CHAPTER - 3
THEORETICAL ORIENTATION

Introduction

In literature we come across several concepts and terms in the context of performance appraisal of the banking sector. Clarity of the concepts and terms may contribute to better understanding, interpretation and discussion. Hence an attempt is made to collect and present the relevant details in different sections in this chapter.

3.1. Theoretical issues on banking

3.1.1. Role of money in the development process

There are standard theories of structuralists and monetarists explaining the role of money in the development process in quite opposite directions. In the structuralist and Keynesian paradigm money and monetary policies have secondary role in the growth process. Fiscal programmes formulated by budgetary exercise will compensate market failure to bring about adjustments in aggregate demand and supply. In a developing economy control over the financial sector by the government only ensures resource flow through public expenditure. Besides proper utilization of financial resources by the government in the interest of social development and control of concentration are the other side issues. Financial institutions are nationalized with this broader objective in view. In this process money is channeled by nonmonetary authorities at their discretion for development and stabilization of the economy. Central bank policy for credit regulation and commercial bank’s credit plan are all formulated by the government after the nationalization.

As against that, the neo classical and monetarist school emphasizes a positive relation between money supply and growth of output. Based on wider substitutability and demand for money, monetarists favour a long term planning of money supply to be consistent with growth. Monetary policy is a steering instrument for maintaining steady growth and short term stability.
The new generation monetarists, the so-called monetary repressionists are for complete liberalization of the economy and particularly the financial sector so that the financial flow determines the interest rates and allocation of resources. Financial repressionist’s causation is that government control imposes an implicit taxation on the financial system as the intermediaries are required to have low yield reserve, low interest on deposits and investments. This reduction in interest rate reduces savings and efficiency and consequently growth rate. McKinnon and Shaw (1973) hypothesis was further developed by writers like Fry (1988). A powerful stimulus to this argument in favour of liberalization of the financial sector was provided by World bank itself (1989). The bank states that the main difference between the rich and the poor of the efficiency and the financial system contribution to growth lies precisely in the ability to increase efficiency. The bank asserts that greater financial deepening arising from increased stock of financial assets will hasten the growth by encouraging savings and extension of financial activities. Obviously, all countries seeking assistance from IMF and World bank will have to make macroeconomic adjustments in the financial sector in particular. IMF and World bank are the world’s multinational agencies fostering the liberalization theory propounded at the macroeconomic level by financial repressionists.

3.1.2. The role of banks in financial intermediation

One of the major debates in financial economics pertains to the role of banks in financial intermediation. In an ideal world of complete and perfect capital markets with full and symmetric information, there is no role for banks and financial intermediaries (Fama, 1980). Then why the economic agents prefer an intermediated source to an unintermediated source. Two ways by which financial intermediaries can improve an unintermediated markets is by reducing search cost and transaction costs. Without intermediation, savers have to search for suitable investors and similarly investors will have to look for suitable source of funding. By engaging intermediaries, agents can cut across cost of duplicating searches and can reap economies gained by financial intermediaries which specialize in such search activity. Similarly, financial intermediaries can reduce transaction costs by reducing the number of transactions required and by offering standardized products.
Financial intermediaries can reduce monitoring costs. There are certain assets whose value can be realized by investing a certain amount of time and effort for monitoring the performance. The existence of monitoring costs gives another reason why an intermediary can improve on the outcome of an unintermediated market. The value of an asset to its owner depends on how he invests time and efforts into monitoring and verifying its performance. Thus individual can entrust this job to an intermediary which possess economics in undertaking such tasks. Financial intermediaries also provide instruments that allow diversification and hedging of risks, thereby allowing the economic agents to utilize resources efficiently. The basic economic function of bank intermediation can be summerised as follows,(Rangarajan,1997)

“Liability-Asset transformation ie accepting deposits as a liability and converting it into assets such as loans.

Size transformation ie. providing large loans on the basis of numerous small deposits.

Maturity transformation ie. offering savers alternate forms of deposits according to their liquidity preferences while providing borrowers with loans of desired maturities. And Risk transformation ie. distributing risk through diversification which substantially reduces the risk for savers which would prevail while lending directly in the absence of financial transformation.”

Financial intermediaries like banks are unique and specialize in performing functions such as (a) mobilizing of savings and channeling them to productive uses and (b) acting as an efficient conduit for payments.

3.1.3. Theoretical Issues on Financial Sector Reforms

Financial repression

A major plank of the financial sector reforms is the financial sector liberalization which can be explained from the view point of theory. The financial policies embodied in the standard IMF and World bank economic reform packages are derived from the financial repression
hypothesis of Mckinnon-Shaw-Fry (Mckinnon 1973, Shaw1973, Fry 1988) which became the orthodoxy in 1980s. The major argument of the financial repression hypothesis is repression is mainly due to government intervention particularly interest ceiling and other quantity rationing devices such as use of selective credit control to maintain low interest rate at times of high inflation, which is meant for financing public sector deficits at low cost. The Mckinnon-Shaw school argues that financial liberalization and deepening enables interest rates and exchange rates reflect relative scarcities, stimulate savings and discriminate more efficiently between alternative investments. This, in turn, not only induces replacement of capital intensive process and technology by labour intensive process but also provides high elasticity of substitution between labour and capital. Financial deepening will generate positive employment and distributional effects in favour of labour, thus contributing to high growth and more equitable distribution of income. (Fry 1988). In their view, the most important step for success is to attain a competitive free market equilibrium level of deposit rate that will maximize growth. First this leads to an increase in the real supply of credit and achieve a higher economic growth without raising the loan rate. Secondly even if the loan rates are raised, it would mean greater efficiency per unit of investment thereby raising output sufficiently to offset the declining share of output allocated to investment. (Mckinnon 1973) These policy recommendation would not only raise the rate of economic growth through an increase in credit availability but also reduce inflationary pressures.

Nationalisation

Private banks operating in the imperfect credit market would only aggravate already existing imperfections. Keynes and Kalecki has already provided the theoretical foundation of this view in 1930’s. As Kalecki put it “the most important pre requisite for becoming an entrepreneur is the ownership of capital…firms below a certain size have no access whatsoever to capital market…a state of business democracy where anybody endowed with entrepreneurial ability can obtain capital for starting a business venture is, to put it mildly, is unrealistic”. (Kalecki 1954)
In General Theory, Keynes expresses the problem little differently. He distinguished two types of risks that affect the volume of investment. (Keynes1935) The borrower risk arising because it is unsure whether the business venture will provide the expected yield and require a low rate of interest especially for a risky endeavour. But the same situation creates “lender’s risk” of default by the borrower (voluntary) what Keynes terms moral hazard or involuntary due to poor returns on investment. This necessitates that the lender charge a rate of interest high enough to induce to lend. Keynes expresses the resulting dilemma somewhat poetically “the hope of a favourable outcome, which may balance the risk in the mind of the borrower is not available to solace the lender.”

Applying the insights of Keynes and Kalecki to the deeply unequal agrarian economy like India, Raj argued that “the very basis of profit making in banking activity sets limits in underdeveloped economies to the enterprise it can display”. Raj felt that “there are important reasons why banking enterprises seeking to maximize their profits would not venture out into areas and sectors of activity to which high priority needs to be attached from a larger social and economic point of view (Raj1974). Thus, rural credit was not merely a commodity that needed to reach the poor to free them from usurious money lenders, it could also be seen as a public good critical to the development of a backward economy like India, especially in the era of green revolution, where private investments by richer families needed massive credit support. Raj showed that mere legislation and control had not led to an “optimum allocation of investible resources” and nationalization of banks was the only way forward. The preamble to the Banking Companies (Acquisition and Transfer of Undertakings) Act of 1969 that empowered the state to nationalize commercial banks speaks of a “larger social purpose” and the need to sub serve national priorities and objectives such as rapid growth of agriculture, small scale industries and exports, raising of employment levels, encouragement of new entrepreneurs and development of backward areas.

The policy framework of the pre reform era focused on Keynesian models that the interactive mechanism between finance and economic development proceed from low interest rates (to increase investment) to high rate of income growth, thereby increasing savings rate.
3.1.4. Moral hazard and adverse selection

The concept of moral hazard and adverse selection explains the increase in NPAs. The relationship between interest rate charged and the expected may not be monotonic because of adverse selection effects and adverse incentive effects. In the case of adverse selection effects, safe borrowers drop out when the bank advance rate is relatively high and borrowers with riskier projects remain thereby reducing profit. In the case of adverse incentive effects or moral hazard behaviour, borrowers tend to undertake riskier projects with increase in interest rates. Adverse selection can be avoided if banks can increase their shares of loans in favour of risk averse borrowers. Bank’s expected return depends not only on the lending rate but also the recovery of loans. It is likely that lower rates of interest not only improve the risk profile of banks but also raise the off take of credit, increasing bank’s profitability on both counts.

3.1.5. Theories of Liquidity management

Theories of liquidity management are based either on the management of assets or liabilities. There are three theories based on the management of asset as commercial loan theory, the shift ability theory and the anticipated income theory and one theory based on the liabilities is called liability management theory.

Commercial loan theory

This theory maintains that a commercial bank’s liquidity would be assured as long as assets were held in short term loans that would be liquidated in the normal course of business. Banks are expected to finance the movement of goods through the successive stages of production to consumption or what would be called today as inventory or working capital loans. In United States strict adherence to this theory prohibited the banks from financing plant and equipment, house purchases, livestock acquisition and land purchases which led to the development of competing financial institutions. The theory did not take into account the relative stability of core deposits. The core deposits enable a bank to extend loans for a reasonable period of time without becoming illiquid. However, the assumption that all loans
would be liquidated in the normal course of business is unlikely to be fulfilled in the time of business slow down or recession.

**The shift ability theory**

The shift ability theory is based on the proposition that the assets the banks hold are either to be sold to other lenders or investors or shifted to central bank which stands ready to purchase assets offered for sale. A commercial bank would be able to meet the liquidity needs if it has assets to sell.

Liquidity problems could however arise as in 1920’s and 1930’s if the price of securities falls and the loans can be liquidated at a loss. Access to central bank can be had only if the loans satisfy eligibility rules such as self liquidating commercial loans. Banks now hold highly marketable government securities to meet liquidity needs.

**The Anticipated Income theory**

The Anticipated Income theory holds that liquidity can be ensured if scheduled loan payments are made on future income of the borrower. This theory relates loan repayment to income than rely on collateral. This theory also holds that a banks liability can be influenced by the maturity pattern of loans and investment portfolios. The theory recognised that certain types of loans have more liquidity than others. On the basis of this theory, bank management adopted ladder effect in the investment portfolio. Banks ensured a certain amount of securities maturing annually and at times when funds might be demanded for lending or withdrawal. However there was no clue about the future income of the borrower.

**The Liability management theory**

The liability management theory holds that banks can meet heir liquidity requirement by bidding in the market for additional funds to meet loan demand and deposit withdrawal. The large money markets started the practice which later spread throughout U.S. The roots of the theory can be traced to the rejuvenation of federal funds markets in the 1980’s and development of negotiable time deposits as a major money market instrument. Banks in U.S
rely for liquidity on federal funds market, Euro dollar market or sale of loan participation certificates. Such borrowing came to be called to be known as liquidity management.

3.1.6. Guiding principles of investment analysis

A good portfolio management is one which brings maximum profit to the shareholders and maximum security to depositors.

Liquidity: It refers to the capacity of the bank to pay in exchange of the deposits. The banks accepts several types of deposits and a large part of it is withdrawable on demand. Hence the bank should keep a sufficient degree of liquidity of its assets.

Profitability: The bank being a business institution, the most important objective is to earn as much profit as possible. The bank must formulate its investment so wisely to provide sufficient income to meet its expenses and pay a fair percentage of dividends to the shareholders.

Security: The bank should never overlook utmost safety in the investment of funds entrusted to them by their valuable depositors.

The banker should strike a balance between liquidity, profitability and security and with a view to earn maximum profits out of its investments a bank must use its resources at the optimum level.

Stability: The bank must invest its surplus funds only in those securities whose prices in the market tends not to fluctuate frequently and widely. It is because the bank may have to suffer heavy losses in case the prices of such securities suddenly fall in the market.

Diversification

The bank should plan its investment policies and lending policies in such a way so as to minimise risks. Therefore it is not worthwhile to concentrate on particular type of security and invest in a variety of investment to avoid excessive risks.
3.2. Banking Terms and Concepts

3.2.1. Definition of Bank

According to Oxford English Dictionary, Bank is, “An establishment for custody of money received from or on behalf of, its customers. Its essential duty is the payment of the orders given on it by the customers, its profit mainly from the investment of money left unused by them.”

As per Charles Woelfel’s Encyclopedia of Banking and Finance, “Bank is any organization engaged in any or all of the various functions of banking, i.e. receiving, collecting, transferring, paying, lending, investing, dealing, exchanging and servicing money and claims to money both domestically and internationally”.

Banking Regulation Act, 1949 has defined the banking company as”Banking company means any company which transacts business of banking in India.” According to Section 5B,”banking means the accepting of deposits of money from the public for the purpose of lending or investment, which are repayable on demand or otherwise and are withdrawable by cheque, draft, order or otherwise”.

3.2.2. Classification of Commercial Banks

Among the banking institutions in the organized sector the commercial banks are the oldest institutions having a wide network of branches, commanding utmost public confidence and having a lion’s share in the total banking operations.
The banks are classified into three categories.

(i) **Public Sector banks**

These include banks in which majority of the shares are held by the central government either directly or through the Reserve Bank of India. They are divided into two classes namely

(a) State Bank Group
(b) Nationalised Banks

**Figure 1. Structure of scheduled commercial Banks**

Notes: 1. Scheduled Commercial Banks are exclusive of Regional Rural Banks (RRBs).
2. Figures in brackets indicate number of banks in each group.
State Bank Group

The State Bank Group comprises of State bank of India and its five associates. The state Bank of India was established on July 1, 1955, by nationalizing Imperial Bank of India. The five associates of the State Bank of India which are fully owned by the State bank or has majority share holdings are, State Bank of Bikanir and Jaipur, State Bank of Patiala, State Bank of Hyderabad, State Bank of Travancore and State bank of Mysore. SBI together with its associates is the largest commercial bank in India in terms of its branch network, resources and manpower. SBI acts as an agent of RBI.

Nationalised Banks

There are 19 Nationalised banks in the country. They were reduced from 20 because of the merger of New Bank of India with Punjab National Bank. The nationalised banks were established under two Acts. ie. Banking companies (Acquisition and transfer of undertakings) Act of 1969 and 1980. Nationalised banks are owned by the government of India.

(ii) Private Sector Banks

The private sector banks can be broadly classified in two categories.

1. Old Private sector Banks
2. New Private Sector Banks

1. Old Private Sector Banks

The banks were working in private sector which escaped from the conditions of nationalisation come in this category. The number of banks were 16 as on 31st March 2010.

2. New Private Sector Banks

The Narasimham Committee on Financial Sector(1991) recommended the establishment of private sector banks in India and RBI has issued guidelines for setting up of new private sector banks in 1993. Now there are 8 New Private sector banks in India.
(iii) Foreign Banks

These are banks established outside India but having a place of business in India and working on purely commercial terms. There are 34 foreign banks from 21 countries operating in India.

3.2.3. Priority Sector

One of the objectives of social control over banks and subsequent nationalization of major commercial banks was to ensure that banks reorient their lending activities so that credit flows to certain sectors of the economy in accordance with the national planning policies. The description of the priority sector was formulated in 1972. As per the targets prescribed, banks are required to advance at least 40 per cent of their net bank credit to agriculture, small scale industry and other priority sectors comprising of retail trading, transport undertakings, housing etc. Within these while lending for agriculture should be at least 18 per cent, for small scale industries and other priority sector advances it is 12 per cent and 10 per cent respectively. Credit to weaker section should be 10 per cent. It may be noted that in the case of Foreign banks, they are not required to lend for agricultural activities. Instead they need to extend credit to exports, other priority activities at least 10 per cent each and total priority sector lending shall not be less than 32 per cent. The post reform period led to the widening of the definition of the priority sector in several ways that diluted the focus on agriculture and the weaker sections. (Chadrashekhar and Ray 2005). At present the following sectors are considered as priority sectors.

- Agriculture
- Small scale industry
- Small road and water transport operators
- Retail trade
- Small business
- Professional and self employed persons
- Weaker sections including scheduled caste and scheduled tribes
- State sponsored organizations for scheduled castes and scheduled tribes
- Education
• Rural Housing
• Consumption loans
• Funds provided to Regional Rural banks
• Loans to self help groups
• Subscription to special bonds floated by State Financial Corporation/State industrial Development Corporation/REC/NABARD/NHB

The targets fixed for the priority sector credit are reviewed from time to time keeping in view the broad based socio-economic objectives.

3.2.4. Classification of assets

According to the recommendations of the Narasimham committee, the Reserve Bank of India issued guidelines to classify the assets based on weaknesses and dependence on collateral securities.

Standard asset does not disclose any problem and it does not carry more than normal risk.

A sub-standard asset is an asset which has been classified as non-performing for a period not exceeding 2 years., The current net worth of the borrowers, guarantor or current market value of security charged in the bank is not enough to ensure recovery of debt due to bank in full.

A doubtful asset is a non-performing asset, which has been continued to so for a period exceeding two years.

A loss is an asset identified by the bank as loss assets, the amount that has not been written off wholly or partly.

Non-performing asset is defined as an advance that has not been serviced as a result of “past dues” accumulating for 90 days and over. Due to the time lag in the process of recovery and the detailed procedure involved before write off, the bank continues to hold such advances even after making provisions for the advances considered irrecoverable.
Net Non-performing assets:

Measured as Gross performing assets less (1) balance in interest suspense account (2) claims from deposit insurance and credit guarantee corporation and kept in suspense account (3) part payment received and kept in suspense account (4) total provisions held.

The financial statements provide the summary of the accounts of the business enterprises, the balance sheet representing the assets, liabilities and capital as on certain date and income statement showing the revenue and expenses during an accounting period.

Spread analysis

Essentially this method measures and examines the causes of changes in the difference between gross interest and fees received on earning assets and the gross interest paid on interest costing liabilities. This difference in absolute terms is called the net interest spread and in percentage terms, the net interest yield.

Capital adequacy ratio

Financial leverage on the other hand is measured by the ratio of capital to risk weighted assets (CRAR) Capital adequacy ratio (CAR) is a measure of the intrinsic strength of a bank to absorb the loss that may arise on certain advances turning sticky. It is calculated as a proportion of capital to assets, which are weighted according to the risk of default attached to them.

Social Banking

The term social banking refers to the policy induced bank assistance to the designated priority sectors and weaker sections of the community, which had hardly any access to banking prior to nationalization of banks. It implies opening of branches in hitherto unbanked areas and accent on liberal lending for rural avocation and aims at generation of employment and income and improvement in the standard of living of people.
3.3. Measures of statistical analysis

3.3.1. Frontier functions of efficiency

The concept of efficiency may be regarded as one of the fundamental precepts of economics and one which also has welfare connotations. The economists use the term efficiency to narrate how well an organisational unit is performing in utilizing resources for generating outputs or outcomes. Farrel (1957) first proposed an approach to estimate the efficiency of observed units and decomposed efficiency into 2 elements a. Technical efficiency (TE) which measures firms success in producing maximal output with a given set of inputs and b. Allocative efficiency (AE) which estimates the firms success in choosing an optimum combination of input, given their respective prices.

Farell’s original work and further extensions made by Charnes et al (1978) and Banker et al (1984) among others consisted of the estimation of efficiency without assuming a functional form. For this reason these methodologies have been termed as nonparametric. Subsequently Charnes et al (1985) provided their formal definition of efficiency.

100 percent efficiency is attained for a unit when None of its outputs can be increased without either increasing one or more of its inputs or decreasing some of its outputs.

None of its inputs can be decreased without either decreasing some of the output or increasing some of its other inputs.

Technical and scale efficiencies

The firms are assigned different efficiencies in case of constant returns to scale and variable returns to scale assumptions. The technical efficiency and scale efficiency can be distinguished using CCR and BCC models. The CCR model estimates the gross efficiency of a DMU on CRS assumption.. This efficiency comprises of technical efficiency and scale efficiency. Technical efficiency describes the efficiency in converting inputs to outputs, while scale efficiency recognizes the economy of scale and cannot be attained at all scales of production, and there one most productive scale size, where the scale efficiency is maximum at 100 percent. The BCC model assuming VRS takes into account the variation
in efficiency with respect to scale operations and hence measures pure technical efficiency. The scale efficiency can be computed as a ratio of CRS efficiency to VRS efficiency

CCR Efficiency = Scale efficiency X Technical (VRS ) Efficiency

3.3.2 Data Envelopment Analysis

DEA involves the use of linear programming methods to construct a non-parametric piecewise surface (or frontier) over the data, so as to be able to calculate efficiencies relative to the surface.

There are three common approaches the intermediation approach, production approach (value added approach) and user cost approach in measuring the inputs and outputs in the banking industry.

In the intermediation approach bank deposits are regarded as being converted into loans. While this approach seems to be appropriate for banks that purchase their funds in big chunks from other banks and large institutional depositors, it may not be so for majority of the Indian banks. Most of the Indian banks provide value added services for their deposit holders, such as safekeeping of funds and other transactional services and therefore, intermediation approach underestimates the overall value additions of the banking activity in developing country’s perspective.

The alternative is the production approach where the banks are regarded as using labour and capital to generate deposits and loans (Mester,1987:Berger and Humpherey,1992). Under this approach high value creating activities such as loans and deposits are classified as outputs, whereas labour, physical capital and purchased funds are classified as inputs.(Wheelock and Wilson,1995)

The third approach is known as user cost. The user cost approach assigns an asset as output if the financial returns are greater than the opportunity cost of funds. Similarly, a liability item is regarded as output if the financial cost are less than the opportunity cost of funds. If neither of these conditions is satisfied then assets and liabilities are classified as input.
(Berger and Humphere, 1992) The user cost method is usually attributed to Hancock (1986). According to Hancock, user costs can be calculated for the assets and liabilities of the balance sheet. However, an important weakness of this approach is that assignment of assets and liability items as inputs and outputs may change with movements in interest rate and service charges.

The literature provides evidence of popularly using either intermediation or production approaches for measuring technical efficiency.

### 3.3.3. Data Envelopment Analysis—Window analysis

DEA is receiving increasing importance as a tool for evaluating and improving the performance of manufacturing and service operations. It has been extensively applied in performance evaluation of institutions like banks. DEA is primarily a diagnostic tool and does not prescribe any reengineering strategies to make inefficient units efficient.

A single firm is considered technically efficient if it cannot increase any output or reduce any input without reducing other outputs or increasing other inputs. The somewhat broader concept of economic efficiency on the other hand is achieved when firms find the combination of inputs that enable them to produce the desired level of output at minimum cost.

In order to capture the variations over time Charnes et al (1985) proposed a technique called window analysis in DEA. Window analysis assesses the performance of a DMU over time by treating it as a different entity in each time period. This method allows for tracking the performance of a unit or process. For eg if there are ‘n’ units with data on their input and output measures, then the total ‘nk’ units need to be assessed simultaneously to capture the efficiency variations over time. Generally a three year period is selected in window analysis and when a new period is introduced the earliest period is dropped.

A DMU which is a good overall performer should have several high efficiency scores along its column. On the other hand, a poorly performed DMU should have several low values.
The column means can be computed to effectively differentiate between good and poor performers.

**DEA and Technical efficiency**

The DEA approach can be undertaken in the context of technical efficiency in the microeconomic theory of production. In microeconomics the production possibility set consists of the feasible input output combinations that arise from available production technology. The production function for production transformation as it is called in the case of multiple inputs is the mathematical expression for a process that transforms inputs into outputs in doing so it defines the frontier of the production possibility set, like in the well known Cobb-Douglas production function.

DEA provides a similar notation of efficiency. The principal difference is that the DEA production frontier is not determined by some specific equation like production function. Instead it is generated from the actual data for the evaluated firms which in DEA terminology are typically called decision making units or DMU’s. Consequently the DEA efficiency is not defined by an absolute standard like equation. Rather it is defined relative to the other firms under consideration. DEA establishes a benchmark efficiency score of unity that no individual firm’s score can exceed. Consequently efficient firms receive efficiency score of unity while inefficient firms receive score less than unity. An advantage of DEA is that it uses actual data to derive the efficiency frontier against which each firm in the sample can be evaluated. As a result, no explicit functional form of production function has to be specified in advance. Instead the production frontier is generated by mathematical programming algorithm which calculates the optimal DEA efficiency score for the firm.

Those who use DEA, however, frequently employ a typical sensitivity analysis called window analysis. In this way, a given firm at a given time can compare its performance at different times and with the performance of other firms at the same time or different times. Through a sequence of windows the sensitivity of a firm’s efficiency score can be derived for a particular year according to changing conditions and a changing set of reference firms. A firm that is DEA efficient, regardless of the window is truly efficient relative to other
firms. Conversely, a firm that is only DEA efficient in a particular window may be efficient solely because of extraneous circumstances.

In addition, window analysis provides some evidence of short run evolution of efficiency for a firm over time. Of course, comparison of DEA efficiency scores over extended period may be misleading because of significant changes in technology and the underlying economic structure.

### 3.3.4. Growth Rate Analysis

Trend analysis becomes imperative to evaluate the profits and profitability performance of banks. It indicates the magnitude and direction of operations over a period of time, highlighting the trend pattern to identify the historical developments and determining the level of efficiency of banks.

**Trends in net profit**

Profit is the renewal source of business activity. Without profit, ultimately there can be no continuity of operations. Growth with profit is essential for continued success of a bank. Profit of a bank represents the revenue in excess of its expenditure and hence is a result of two functions i.e revenue function and cost function. The revenue function shows that the total income of a bank is derived from the services rendered from the bank and the cost function shows the total expenditure incurred on producing the services rendered by it.

**Trends in income**

The income of the commercial banks is the result of the size and types of assets held the return in these assets and the charges imposed for the performance of various services. Usually for the bank’s main source of income as shown in the profit and loss statement include interest, discount, commission, exchange and brokerage.

**Trends in expenditure**

Banking is highly personalized service industry. The expenses of banks are to a large extent fixed particularly in the short period. However this does not mean that bank management
has no control over its expenses. In recent years, the management of the banks have attempted to reduce their expenditure by improving their organizational structure, by introducing information technology. The expenses are divided into interest paid on deposits and borrowings, salaries & allowances other expenses.

3.3.5. Ratio analysis

Financial appraisal is the process of scientifically making a proper, critical and comparative evaluation on the profitability and financial health of a given concern through the application of the techniques of financial statement analysis.

Ratio analysis is one of the most widely used techniques of financial analysis of banks. It aims at making use of quantitative information for decision making and thus provides great help to the management in the planning and control of their activities. For measuring the profitability of banks, analysis of the relevant ratios is the best available method because of their conciseness, comparability and the direct relevance of the relationships established to the various earning capabilities of the banks. Ratio analysis also enables the management of banks to identify the causes of changes in profitability over a period of time and thus helps in pinpointing the direction of action required for altering the profitability prospects of the banks in future.

3.3.6. Principal Component Analysis

Principal component analysis is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called the principal components. The number of principal components will be less or equal to original variables. The transformation is defined in such a way that the first principal component has the largest possible variance and each succeeding component in turn has the highest variance possible under the constraint that it be orthogonal to the preceding component. Principal components are guaranteed to be independent if the data set is jointly normally distributed. PCA was invented by Karl Pearson in 1901. Now it is widely used as a tool in exploratory data analysis and for making predictive models. PCA can be done by eigen value decomposition.
of a data covariance (or correlation) matrix or singular value decomposition of the data matrix. The results of a PCA are usually discussed in terms of component score, sometimes called factor scores when the transformed variable values corresponding to a particular data point and loadings which is the weight by which standardized original variables should be multiplied to get the component score.

Its general objectives are data reduction and interpretation. Although \( p \) components are required to reproduce the total system variability, often much of the variability can be accounted by a small number, \( k \), of the principal components. If so, there is (almost) as much information in the \( k \) components as there is in the original \( p \) variables. The \( k \) components can replace the initial \( p \) variables, and the original data set, consisting of \( n \) measurements on \( p \) variables, is reduced to one consisting of \( n \) measurements on \( k \) principal components. The principal components of a set of variables can be obtained by computing the eigen value decomposition of the observed variance matrix wherein the components with eigen value less than one would be eliminated as per the Kaiser’s rule.

An analysis of principal components often reveals relationships that were not previously suspected and thereby allows interpretations that would not ordinarily result. Analysis of principal components is more of a means to an end rather than an end in themselves because they frequently serve as an intermediate step in much larger investigations. For example principal component analysis may be inputs to a multiple regression analysis or cluster analysis. Moreover, principal components are one factoring of the covariance matrix for the factor analysis model.

The foregoing familiarization, with the concepts, definitions of terms and statistical methods of analysis in banking helps in the selection of appropriate tools for analysis of data, interpretation and discussion of the results of the study based on secondary data which is taken up in the next chapter. The conceptual framework of the study is presented in Figure 2.