as primary input and generate Invoices, Staff Loan approval, General Ledger (File), Cash Management (File), Earnings / recovery Summaries as main outputs.

Cash Management

This module helps to maintains records of transactions in bank and cash accounts and facilitates bank reconciliation.

Fixed Assets

This module will be used for maintenance of a central Assets Register and to control movements of valuable items. The Fixed Assets application would essentially be an electronically maintained Asset Register which would add new assets and delete old assets based on the NRB's policies and practices. The application will also calculate depreciations for all assets (chargeable to Profit & Loss Accounts) and generate registers containing information on Written Down Values etc.
Primary sources of input for this module include:

- Input information generated by Purchasing Module
- Movements information
- Deletion information

Major processes involved in this module are:

- Records and maintains all Assets
- Performs additions and withdrawals

- There should be an on-line link with the Purchasing module to record receipt of goods.
- Calculates depreciation (based on NRB's Depreciation Policies) and automatically creates journals for entries into the General Ledger.

HR and Payroll Application

Management of Human Resources is a critical success factor in achieving NRB's business goals. This application should cover a number of functions including Personnel Management, Payroll, and Provident Fund etc. These could be treated as modules in a single application or applications in an integrated suite, as listed below:

- Personnel Module
- Payroll Module (Allowances and Deductions)
- Attendance Module
- Advances Module
- Provident Fund Module
- Income Tax Module
- Pension & Gratuity Module

The primary features required for this system are:

- Maintenance of Personnel Information
- Maintenance of Allowances and Deduction Information
- Maintenance of Loan and advances, both for interest and non-interest base.
- Maintenance of Leave and attendance information
- Maintenance of Provident Fund deduction and PF Ledger
- Maintenance of Income Tax Deduction and computation

Budgets and Cost Center Accounting System

NRB requires improved support for its budgeting and cost centre accounting processes as these are mainly manual at present, with some localized use of spreadsheet software. The budgeting process is carried out twice a year and new bank wide budgets established and

approved. Measurement between budgeted figures and actual figures is currently prepared quarterly. NRB needs to control its balance sheet and profit and loss activities through cost centre management and should be measuring deviances from budget at least on a once-a-month basis. There should be an element of cross charging between departments for services used so that the business areas are more aware of the costs of using these internal services. Introduction of a suitable budget and cost centre accounting process will enable NRB to improve efficiency and effectiveness.

Main purpose of this system is to compile a budgetary plan for a period, allocate planned funds to the Cost Centers, keep the plan up to date in order to ensure financial efficiency and control through proper cost centre management.

The Budgeting application would primarily be operated by the Accounts Department but would process data from all departments / Cost Centers. It is envisaged that data entry / processing would be done centrally by Accounts. The application would essentially be one to accept budgetary demands from various departments / offices / Cost Centers and consolidate these into a budget for NRB.

4.7.1.3 Nepal Rastra Bank Data Warehouse

Data Warehouse Information gives an overview of the types of data which would be stored in the EDW (Enterprise Data Warehouse), indicating which departments are envisaged as users of each type of data and the application for which it would be used. Conceptually the Data Warehouse will consist of a multi-tiered database and a set of applications, which will keep it up to date.

Data warehouse should house all data used by more than one department within NRB or necessary for decision support. However, keeping practicality in view, the data warehouse needs to be implemented in stages. The scope of data that would reside in the Data Warehouse at each stage would be as follows:

Stage 1: Data from Banks and Non-Banking Financial Institutions for Off-Site Surveillance only. NRB is currently in the process of revamping Banking Supervision. As

a part of this exercise an Off-Site Surveillance application is to be implemented. An initial version of the Data Warehouse is therefore required for this purpose.

Stage 2: All information that is gathered from the Banks and NBFIs other than that required for direct foreign exchange control

Stage 3: Data as per Stage 2 plus data generated from Core Transaction Processing Applications (particularly the General Ledger and Deposit Banking Applications).

Other Future Stages: Other data (including external data) to be added in a phased manner.

The Data warehouse will contain data from two primary sources:

- Data Input – manual data entry or processing received in electronic format received from banks.
- Automated System-driven replication of summary data from the transaction Processing Systems.

A large portion of data input will emanate from financial institutions. Reception, initial validation and dissemination of data within NRB should be centralized.

Economic and Monetary Analysis System / Module

NRB's information systems need to be able to provide senior policy-makers immediate access to accurate, timely and relevant economic and monetary data. This includes data on monetary policy, foreign exchange policy, domestic financial markets and international financial statistics. Moreover, this information needs to be in a form that allows sophisticated economic and statistical analysis, including econometric studies.

The toolset will allow comparison of different data series across time, the preparation of a set of pre-defined reports on such monetary policy, foreign exchange and financial market policy. Data from within NRB on key monetary variables such as reserve balances, liquidity balances, individual bank balances, and daily clearings will be available through the database. In addition, data from sources outside of NRB, whether from other branches of the government, or from abroad, including the IMF or BIS, will be supported within the database. Senior management and policy makers will also be able to query the database on an ad hoc basis and to have additional set reports prepared as needed.

Main Characteristics of the Economic & Monetary Analysis system

- The EDW will record the existing data
- Additional external data feeds, managed by a Gateway, will receive data and populate the EDW or appropriate Data Mart.
- Data from existing applications will be migrated to the EDW as part of the RDBMS project.
- An analytical toolset to assist with forecasting aggregates on an extrapolation basis and single variables basis and using a series of multiple-variables. This will be used for Balance of Payments forecasting and monetary aggregates forecasting. They further require analysis tools to assist to forecast GDP on a quarterly basis based on annual statistics. They require tools to analyze and forecast the flow of funds account covering the four sectors within the Nepal economy, namely, Fiscal Sector, Monetary Sector, the External Sector and the Real Sector measuring the impact of movements in one sector on the other three sectors. They also wish to measure and analyze National Income statistics more effectively.
- The Toolset needs to:
    - Enable receipt of other external data received on CD read/write discs or the internet and this data will be able to be stored on the DW if required and used in conjunction with the EDW data for analysis
    - Permit the convenient loading of raw data from free format, fixed format, binary and spreadsheets
    - Display and save the original and transformed time series; print and write to external files

Prudential Supervision System

One of NRB's prime functions is the prudential supervision of the banks and financial institutions. This process involves the submission of prudential reporting statistics by each supervised institution filling out a series of returns covering its principal risk positions, balances and exposures. The requirement to complete these prudential returns

and the ongoing maintenance of prudential ratios and related positions are normally governed by the local Banking Regulations. These returns are sent to the Central Bank or reporting authority within an agreed reporting timeframe for analysis, examination an assessment. NRB requires the implementation of computer software that will generate automated off-site surveillance reports and related support. The overall objective is to implement an analytical application which is capable of automating a number of the functions currently performed manually (or semi-automated) by NRB staff.

Input Documents

There are, currently, pre-set Prudential Returns which are used as data sources for information to be used by NRB for analysis, and require to be stored by the system for reporting purposes. The formats for these Prudential Returns are established by NRB and are in strict accordance with the regulations.

Outputs

The need for automated Prudential Ratio analysis has been identified. All standard report formats designed and held within the system will be available 'on demand' by screen display, and may be sent to hard copy if required. Therefore all standard report formats will be available in both screen and printable formats.

Processes

NRB wishes the application to receive data directly from the reporting institutions, to perform
Prudential Ratio analysis immediately and then store the data for further 'on demand' reporting.

The NRB server would need to be firewall protected and have anti-virus protection. System should provide for data to be received either directly through the network or through a CD with manual intervention in approving 'clean' data.
Data Transmission/Capture

The system will be developed to permit electronic transmission of data, in a secure form, but with manual intervention at the receiving and storage points at the initial stages of the implementation process. There will possibly be a requirement for hardware and software to be installed by the reporting institutions where suitably configured PC's and modems are not available. A delivery gateway will be needed into NRB. There is also a clear need to use a minimum of 128 bit encryption techniques to data prior to transmission. The manual intervention approach at the initial stages will ensure that the NRB remain secure from external threats prior to proper firewalls and other security protection being installed.

Data Protection

Given the sensitivity and confidentiality of the data, there is a need to protect it at all stages. This requirement will be addressed through use of data encryption techniques and access control

Conceptual Database

The data that will be collected from various sources must follow the preparation and verification stages as described below:

- Data transmission should be in the defined/prescribed formats (templates should be designed and supplied by NRB)
- When receiving the data (if in electronic formats) it should go through the rigid processes:
    - Verification and validation of the returns/reports for completeness and shortfalls (if any)
    - Uploading the returns/reports into the defined database.
- Application for the analysis of the collected and stored data as per the definitions of NRB using various analytical tools available in the Data Warehouse.
- Maintenance of the collected and compiled data should done as per the Data Warehouse practices

4.7.1.4 Nepal Automated Clearing House System

The introduction of Nepal Automated Clearing House (NACH) will enable the automated clearing of cheques, credit and debit payment instruments. The proposed processes and systems should conform to best practices in industry and should provide a cost effective solution. The system should be designed to support inter-city clearings, initially starting with Kathmandu and later adding the other cities where NRB has branches.

Services to be offered by the ACH

- Capture the clearing information
- Sort the cheque down to bank/branch level and account/cheque number sequence
- Handle cheque returns, as part of daily operations.
- Generate the relevant reports, such as inward listings, statement of clearing, etc.
- Create settlement entries in either report format or magnetic media, if required
- Accumulate clearing statistics for the purpose of billing, audit, business analysis, etc.
- Generate clearing information on magnetic tapes or diskettes for the computerized banks to debit their customers automatically.

The proposed system should be such as to meet requirements of the clearing house and be able to provide mature performance as in other countries in the world. It should be able to meet all critical cut off time in addition to providing smooth, user friendly facilities and features.

4.7.2 Networking Infrastructure and Hardware

For the successful implementation of the new system, it will be necessary to purchase additional Computer Hardware and Better Broadband access for the various NRB offices and better Network Infrastructure Linkages between the NRB Head Office, Banking Office and various selected NRB branches.

A secured data center with automated data backup system need to be developed and a reliable and secure disaster recovery site need to be established for data security.

4.7.3 IT Department Restructuring

For successful implementation and operation of new system the role of IT department and its employee is very crucial. Restructuring and reorganization of IT department is required to take the full advantage of the new system. With the implementation of the new system, the role of the IT Department should be to support the users (encourage technology adoption) and the underlying Hardware/Networking Infrastructure. The IT Department should not be focused on the tasks of writing software code and creating software applications. IT department staff need to be trained on areas important to supporting the new system.

4.7.4 Data Directory

a) Data Directory for Inventory System

tblAssets : Table

Field Name	Data Type
AssetID	Number
RoomName	Text
Description	Text
DepartmentID	Number

tblAssetsDetail : Table

Field Name	Data Type
SN	Number
ProductID	Number
ModelNo	Text
SerialNo	Text
ProductQty	Number
Remarks	Text
AssetID	Number

tbl_Department : Table

Field Name	Data Type
Department_ID	Number
Department_Name	Text
Department_Address	Text
status	Yes/No

tbl_Designation : Table

Field Name	Data Type
Designation_ID	Number
Designation_Name	Text
status	Yes/No

tbl_Category : Table

Field Name	Data Type
Category_ID	Number
Category_Name	Text
Parent_ID	Number

tblFiscalYear : Table

Field Name	Data Type
FiscalYear	Text
isActive	Yes/No

tblIssue : Table

Field Name	Data Type
IssueID	Number
IssueNo	Number
Department	Text
IssuedTo	Text
IssuedDate	Text
IssuedEngDate	Text
IssuedBy	Number
DemandedBy	Number
StoreIncharge	Text
FiscalYear	Text
PersonalAcc	Yes/No

tblIssueDetail : Table

Field Name	Data Type
sn	Number
IssueID	Number
ProductID	Number
Quantity	Number
Size	Number
TotalAmount	Number
Remarks	Text
Remaining	Number

tblProduct : Table

Field Name	Data Type
ProductID	Number
ProductName	Text
CategoryID	Number
CategoryHeadID	Number
StockinHand	Number
StockValue	Number
SerialNo	Text
ModelNo	Text
UnitPrice	Number

tblPurchaseDetail : Table

Field Name	Data Type
SN	Number
PurchaseID	Number
ProductID	Number
Quantity	Number
UnitPrice	Number
Size	Number
TotalAmount	Number
Remarks	Text

tblPurchase : Table

Field Name	Data Type
PurchaseID	Number
PurchaseOrderNo	Number
SupplierID	Number
OrderDate	Text
OrderEngDate	Text
ReceivedDate	Text
ReceivedEngDate	Text
EntryDate	Text
EntryEngDate	Text
TransporterName	Text
PreparedBy	Text
VerifiedBy	Text
StoreIncharge	Text
ProductCheckedBy	Text
ProductStatus	Text
FiscalYear	Text

tbl_Employee : Table

Field Name	Data Type
Emp_ID	Number
Emp_FName	Text
Emp_LName	Text
Emp_Address	Text
Emp_ContactNo	Text
Department_ID	Number
Designation_ID	Number
Gender	Text
DOJ	Text
DOB	Text
Emp_Pic	OLE Object
Emp_Status	Yes/No

tblOpeningStock : Table

Field Name	Data Type
sn	Number
ProductID	Number
FiscalYear	Text
Quantity	Number
Value	Number

tblRoom : Table

Field Name	Data Type
SN	Number
Room_No	Text
Room_Name	Text
Department_ID	Number
status	Yes/No

tblReturn : Table

Field Name	Data Type
ReturnID	Number
ReturnNo	Number
ReturnDate	Text
ReturnEngDate	Text
IssueID	Number
EmpID	Text
CheckedBy	Text
StoreIncharge	Text
FiscalYear	Text

tblReturnDetail : Table

Field Name	Data Type
SN	Number
ReturnID	Number
ProductID	Number
ReturnQty	Number
Remaining	Number
Remarks	Text
ReturnedAmount	Number

tblUser : Table

Field Name	Data Type
UserID	Number
UserName	Text
UserPassword	Text
IsAdmin	Yes/No
UserFullName	Text
UserAddress	Text
UserContactNo	Text
UserEmail	Text

Table 6: Data Directory for Inventory Management System

a) Data Directory for Attendance System

tbl_messagedetail : Table

Field Name	Data Type
messagedetail_ID	Number
message_title	Text
message_ID	Number
valid_from	Text
valid_to	Text
message_language	Yes/No

tbl_message : Table

Field Name	Data Type
message_ID	Number
messagedetail_ID	Number
emp_ID	Text

tbl_holiday : Table

Field Name	Data Type
holiday_ID	Number
holiday_date	Text
holiday_detail	Text
is_event	Yes/No

tbl_holiday_details : Table

Field Name	Data Type
holiday_details_ID	Number
holiday_ID	Number
emp_ID	Text

tbl_designation : Table

Field Name	Data Type
designation_ID	Number
designation_name	Text
status	Yes/No

tbl_department : Table

Field Name	Data Type
dept_ID	Number
dept_name	Text
status	Yes/No

tbl_category : Table

Field Name	Data Type
category_ID	Number
category_name	Text

tbl_fingerprint : Table

Field Name	Data Type
finger_ID	Number
emp_ID	Text
finger_template	OLE Object

	Field Name	Data Type
	emp_sn	Number
🔑	emp_ID	Text
	emp_fname	Text
	emp_lname	Text
	emp_paddress	Text
	emp_taddress	Text
	emp_contactno	Text
	emp_email	Text
	emp_DOB	Text
	emp_DOJ	Text
▶	emp_nationality	Text
	category_ID	Number
	designation_ID	Number
	dept_ID	Number
	emp_status	Yes/No
	emp_gender	Text
	emp_photo	OLE Object
	barcode_no	Number

tbl_attendance : Table

	Field Name	Data Type
🔑	attendance_ID	Number
	emp_ID	Text
	attendance_date	Text
	attendance_nepdate	Text
	login_time	Date/Time
	logout_time	Date/Time
	lunchout_time	Date/Time
	lunchin_time	Date/Time
	tiffinout_time	Date/Time
	tiffinin_time	Date/Time
	login_remarks	Text
	logout_remarks	Text
	lunchout_remarks	Text
	lunchin_remarks	Text
	tiffinout_remarks	Text
	tiffinin_remarks	Text
	record_created	Binary

Table 7: Data Directory for Attendance System

4.7.5 E-R Diagrams

a) E-R Diagram for Inventory System

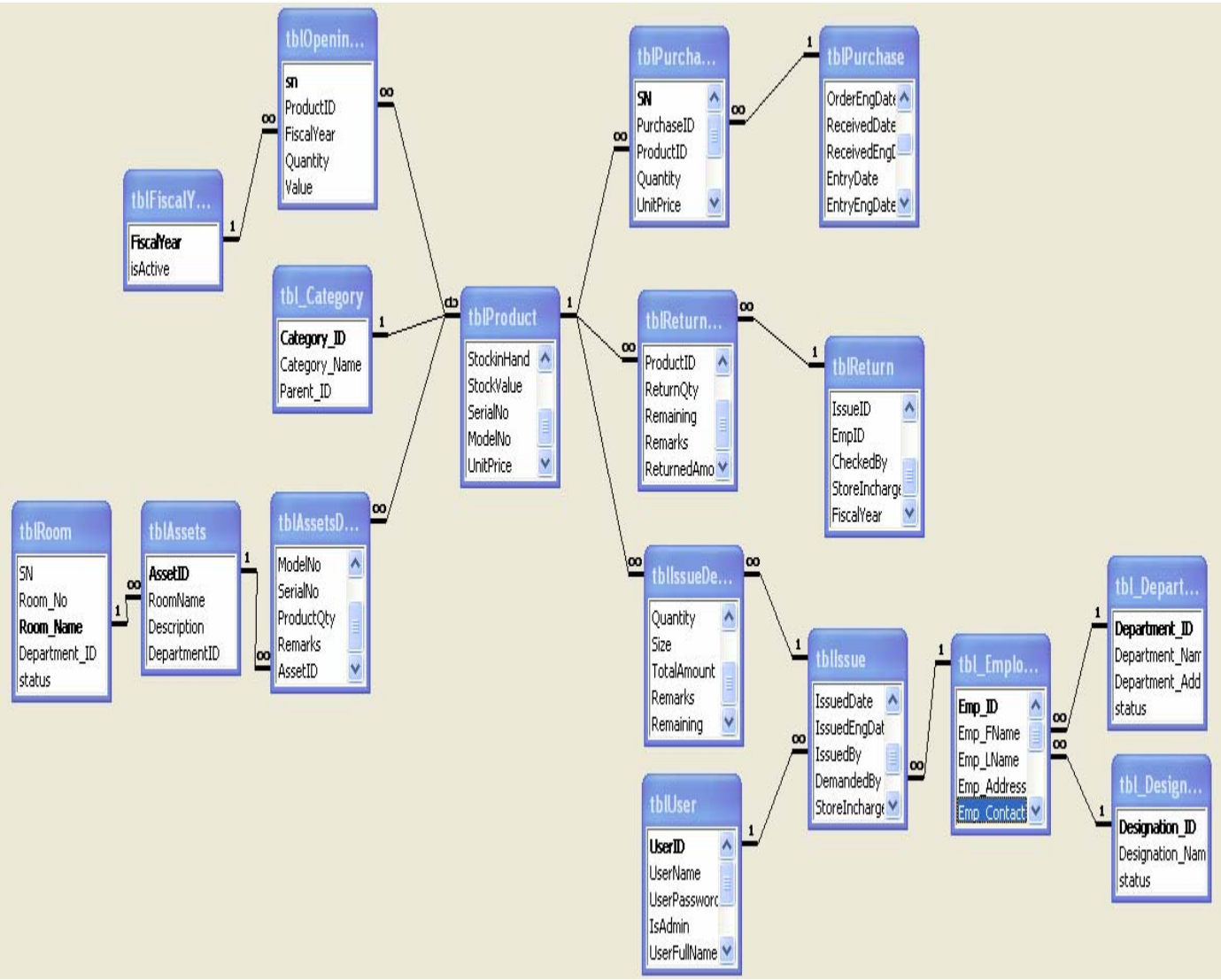

Figure 14: E-R Diagram of Inventory Management System

b) E-R Diagram for Attendance System

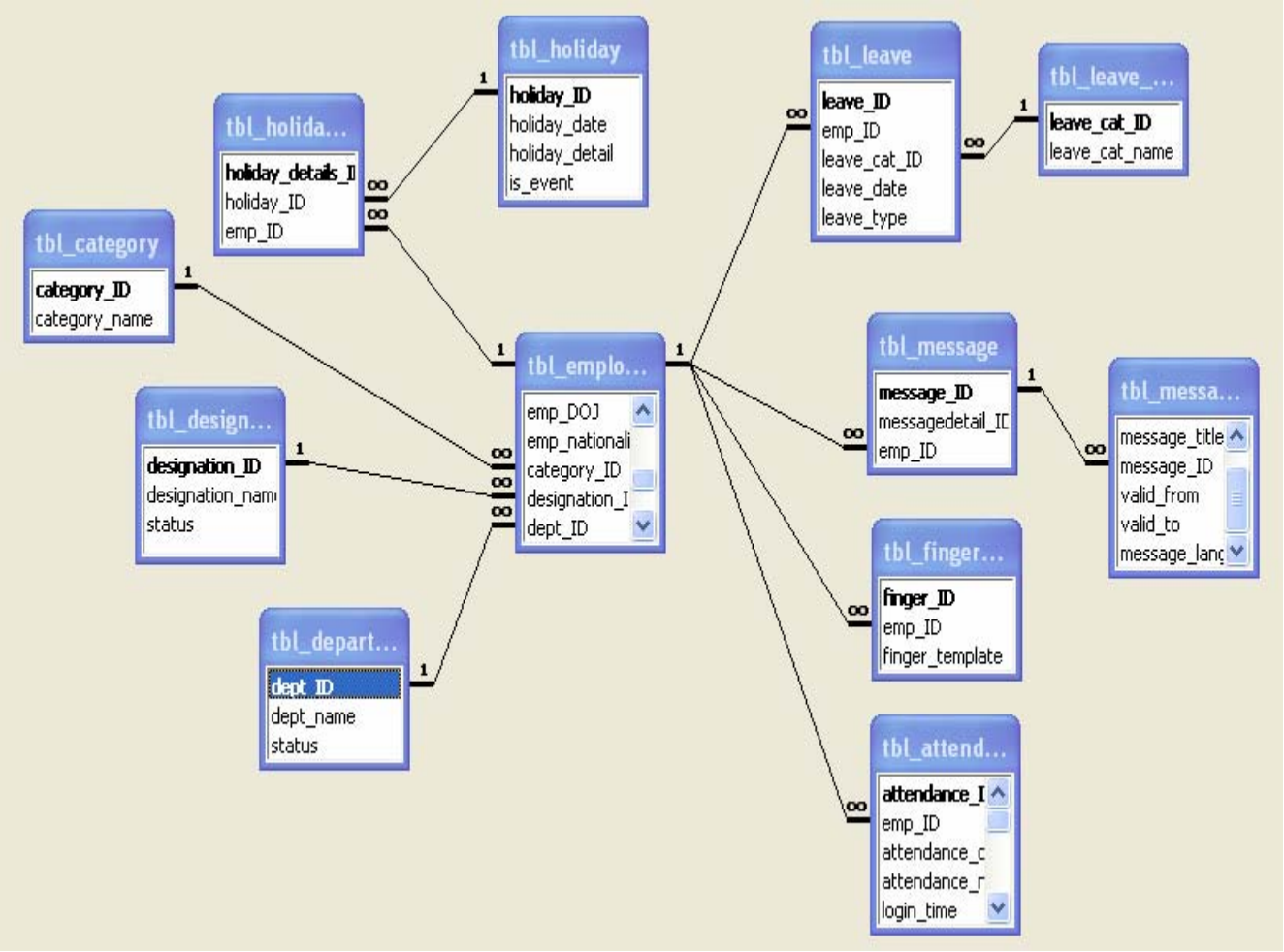

Figure 15: E-R Diagram of Attendance System

4.8 Comparison between new and existing system

As outlined in section 4.5 existing system of Nepal Rastra Bank have number of limitations. A successful implementation of new system will provide the following benefits over the existing system:

- Automate the existing manual systems and remove the shortcomings of old standalone systems
- Reduce the cost of operation
- Collect accurate, timely, complete, reliable, consistent information
- Provide adequate management reporting
- Support government-wide and agency policy decisions
- Support budget preparation and execution

- Facilitate financial statement preparation
- Provide audit trail to facilitate audits
- Develop a local and wide area networks, connecting departments and offices across the country
- Establish an efficient Central Bank management system
- Design and implement an effective economy research and analysis system
- Develop a Executive Information System and Decision Support System
- Improved work environment, job satisfaction, and increased productivity
- Encourage paperless environment

4.9 Justification of the new system

The function of Information Technology in Banking sector has been changed from supporting factor to driving factor. New products based on Information Technology are evolving day by day in banking industry. Moreover; most of the operations in the banking sector are automated and all information are stored and transmitted electronically. The use of information Technology not only facilitates the operations of the bank, it also brings along concerns on the privacy, confidentiality and integrity of information. As a regulatory and supervisory authority of the Banks and Financial Institutions, NRB must strengthen its capability in terms of ICT utilization for effective supervision and regulation. As a monetary authority, NRB need to develop a sophisticated system for analysis and preparation of different research data accurately and timely. As a bank of government, NRB must ensure sound and efficient payment and settlement system by utilizing ICT optimally. Implementation of the new system will facilitate the bank to carry out central banking operations effectively and efficiently and promote and encourage paperless environment. There is an opportunity to use the new system to improve processes, efficiency and transparency within NRB's operations and administration. When transactions get processed faster and more efficiently, NRB can better fulfill its role as the regulatory compliance agency. Accessing and gleaning knowledge out of the data inherent in such a system, will improve the strategic planning capability of NRB.

CHAPTER - 5

CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the whole study in two sections. Section first includes the conclusion of the study. The second section includes some recommendations to the Nepal Rastra Bank for implementing the new system.

5.1 Conclusion

Although, Nepal Rastra Bank is using computers since 2030 BS, NRB is far behind in technology adaptation compared to banks and financial institutions of the country as well as Central Banks of other countries.

There are numerous software systems for addressing operational, compliance, and internal administration needs of the bank but they have numerous problems like:

- Most of the software applications lack scalability, interoperability, robustness, security, and usability
- Multiple stand-alone software applications encourage Reports Reconciliation problems, affect timeliness and cause many delays associated with data entry, data aggregation/analysis and reporting.
- Lack of complete functionality in many of these software applications
- No Audit-Trail features in any of the software applications
- Few standalone applications address only part of the Departmental users' needs
- Lack of Software Documentation associated with most of the software applications leading, modifications in the software applications complex
- Lack of user support documentation, such as user manuals, demonstration modules or comprehensive help functions

Although, the hardware infrastructure at NRB seems to be at satisfactory level but their capabilities are being underutilized. Limited bandwidth for internet connectivity, lack of connectivity between the district offices located at different location and the central office at Baluwatar is making the coordination and collaboration extremely difficult. Poor data backup system, lack of Disaster Recovery Site, lack of risk management guidelines, poor mechanism

for protecting the network from malicious-ware is increasing the level of risk in the Central Banking operation. Due to lack of enough focus from high level management of NRB for expansion and enhancement of IT department, IT department of NRB is limited to support and maintenance of existing hardware and software systems.

Being a monetary authority and regulatory/supervisory body of the banks and financial institutions, NRB should utilize ICT optimally for its efficiency and effectiveness. It is necessary to take an immediate step towards implementing the new centralized integrated financial management information system for the complete automation of Central Banking operations.

The study is based on mainly primary data but on secondary source of information as well. The study of existing MIS at NRB was accomplished by using primary data from the IT department and the concerned department of NRB. The data was collected primarily from questionnaire, interview, and direct observations as well as from manuals, procedures and policies.

5.2 Recommendations

Evolutionary nature of financial services along with the need to formulate and implement monetary, financial, and external sector policies effectively in real time demands wider use of modern information and communication technology. Being a monetary authority and regulatory/supervisory body of the banks and financial institutions, NRB should utilize ICT optimally for its efficiency and effectiveness. The ICT strategy of NRB should be geared up to develop ICT capability for facilitating the bank to carry out central banking functions effectively and efficiently and promote and encourage paperless environment.

A new centralized Integrated Financial Management Information System should be designed, procured and implemented to improve processes, efficiency and transparency within NRB's operations and administration. When transactions get processed faster and more efficiently, NRB can better fulfill its role as the regulatory compliance agency. Accessing and gleaning knowledge out of the data inherent in such a system, will improve the strategic planning capability of NRB. The new system should be designed to meet industry best management practices. From a functionality perspective it should support a "Single Data Entry" oriented data model, in-built audit control logs (audit trail features), in-built User Access Administration tools and other features associated with modern Accounting, Financial Management and MIS systems. Keeping in mind budget and time constraints, the development and introduction of software modules of new system may need to be done based on priorities. However, the design architecture should be flexible and open enough to accommodate future modules.

Most of the existing stand-alone systems need to be phased out with the introduction of the new system. However, the data from the stand-alone systems needs to be retrieved and integrated so that the new system can benefit from this data, such as development of Exception Reports or Statistical/Monetary Trends Analysis.
Local Area Network (LAN) inside the bank offices, Wide Area Network (WAN) between different offices of the bank as well as between banks and related external agencies need to be strengthened.

To assure continuity of computing and telecommunications operations needed to support critical NRB functions, suitable Disaster Recovery Site must be designed and the resumption plan should be developed for achieving a systematic and orderly resumption of all NRB's

computing and telecommunications services. The plan should provide for restoring service as soon as possible. Those functions that are most critical to NRB must remain in operation during the Recovery period.

For the successful implementation of the new system, it is important that the right people with the right skills & backgrounds are involved with the project. Specifically, it is important to form a project team which includes staff from the IT Department and representatives from other departments. Such a team comprising of IT and Domain Experts will be important to develop the specifications and successfully carryout Project Implementation and ensure Post-Implementation Technology Adoption.

The organizational structure of the IT Department needs to be revised in order to be in a position to support the new system. With the implementation of the new system, the role of the IT Department should be to support the Users, Encourage Technology Adoption and the underlying Hardware/Networking Infrastructure. IT department staff and the new system implementation team need to be trained on areas important to supporting the new system such as Software Development & Business processes, QA & Testing protocols, Documentation and Project Management.

A standard internal ICT policy and data integrity policy need to be developed. Necessary procedures and infrastructure need to be developed and implemented for acceptance of digitally signed documents. An effective mechanism of electronic communication need to be developed and implemented for encouraging towards paperless environment.

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ANNEXES

Annex - I

QUESTIONNAIRE

Dear Respondent,

I have been conducting a research on "MIS in Nepal Rastra Bank" as a requirement for the partial fulfillment of the degree of MBS. I hope this questionnaire be an effective methodology to find out the status of Information Technology and MIS at Nepal Rastra Bank.

I heartily request you to fill this questionnaire at the best of your Knowledge. Your kind cooperation in this regard will be of great value for me.

Yours faithfully,

Shubhash Chandra Ghimire

Tribhuvan University

Shanker Dev Campus

MBS Final Year

Questionnaire for sampled respondent from each department of NRB

Respondents:

Name of Respondent: [optional]

Address: [optional]

Department:

Current Post:

Please check the box with '×' sign before the option where applicable.

1. Is there any software in use for the automation of your departmental work?

	1. Yes		2. No

2. Does the existing software support all business processes?

	1. Yes		2. No

3. What type of system you are using?

	1. Standalone System		2. Networked System

4. Which database is used by your system? (Write down the name of software)

5. What are the major problems with the present software systems? (Please List it out.)

i. .....
ii. .....
iii. .....
iv. .....

6. What is the data backup medium?

	1. CD		ii. Hard Disk
	iii. Pen drive		iv. Others (specify).....

7. What is the frequency of data backup?

	1. Daily		ii. Weekly
	iii. Quarterly		iv. Others (specify).....

8. Is there sufficient hardware and network infrastructure?

	1. Yes		2. No

9. Is the support service is adequate?

	1. Yes		2. No

10. Are the changes accommodated properly and on time to the system?

	1. Yes		2. No

Questionnaire for staff of IT Department of NRB

Respondents:

Name of Respondent: [optional]

Address: [optional]

Unit:

Current Post:

Please check the box with '×' sign before the option where applicable.

1. Software used

a. How many software are in use at NRB?

	i. 1-5		ii. 5-10
	iii. 10-15		iv. more than 15

b. How software are acquired?

	i. Developed Internally		ii. Purchased from local market
	iii. Purchased from International market		iv. Others (specify).....

c. Does designed software support all functionalities?

	1. Yes		2. No

d. Is the software documentation comprehensive?

	1. Yes		2. No

e. Is there DR site for data backup?

	1. Yes		2. No

2. Hardware Used

a. What are the servers used in NRB ?

	i. RISC		ii. CISC
	iii. General PC		iv. Others (specify).....

b. How many Servers are in use?

	i. 1-4		ii. 4-8
	iii. more than 8		

c. What security hardware is used by NRB?

	i. Firewall		ii. Router
	iii. HSM		iv. Others (specify).....

3. Network Technology

a. Which Network Topology is being used for LAN connectivity?

	i. Star and extended star topology		ii. Bus topology
	iii. Mesh Topology		iv. Others (specify).....

b. What are the Communication Media used to connect NRB and its district offices?

	i. Optic Fiber		ii. V-SAT
	iii. Radio Link		iv. Others (P.S.).....
	v. None		

c. Are all computers in network?

	1. Yes		2. No

4. Human Resource of Information Technology

a. How long you are working in Information Technology?

	i. 0-2 years		ii. 2-5 years
	iii. 5-10 years		iv. >10 years

b. How long you are working in your current post?

	i. 0-2 years		ii. 2-5 years
	iii. 5-10 years		iv. >10 years

c. What is your faculty of education?

	i. Management		ii. Information Technology
	iii. IT related field		iv. Others (specify).....

d. What is your qualification?

	i. Masters		ii Bachelor
	iii. Intermediate or less		iv. above masters

e. Have you taken any special training to handle your job more qualitatively?

	i. Yes (P. List below)		ii. No

5. Physical and Environment Security

a. How is the server room protected from external and internal intruders?

	i. Door Lock with restricted sign		ii. Door Lock only
	iii. Door Lock with security Guard		iv. Door Lock with Auto Log facility

b. How are Equipment protected from high voltage and power outage?

	i. UPS with Generator Backup		ii. UPS only
	iii. CVT		Others(Specify)

c. Is server room equipped with electronic detectors and loggers?

	i. CCTV		ii. Smoke Detector
	iii. Moisture Absorber		iv. N/A

6. Logical Security

a. What password policy is practiced to access the system?

	i. minimum length control		ii. combination of alphanumeric
	iii. alphanumeric with special character		iv. periodic forced change
	v. change on first use		vi. Others

b. How virus is controlled in the system?

	i. Preventive Measures		ii. Detective Measures
	iii. Corrective Measures		iv. Others (Please specify)

c. Please check if where VPN is applied?

	i. branch connectivity		ii. connection to server via internet
	iii. No VPN		iv. we have private network and VPN necessary

d. How is firewall configured to protect the system?

	i. Public network access is firewall protected.		ii. Inter connectivity is firewall protected
	iii. Access to the server is firewall protected even from internal LAN		iv. none of above
	v. all of above		

Annex- II

Responses to the field survey based on Questionnaire for the staff of non-IT department

Q.N	Optionwise Response						Total Response	Remarks
	i.	ii.	iii.	iv.	v.	vi		
1	22	10					32	
2	6	26					32	
3	32						32	
4								
5								
6	14	6					20	
7	6	20					26	
8		32					32	
9	5	27					32	
10	4	28					32	

Responses to the field survey based on Questionnaire for the staff of IT department

Q.N		Optionwise Response					Total Response	Remarks
		i.	ii.	iii.	iv.	v.		
	a				8		8	
	b				8		8	
	c	2	6				8	
	d	1	7				8	
1	e		8				8	
	a	5		2	1		8	
	b			8			8	
2	c	6	1				7	
	a	6	1		1		8	
	b					8	8	
3	c				8		8	
	a			5	3		8	
	b			8			8	
	c		5	3			8	
	d		4	4			8	
4	e	4	4				8	
	a		8				8	
	b	8					8	
5	c	8					8	
	a		8				8	
	b	5	2	1			8	
	c			8			8	
6	d					8	8	