Chapter – III

Research Methodology and Data Base

3.1 INTRODUCTION:

This research work is an effort to investigate the analogy of e-banking in public and private sector banks in India. Impact of electronic banking services on the performance of banks and efficiency of banks due to e-banking among public & private sector banks in India are observed for this purpose. This research work also deals with the opinions of customers and employees regarding various e-banking services among public and private sector banks in India. In this direction, the present chapter describes the methodology used, hypotheses, and research design of the study for achieving the objectives of the study. This chapter has been divided into different sections. Details related to period of the study, sample design of the study, parameters for checking the efficiency of banks, parameters for checking the relationship between e-banking services and bank performance, sample design for the study of customer and employee, collection of data, analysis of data & brief description of tools/ quantitative techniques has been discussed in this chapter.

3.2 RESEARCH DESIGN:

The study is descriptive and empirical in nature. Both primary and secondary data has been used according to objectives and the study is based on the Indian public and private sector banks. Analysis has been divided in different parts for measuring growth,
efficiency, influential factors and opinions of customers and employees. Growth of Indian banking industry has been checked in first part and the second part covers the measurement of relative efficiency of Indian public and private sector banks in India. Nature with the dynamics of relationship and effectual measure between the key variables of e-banking services and bank performance variables has been investigated in third part of this study. Opinion of bank customers and employees regarding e-banking services has been checked out in the later part of this study.

3.2.1 Hypotheses of the Study: Hypotheses of the study are as follows:

A. Hypothesis related to the difference in the efficiency of public and private sector banks

H₁: Differences in mean efficiency scores of public and private sector banks are significant.

B. Hypothesis related to the relationship of e-banking and bank performance

H₂: E-banking services are significantly correlated with the performance of public and private sector bank groups in India.

C. Hypothesis related to the impact of e-banking on bank performance

H₃: There is a significant impact of e-banking services on the performance of public and private sector bank groups in India.

D. Hypothesis related to the difference in the attitude of bank customers

H₄: The attitude of bank customers regarding e-banking services is significantly different in public and private sector banks in India.

E. Hypothesis related to the difference in the perception of bank employees

H₅: The perceptions of bank employees regarding e-banking services are significantly different in public and private sector banks in India.
F. Hypotheses related to Technology Acceptance Model:

Hypotheses of the study related to technology acceptance model are as follows:

<table>
<thead>
<tr>
<th>Research Hypothesis</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2: Social Influences has a direct positive impact on attitude for using e-banking services.</td>
<td>Hsu &amp; LU (2004)</td>
</tr>
<tr>
<td>H3: Perceived ease of use has a direct positive impact on perceived usefulness of using e-banking services.</td>
<td>Davis et al. (1989)</td>
</tr>
<tr>
<td>H4: Perceived ease of use has a direct positive impact on attitude of using e-banking services.</td>
<td>Davis et al. (1989)</td>
</tr>
<tr>
<td>H5: System Quality has a direct positive impact on perceived usefulness of e-banking services.</td>
<td>Gu et al. (2009)</td>
</tr>
<tr>
<td>H6: Self efficacy has a direct positive impact on perceived ease of use of e-banking services.</td>
<td>Agarwal &amp; Karahana (2000) Venkatesh &amp; Davis (1996)</td>
</tr>
<tr>
<td>H8: Trust has a direct positive impact on perceived usefulness to use e-banking services.</td>
<td>Gu et al. (2009) Gefen et al. (2003)</td>
</tr>
<tr>
<td>H9: Trust has a direct positive impact on behavioral intention to use e-banking services.</td>
<td>Gefen et al. (2003) Gu et al. (2009)</td>
</tr>
<tr>
<td>H10: Perceived usefulness has a direct positive impact on attitude to use e-banking services.</td>
<td>Davis et al. (1989)</td>
</tr>
<tr>
<td>H11: Perceived usefulness has a direct positive impact on behavioral intention to use e-banking services.</td>
<td>Davis et al. (1989)</td>
</tr>
<tr>
<td>H12: Attitude has a direct positive impact on behavioral intention to use e-banking services.</td>
<td>Davis et al. (1989)</td>
</tr>
</tbody>
</table>

3.2.2 Period of the Study:

For measuring the relative efficiency of public and private sector banks of Indian banking industry and to check the impact of e-banking on bank performance of different bank groups, the focus is on nine financial year data, i.e. from 2004-05 to 2012-13.

3.2.3 Sample Design for the study of efficiency of banks and impact of e-banking:

The study is focused on public and private sector banks to check the e-banking status in
India. For checking the efficiency, individual banks are also considered to know how many banks are efficient under both bank groups and total 38 banks are selected for analysis which includes 19 public sector banks and 19 private sector banks. These banks are considered on the basis of availability of relevant data. These public and private sector banks were taken to measure the relative efficiency of banks operating in India and to observe the changes in efficiency. While impact of e-banking services is checked on both sector bank groups by further dividing these groups to know which bank group has more impact due to e-banking. Public sector banks group is further divided into SBI group and nationalized banks group and private sector banks group is divided in new private sector banks group and old private sector banks group.

3.2.4 Parameters for checking the efficiency of banks:

On the basis of available literature of the related studies, following variables are selecting for measuring the relative efficiency of public and private sector banks in India:

3.2.4.1 Input variables: Deposits, Borrowings, Fixed Assets, Numbers of ATMs.

3.2.4.2 Output variables: Investment, Total Income and Loan & Advances.

3.2.5 Parameters for checking the relationship between e-banking services and bank performance:

To analyze the role of e-banking services on the bank performance, e-banking service index and bank performance index have been constructed. Performance of banks and e-banking service can be measured through a number of parameters. Some parameters have been selected on the basis of literature to construct bank performance index and e-banking service index.
3.2.5.1 Parameters of Bank Performance:

Various parameters are selected for finding the impact of e-banking services on bank performance and study employs seven ratios. The details of ratios of bank performance with abbreviation are as follows:

- Credit- Deposit ratio : C-D
- Operating expenses as percentage of total assets : OETA
- Interest income as percentage of total assets : IITA
- Interest expenses as percentage of total assets : IETA
- Spread as percentage of total branch : SB
- Burden to total assets : BTA
- Total income per employee : TIE

3.2.5.2 Parameters of E-Banking Services:

E-Banking services like ATM on-site, ATM off-site, credit card and debit card have been taken to analyze the role of e-banking services on the performance of Indian banks. These e-banking services are converted in ratios. Therefore, parameters of e-banking services are ATM on-site as percentage of total branch, ATM off-site as percentage of total branch, debit card per branch and credit card per branch. The abbreviation of the parameters of e-banking services is as follows:

- ATM on-site as percentage of total branch : AONB
- ATM off-site as percentage of total branch : AOFB
- Debit card per branch : DCB
- Credit card per branch : CCB
3.2.6 Sample Design for the study of the attitude of customers and employees:

It is essential to know the perception of bank employees regarding various e-banking services for ascertaining the challenges for the improvement of e-banking in India. It is also necessary to observe various factors which affect the attitude and acceptance of customers towards e-banking services. These objectives are empirical in nature based on primary data. A well structured questionnaire is distributed with close-ended questions to collect primary data. The data is collected from the customers and employees of four public and four private sector banks. Four major cities of the North region of India were selected for this purpose and these cities were Delhi, Lucknow, Chandigarh and Dehradun. Those customers are selected for the study that have the knowledge of e-banking services and use e-banking services. Only cities are taken under study because electronic system is not so popular in semi-urban and rural areas. Only, those banks are selected whose total assets was found highest in public and private sector banks according to RBI, Statistical Tables Relating to Banks in India, 2012-13. The survey is conducted at random over the sample size of 600 bank customers and 240 bank employees. Two questionnaires were prepared, separate for bank customers and employees and pilot survey is also conducted for more accuracy of the questionnaires.

Employees are selected among the people working at different levels in banks like manager, officer, and clerk. Total 300 questionnaires are distributed to the employees of both sector banks. 120 questionnaires are received from the employees of public sector banks and 120 questionnaires are also received from the employees of private sector banks. Thus, total 240 questionnaires are found completed in all respects for further analysis. Therefore, 30 employees from each bank of selected sample banks are analysed.
under this study. Demographic profile of the employees considered gender, age group, marital status, education qualification, experience, category of post and income group. The previous studies on banking have shown that demographic profile of the respondents to be one of the factors which affect their perceptions towards various dimensions of services provided by banks.

Customers are chosen from different social-economic background. Total 800 questionnaires are distributed to the customers of both sector banks. 600 questionnaires are received from both sector banks and total 300 questionnaires from the customers of public sector banks and 300 questionnaires from the customers of private sector banks are found completed in all respects for further analysis. Therefore, 75 customers from each bank of selected sample banks are analysed under this study. The distribution of total sample size of customers and employees among the banks is as follows:

**Table 3.2**

<table>
<thead>
<tr>
<th>Public Sector Banks</th>
<th>Customers</th>
<th>Private Sector Banks</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Bank of India</td>
<td>75</td>
<td>ICICI Bank</td>
<td>75</td>
</tr>
<tr>
<td>Punjab National Bank</td>
<td>75</td>
<td>HDFC Bank</td>
<td>75</td>
</tr>
<tr>
<td>Bank of Baroda</td>
<td>75</td>
<td>Federal Bank</td>
<td>75</td>
</tr>
<tr>
<td>Bank of India</td>
<td>75</td>
<td>Jammu &amp; Kashmir Bank</td>
<td>75</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>Total</td>
<td>300</td>
</tr>
</tbody>
</table>

**Table 3.3**

<table>
<thead>
<tr>
<th>Public Sector Banks</th>
<th>Employees</th>
<th>Private Sector Banks</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Bank of India</td>
<td>30</td>
<td>ICICI Bank</td>
<td>30</td>
</tr>
<tr>
<td>Punjab National Bank</td>
<td>30</td>
<td>HDFC Bank</td>
<td>30</td>
</tr>
<tr>
<td>Bank of Baroda</td>
<td>30</td>
<td>Federal Bank</td>
<td>30</td>
</tr>
<tr>
<td>Bank of India</td>
<td>30</td>
<td>Jammu &amp; Kashmir Bank</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>Total</td>
<td>120</td>
</tr>
</tbody>
</table>
3.2.7 Collection of data:

The study is based on primary and secondary data. Primary data is obtained through well structured questionnaires from employees and customers of banks. Secondary data is collected for analyzing the efficiency and performance of banks. The data for individual banks is collected through CMIE Prowess (Centre for Monitoring Indian Economy Pvt. Ltd.). Secondary data is also used while framing the questionnaires for customers and employees. Various reports of Reserve Bank of India like Report on Trend and Progress of Banking in India, Statistical Tables Relating to Banks in India, Monthly Bulletin for various issues, various other reports of RBI. Annual reports of banks, various journals and magazines issued by the banks, newspaper and other authentic reports are also used in this study.

3.3 TOOLS/QUANTITATIVE TECHNIQUES:

Various statistical tools like descriptive analysis (mean, standard deviation, weighted average score, ranks), cross tabular, growth rates, compounded annual growth rate, correlation analysis, regression analysis, Cronbach’s alpha, data envelopment analysis, structural equation modeling, t-test and Mann-Whitney U test are applied in this research work.

MaxDEA Basic 6.3 (R2014-11-17) developed by CHENG Gang & QIAN Zhenhua (2014) (this can be downloaded for free from the link: http://www.maxdea.cn/Download.htm) is used for checking the efficiency of banks and results of efficiency scores are verified. Efficiency scores based on CCR model have been verified by using Solver (a special add-in of Microsoft Excel) and Efficiency scores based on BCC model have been verified by using another Microsoft Excel based add-in-
DEA Qualitative, developed by Wagner A. Kamakura (2002). The relationship between e-banking service index and bank performance index is measured by using Karl Pearson’s coefficient of correlation. Further, regression analysis has been applied to judge the impact of e-banking services on performance of banks. Various issues like preference of customers, payment and clearing system of electronic banking, efficiency of e-banking services, indicators in the interest of employees regarding his/her job, challenges regarding growth of e-banking and suggestions for the improvement of e-banking services are analyzed using 5-point Likert scale and difference in the perception of banks employees is observed for public and private sector banks. Part-A, Part-B and part-C of the questionnaire for customer that comprises various factors that affect the attitude and acceptance of customers towards e-banking services are also analysed with the help of different statistical tools like descriptive analysis (mean, standard deviation, weighted average score, ranks), cross tabular and t-test. Responses are analyzed at 5-point Likert scale for part-B and part-C. Various issues like duration of using e-banking services, comfort-level of e-banking services, satisfaction level for grievance settlement system, opinion of customers regarding transformation of banks, preference of banks, problems of e-banking, suggestions to improve the e-banking services and assessment of e-banking towards payments & clearing system are analysed and compared to know the attitude and acceptance of customers of both sector banks towards e-banking services. SPSS version 22 and AMOS (Analysis of Moment Structures) versions 21 are used. Nine constructs and thirty four statements based on technology acceptance model are analyzed with the help of structural equation modeling (SEM). Responses are analyzed using 7-point Likert scale in this part of the study. Those nine constructs with abbreviations are as

3.3.1 Bank performance index and E-banking service index:

Parameters of e-banking services have been consolidated for computing electronic banking service index and bank performance parameters have been consolidated to form bank performance index. These indices are formed to find out the effect of electronic banking services on bank performance. As variables are on different scales, so to overcome the limitation of scale and origin, normalization of all data is done with the help of z-score which represents the score with mean 0 and standard deviation 1, and transformed score is calculated for eliminating the effect of negative sign obtained after z-score. Indices have been constructed using standardized values of all selected variables which show scores with mean 50 and standard deviation equal to 10.

\[ T\text{-Score} = 50 + 10 \times \frac{(X - \text{Mean})}{\text{S.D}} \]

3.3.2 Brief description of Tools/ Quantitative Techniques used in the study:

Brief description of tools/ quantitative techniques used in the study is as follows:-

3.3.2.1 Growth Analysis: Annual growth rate and trend based compound annual growth rates have been used for growth analysis. Annual growth rate is stands for the percentage increase in the current period over the previous period. Annual growth rate is defined as:

\[ G = \frac{(V_t - V_{t-1})}{V_{t-1}} \times 100 \]

Where G is the annual growth rate in current year on the basis of previous year; \( V_t \) is value of the given parameter in the current year; and \( V_{t-1} \) is the value of the given parameter in the base year. It is measured in percent per annum.
3.3.2.2 **Compound Annual Growth Rate (CAGR):** is a trend based growth rate of a variable. In order to work out trend growth rate, the following functional relationship is fitted to time series data. CAGR is interpreted in units of percent per annum as:

\[ \text{CAGR} = \left( \frac{V_n}{V_0} \right)^{\left( \frac{1}{n} \right)} - 1 \]

Where \( V_n \) is last year value, \( V_0 \) is starting year value and \( n \) is number of years.

3.3.2.3 **Descriptive Analysis:** Mean, standard deviation, weighted average score, ranks, etc. are applied to analyse the distribution of scores on different parameters.

3.3.2.4 **T-test:** t-test is used to check the significance of the difference between two sample means, whose population variance being equal but unknown. This test was developed by W. S. Gossett. The statistics ‘t’, is calculated under this test and then compared with its critical value at a specified level of significance for accepting or rejecting the null hypothesis.

3.3.2.5 **Mann-Whitney U Test:** This test is one of the most popular non-parametric tests and can be used to as an alternative to standard significance tests for the difference between two sample means where assumption about normality is not satisfied. This test uses ranking data rather than plus and minus sign and its use is less wasteful.

3.3.2.6 **Cross Tabulation:** In simple tabulation, the frequency and percentage for each question is calculated. In cross tabulation, responses to two questions are combined and data is tabulated together. A cross tabulation founds the number of observation in each cross category of two variables. The descriptive results of a cross tabulation is a frequency count for each cell in the analysis (Chawla & Sondhi, 2011).

3.3.2.7 **Data Envelopment Analysis (DEA):** DEA provides work for appraising the relative performance of a set of DMUs that use a variety of identical inputs to produce a
variety of identical outputs. In other words, DEA evaluates any number of DMUs, with variety of inputs and outputs. It has been successfully applied on DMUs which are involve in any type of service and making use of identical inputs like banks, schools, hospitals etc. Under DEA each DMU is compared with the relatively best DMU (Ramanathan, 2003).

**Mathematical Formulation for DEA:**

The following mathematical formation of DEA is given by Ramanathan (2003). Let us use \( x \) and \( y \) to represent inputs and outputs, respectively. Let the subscripts \( i \) and \( j \) to represent particular inputs and outputs respectively. Thus \( x_i \) represents the \( i \)th input, and \( y_j \) represent the \( j \)th output of a decision-making unit. Let the total number of inputs and outputs be represented by \( I \) and \( J \) respectively, where \( I, J > 0 \).

In DEA, multiple inputs and outputs are linearly aggregated using weights. Thus, the virtual input of a firm is obtained as the linear weighted sum of all its inputs.

\[
\text{Virtual Input} = \sum_{i=1}^{I} u_i x_i,
\]

Where \( u_i \) is the weight assigned to input \( x_i \) during the aggregation. Similarly, the virtual output of a firm is obtained as the linear weighted sum of all its outputs.

\[
\text{Virtual Output} = \sum_{j=1}^{J} v_j y_j,
\]

Where \( v_j \) is the weight assigned to output \( y_j \) during the aggregation.

Given these virtual inputs and outputs, the efficiency of the DMU in converting the inputs to outputs can be defined as the ratio of outputs to inputs.
Fractional DEA:

Let there be \( N \) DMUs whose efficiencies have to be compared. Let us take one of the DMUs, say the \( m^{th} \) DMUs, and maximize its efficiency according to the formula given above. Here the \( m^{th} \) DMU is the reference DMU.

\[
\max E_m = \frac{\sum_{j=1}^{J} v_{jm} y_{jm}}{\sum_{i=1}^{I} u_{im} x_{im}}
\]

subject to

\[
0 \leq \frac{\sum_{j=1}^{J} v_{jm} y_{jn}}{\sum_{i=1}^{I} u_{im} x_{in}} \leq 1; \quad n = 1, 2, K, N \\
v_{jm}, u_{im} \geq 0; \quad i = 1, 2, K, I; \quad j = 1, 2, K, J
\]

Where,

\( E_m \) is the efficiency of the \( m^{th} \) DMU,

\( y_{jm} \) is \( j^{th} \) output of the \( m^{th} \) DMU,

\( v_{jm} \) is the weight of that output,

\( x_{im} \) is \( i^{th} \) input of the \( m^{th} \) DMU,

\( u_{im} \) is the weight of that input, and

\( y_{jn} \) and \( x_{in} \) are \( j^{th} \) output and \( i^{th} \) input, respectively, of the \( n^{th} \) DMU, \( n = 1, 2, \ldots, N \).

Note that here \( n \) includes \( m \).
3.3.2.8 Correlation Analysis:

Empirical relation of e-banking services and bank performance is observed by using time series correlation analysis which is a tool of statistics to describe the degree of relationship to which one variable is linearly related to another. Relationship between e-banking services and parameters of bank performance is analyzed with the help of Pearson’s coefficient of correlation. The formula to calculate correlation is:

\[
r = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n} (X_i - \bar{X})^2 \sum_{i=1}^{n} (Y_i - \bar{Y})^2}}
\]

Where \( X \) is the e-banking services and \( y \) is bank performance indicators and \( r \) indicates the direction of relationship between two variables. The range of \( r \) lies from -1 to +1. If \( r \) is closer to 1, it means there is strong correlation between two variables.

3.3.2.9 Regression Analysis:

In the attempt to pick the most effectual e-banking service and draw functional relationship of e-banking services with bank performance, regression analysis has been done to have a deeper evidence of relationship between e-banking services and bank performance. In the due course of this, regression has been applied for different bank groups using e-banking services as dependent variable and bank performance as independent variable. The functional relationship used is as:

\[
Y = a + b X
\]

Where, \( Y \) is the bank performance index; \( a \) is the constant intercept; \( b \) is the regression coefficient that represent the estimated change in the value of dependent
variable and X is the e-banking service index. Significance of regression has been tested at five percent and one percent level of significance.

### 3.3.2.10 Structural Equation Modeling:

Structural equation modeling is (SEMs) a well-known component of the methodological arsenal of the social sciences. Much of their attractiveness stems from their generality. Like econometric methods, SEMs allow consideration of simultaneous equations with many endogenous variables. Unlike most econometric methods, SEMs allow measurement error till the exogenous and endogenous variables. As with factor analyses developed in psychometrics and related procedures in socio metrics, SEMs permit multiple indicators of latent constructs and estimation of reliability and validity. In addition, SEMs allow more general measurement models than traditional factor analytic structures and enabled the researcher to specify structural relationship among the latent variables (Bollen and Long).

In a measurement model, it is common to represent constructs by Greek characters and measured variables by alphabets. Measurement model may be represented as:

\[ X = \lambda \xi + \delta \]

Where, \( \xi \) = latent factors, \( X \) = measured variables, \( \lambda \) = factor loadings, \( \delta \) = errors

Composite reliability is used to assess the reliability of the constructs in the measurement model. Composite reliability is defined as the total amount of true score variance in relation to the total score variance and it is computed as:
Convergent validity and discriminant validity are used to assess the validity of measurement model. Convergent validity measures the extent to which the scale correlates positively with other measures of the same constructs. Hence, the size of the factor loadings provides evidence of convergent validity. High factor loadings indicate that the observed variables converge on the same construct. Another measure that is used to assess convergent validity is the average variance extracted which is defined as the variance in the indicators or observed variables that are explained by the latent construct. Average variance extracted is calculated in terms of the (completely) standardized loadings as:

\[
\text{AVE} = \frac{\sum_{i=1}^{p} \lambda_i^2}{\sum_{i=1}^{p} \lambda_i^2 + \sum_{i=1}^{p} \delta_i}
\]

Where,

\( \text{AVE} = \text{Average variance extracted} \)
\( \lambda = \) completely standardized factor loading
\( \delta = \) error variance
\( p = \) number of indicators or observed variables

Discriminant validity is used to know that the construct is distinct from other constructs and thus makes a unique contribution. Individual observed variables should load on only one latent construct. Cross-loadings indicate lack of distinctiveness and present potential problems in establishing discriminant validity. SEM typically assumes that a set of observed variables represents only one underlying construct, and this concept is called unidimensionality. This validity is based on the logic that a construct should explain its observed variables better than it explains any other construct. This test is conducted by showing that the average variance extracted is greater than the square of the correlations (Malhotra and Das, 2013).

**Testing SEMs:**

Testing SEMs is viewed as a way of testing a specified theory about relation between theoretical constructs.

**From Theory to Statistical Model:**

Most theory in the social and behavioral sciences are formulated in terms of hypothetical constructs which are theoretical creations that cannot be observed or measured directly. The measurement of a hypothetical construct is done indirectly through one or more observable indicator, such as responses to questionnaire items that are assumed to replace the construct adequately. In theory, the researcher defines the hypothetical constructs by specifying the dimensions of each constructs. The theory specifies further how the various constructs are postulated to be interrelated. This
includes first of all the classification of the constructs interdependent and independent constructs. Second, for each dependent construct, the theory specifies which of the other construct it is postulated to depend on. The theory may also include a statement about the sign and / or relative size of the direct effect one construct on another. The theoretical relationship between the construct constitute the structural equation part of the model and relationships between the observable indicators and the theoretical constructs constitute the measurement part of the model. The fundamental assumptions in structure equation models are that the error in each relationship is uncorrelated with all the independent constructs. Studies should be planned and designed and variables should be chosen. Failure to do so will lead to biased and inconsistent estimates of the structural coefficients in the linear equations and will invalidate the testing of the theory. The testing of the structural models—that is, testing of the initially specified theory—may be meaningless unless it is first establish that the measurement model holds. If the chosen indicators for a construct do not measure that construct, the specified theory must be modify before it can be tested. Therefore the measurement model should be tested first (Bollen & Long, 1993). In SEM, theoretical relationships are generally transformed into hypotheses that can be empirically tested. The structural theory is considered to be valid to the extent that these hypotheses are supported in the SEM analysis (Malhotra & Das, 2013).