CHAPTER 4: RESEARCH METHODOLOGY

4.1. Introduction:

Research in common parlance refers to a search for knowledge. Once can define research as a scientific and systematic search for pertinent information on a specific topic. In fact, research is an art of scientific investigation. According to D. Slesinger and M. Stephenson in the Encyclopedia of social science defines research as “The manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in the construction of theory or in the practice of an art.” Thus research is an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment. In short, the search for knowledge through objective and systematic method of finding a solution to a problem is research. According to Dr. Deryck D. Patron—“Research Methodology is defined as a highly intellectual human activity used in the investigation of nature and matter and deals specifically in the manner in which data is collected, analyzed and interpreted”.

Research Methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. It is necessary for the researcher not only to research methods/techniques but also the methodology. The researcher not only need to know how to develop certain indices or tests, how to calculate the mean, the mode, the median or standard deviation or chi-square, how to apply particular research techniques, but they need to know which of these methods and techniques, are relevant and which are not, and what would they mean and indicate and why. Researchers also need to understand the assumptions under various techniques and they need to know the criteria by which they can decide that certain techniques and procedures will be applicable to certain problems and others will not. All this means that is necessary for the researcher to design his methodology for his problem as the same differ from problem to problem. For example, an architect, who design a building, has to
consciously evaluate the basis of his decisions, i.e., he has to evaluate why and on what basis she selects particular size, number and location of doors, windows and ventilators, uses particular materials and not the others and the like. Similarly, in research the scientist has to expose the research decisions to evaluation before they are implemented. She has to specify very clearly and precisely what decisions she selects and why she selects them so that they can be evaluated by others also.

From what has been stated above, we can say that research methodology has many dimensions and research methods do constitute a part of the research methodology. The scope of research methodology is wider than that of research methods. Thus, when we talk about research methodology we not only talk about the research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or technique and why are not using others so that research results are capable of being evaluated by the researcher himself or by others. Why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data has been collected and what particular methods has been adopted, why a particular technique of analyzing data has been used and a host of similar other questions are usually answered when we talk about research methodology concerning a research problem or study.

4.2. Importance of Research Methodology:

- It facilitates the smooth sailing of the various research operations, thereby, making research as efficient as possible, yield maximal information with minimal expenditure of effort, time and money.
- Planning provides a framework within which the goal of research is to be achieved.
- The plan and procedure of any research study is bound up with its purpose. The purpose of the present study was to study Future of banking services (in the context of IT enabled services) in private sector banks with reference to Bikaner-Jaipur zone.
Methodology of any research, mean the selection of the representative sample, collecting of relevant data, applying appropriate research tools and techniques, analysis and interpretation of the same for scientific investigation of the problem. The content of this section deals with the method and procedures of the study.

4.3. Defining the research problem

In the research process, the first and foremost step happens to be that of selecting and properly defining a research problem. A research problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same. A research problem is one which requires a researcher to find out the best solution for the given problem, i.e., to find out the course of actions, by which the objective can be attained optimally in the context of a given environment. There are several factors which may result in making the problem complicated. For instance, the environment may change affecting the efficiencies of the courses of action or the values of the outcomes; the number of alternative course of action may be very large; persons not involved in making the decisions may be affected by it and react to it favorably and unfavorably, and similar other factors.

The present study can be stated as: “Future of banking services (in context of IT enabled services) in private sector banks with reference to Bikaner-Jaipur zone”. Some of the problems and issues of the present study are as follows:

1. What are the expectations of respondents regarding accuracy, transaction speed, user friendliness, user involvement and convenience of the IT services provided by the banks?
2. What are the respondents concerns about the security and the safety aspects of the IT services of the private sector banks?
3. How do the respondents perceive the role of IT enabled services in private sector banks?
4. How do the respondents perceive or believe their awareness can help in reducing fraud and insecurity related with IT services in banks?
5. What will be the frequency of usage and level of satisfaction with the IT services of banks?
6. What is the perception of the Bank Employees towards the potential benefits and risk associated with application of Information Technologies in the Banks?

4.4. Need of the study:

Information is at the heart of today’s business and all the pervasive impact of information technology in harnessing, collating and processing huge volumes of information is definitive. In this scenario, the need for ensuring that information is kept confidential adhering to accepted norms of privacy and making it available to authorized users at the appropriate time assumes great significance. This is particularly valid for the banking sector where day to day operations are centered on information and information processing, which in turn highly dependent on technology.

4.5. Objective of the study

The objectives of the study are as follows:

1. To study the role of Information Technology in banking Industry.
2. To explore the major factors those influences the adoption of information technology in private banks.
3. To study the progress and growth of different IT banking services in private banks and predict the future of e-banking in India.
4. To study the influence of demographic variables on banking technology adoption.
5. To study variables that enables and inhibits customer’s adoption for banking technology.
6. To examine the level of customer satisfaction with banking technology.
7. To study the factors influencing employees perception towards IT uses in banking services.
8. To test the identical and non identical responses towards the five segment such as relative advantage, complexities, potential risk, decision making process and
Innovation techniques faced by the bank employees in providing services to the customer.

4.6. Time Period for the Study:

Bank, Banking services, Customers and Employees were studied from June 2010 to March 2011. The data was collected with the help of pilot study from April 2011 to January 2012. Finally data compilation work, findings and report construction was done from February 2012 to July 2012.

4.7. Hypotheses of the study:

It refers to the process of selecting and using a sample statistic to draw inferences about a population-parameter based on a subset of it-sample drawn from the population. A hypothesis is a proposition made as a basis for reasoning. Keeping in view the objectives of present study eight null hypotheses (starting with H01, H02 …) and alternate hypotheses (starting with Ha1, Ha2) is presented in the study.

i. The hypotheses are formulated for the usefulness of banking services:

a. H01a: There is no significance difference between the usefulness of cash withdrawal banking services between the four private banks.

H01a: There is a significance difference between the usefulness of cash withdrawal banking services between the four private banks.

b. H01b: There is no significance difference between the usefulness of utility banking services between the four private banks.

H01b: There is a significance difference between the usefulness of utility banking services between the four private banks.

c. H01c: There is no significance difference between the usefulness of account balance banking services between the four private banks.
H_{a1c}: There is a significance difference between the usefulness of account balance banking services between the four private banks.

d. H_{01d}: There is no significance difference between the usefulness of fund transfer banking services between the four private banks.

H_{a1d}: There is a significance difference between the usefulness of fund transfer banking services between the four private banks.

e. H_{01e}: There is no significance difference between the usefulness of investment banking services between the four private banks.

H_{a1e}: There is a significance difference between the usefulness of investment banking services between the four private banks.

f. H_{01f}: There is no significance difference between the usefulness of downloading banking services between the four private banks.

H_{a1f}: There is a significance difference between the usefulness of downloading banking services between the four private banks.

g. H_{01g}: There is no significance difference between the usefulness of e-ticketing banking services between the four private banks.

H_{a1g}: There is a significance difference between the usefulness of e-ticketing banking services between the four private banks.

ii. Hypotheses related to factors affecting adoption of IT banking services:

a. H_{02a}: There is no significant difference between ATM banking services provided by different private banks to the customers.

H_{a2a}: There is a significant difference between ATM banking services provided by different private banks to the customers.

b. H_{02b}: There is no significant difference between branch banking services provided by different private banks to the customers.

H_{a2b}: There is a significant difference between branch banking services provided by different private banks to the customers.
c. $H_{02c}$: There is no significant difference between internet banking services provided by different private banks to the customers.

$H_{a2c}$: There is a significant difference between internet banking services provided by different private banks to the customers.

d. $H_{02d}$: There is no significant difference between mobile/Tele banking services provided by different private banks to the customers.

$H_{a2d}$: There is a significant difference between mobile/Tele banking services provided by different private banks to the customers.

iii. $H_{03}$: There is no significant difference between adoption of Information Technology and Customer satisfaction.

$H_{a3}$: There is a significant difference between adoption of Information Technology and Customer satisfaction.

iv. $H_{04}$: There is no significant difference between customer adoption and benefits of IT banking services for all four private banks.

$H_{a4}$: There is a significant difference between customer adoption and benefits of IT banking services for all four private banks.

v. $H_{05}$: There is no significant difference between unwillingness to use e-channel and customer rejection for all four banks.

$H_{a5}$: There is a significant difference between unwillingness to use e-channel and customer rejection for all four banks.

vi. Hypotheses related to factors affecting decision making and adoption of IT banking services:

a. $H_{06a}$: There is no significant difference between relative advantages and adoption of IT banking services.
H_{a6a}: There is a significant difference between relative advantages and adoption of IT banking services.

b. H_{06b}: There is no significant difference between complexity and adoption of IT banking services.

H_{a6b}: There is a significant difference between complexity and adoption of IT banking services.

c. H_{06c}: There is no significant difference between potential risk and adoption of IT banking services.

H_{a6c}: There is a significant difference between potential risk and adoption of IT banking services.

d. H_{06d}: There is no significant difference between strategic decision making and adoption of IT banking services.

H_{a6d}: There is a significant difference between strategic decision making and adoption of IT banking services.

e. H_{06e}: There is no significant difference between innovation & development and adoption of IT banking services.

H_{a6e}: There is a significant difference between innovation & development and adoption of IT banking services.

vii. H_{07}: There is no significant difference between Confidentiality of data and usage of IT services.

H_{a7}: H_{07} is not true.

viii. Hypotheses related to mean among different bank groups:

a. H_{08a}: There is no difference between the mean of relative advantages among different bank groups.
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\( H_{a8a} \): There is a difference between the mean of relative advantages among different bank groups.

b. \( H_{08b} \): There is no difference between the mean of complexity among different bank groups.

\( H_{a8b} \): There is a difference between the mean of complexity among different bank groups.

c. \( H_{08c} \): There is no difference between the mean of potential risk among different bank groups.

\( H_{a8c} \): There is a difference between the mean of potential risk among different bank groups.

d. \( H_{08d} \): There is no difference between the mean of strategic decision making among different bank groups.

\( H_{a8d} \): There is a difference between the mean of strategic decision making among different bank groups.

e. \( H_{08e} \): There is no difference between the mean of innovation & development among different bank groups.

\( H_{a8e} \): There is a difference between the mean of innovation & development among different bank groups.

4.8. Research Design

According to Claire Selltiz et. Al.-: “A research design is the arrangement of condition for collection and analysis of data in a manner that aim to combine relevance to the research purpose with economy in procedure.” In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data.
4.8.1. Need of Research Design

- Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money.
- Research design stands for advance planning of the methods to be adopted for collecting the relevant data and the techniques to be used in their analysis, keeping in view objective of the research and availability of respondents, time and effort.
- The design helps the researcher to organize his ideas in a form whereby it will be possible for him to look for flaws and inadequacies.

4.8.2. Type of research design used

The study is confined to Indian Banking Industry. Hence, the universe of the study is banking Industry of India. The present study is designed to investigate the role of Information technology in banking Industry. The study is descriptive and empirical in nature where secondary and primary data is used to address the objectives. The design in such studies must be rigid and not flexible and must focus attention on the following:

a) Formulating the objective of the study (To examine the level of customer satisfaction and to understand the factors influencing employee’s perception towards use of IT banking services).

b) Designing the methods of data collection (Observation, Interview, Questionnaire, pilot study were used for data collection).

c) Selecting the sample (Sample was decided on the basis of multi stage sampling. The data were collected from 180 bank employees (Executive, Manager, Officer) through the structured questionnaire method, E-mail and personal interview, Out of which 129 employees replied with full information. 500 bank customers (ICICI bank- 154, HDFC bank- 88, AXIS bank- 77, INDUSIND bank- 84) through structured questionnaire method out of which 403 replied it).
d) Collecting the data (This study was conducted using respondents involved with four private sector banks (ICICI, HDFC, AXIS, and INDUSIND) in India from Bikaner to Jaipur regions of Rajasthan).

e) Processing and analyzing the data. (Weighted score through likert scale, Kruskal wallis, Chi square test and one way Anova test were used to analyze data).

f) Reporting the findings.

4.9. Method of data collection

The task of data collection begins after a research problem has been defined and research design/plan chalked out. While deciding about the method of data collection to be used for the study, the researcher should keep in mind two types of data viz., primary and secondary. The primary data are those which are collected afresh and for the first time, and thus happen to be original in character. The secondary data, on the other hand, are those which have been already collected by someone else and which have already been passed through the statistical process.

The present study is based on primary as well as secondary data.

4.9.1. Secondary data

The secondary data has been collected through various published and unpublished sources of the Government of Rajasthan, magazines, journals, Internet searches, libraries, official websites of respective banks, reports on RBI, etc. The information has been gathered through various brochures, catalogues etc.

4.9.2. Primary data

In order to obtain desired information regarding various services provided by banks, primary data have been used. This data has been collected with the help of self administered questionnaires, interviews, observation and pilot study.

4.9.2.1. Interview

To have first hand information and to know the views of bank employees in a better way, personal visit to the banks, the interviews and discussions with the bank employees have been conducted.
4.9.2.2. Observation

Sometimes, the respondents did not agree to answer various questions honestly, so the researcher observed from a close angles the reality on the ground by observing which helped to study the problems more significantly.

4.9.2.3. Pilot Study

A pilot study has been carried out for testing the validity of the questionnaire. After the pilot study survey, the questionnaires were edited in the light of the feedback of this survey.

4.9.2.4. Questionnaires

The survey instrument/questionnaire was designed and developed after an extensive literature review, close consultation with experts in the banking area (both practitioners and researchers) and inputs from two focus group discussions. The questionnaire contains questions pertaining to the respondents’ accessibility to computers and internet, plus the hours that they spent using the computer and browsing the internet. The questionnaire included questions to gauge the awareness, frequency of usage and the duration of usage if using of the ATM services, internet banking services, tele banking services and mobile banking services offered by their respective “Most frequented banks”. The respondents were also required to indicate the approximate percentage of banking transactions done by them through various modes of banking such as branch banking, ATMs, internet banking, tele banking and mobile banking. Finally the demographic variables were also captured.

The Questionnaires were developed in view of the objectives laid down. Two questionnaires were developed for each category annexure. The questionnaire for employee consists of four sections. Section 1: Demographic profile of the Respondents, Section 2: Employment profile of the Respondents, Section 3: Employee’s opinion about awareness of customers towards banking services, Section 4: It was developed based on five parameters Relative advantage, complexity, potential risk, strategic advantage by decision-making process and Innovation & development to ascertain the perception of the employees. Five point Likert scale is used to elicit responses on the questionnaire.
The questionnaire for customers consists of four sections. Section 1: Demographic profile of the Respondents, Section 2: Customer’s account profile of the Respondents, Section 3: Personal Characteristics of customers with different banking services Section 4: Characteristic and usefulness of different banking services. Five point likert scales is used to elicit responses on the questionnaire.

4.9.3. Sampling design and sample size

A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedures the researcher would adopt in selecting items for the sample. Sample design may as well as lay down the number of items to be included in the sample i.e., the size of the sample. Sample design is determined before data are collected. There are many sample designs from which a researcher can choose. Some designs are relatively more precise and easier to apply than others. The researcher must select a sample design which should be reliable and appropriate for the research study.

<table>
<thead>
<tr>
<th>Banks</th>
<th>Customer Circulated</th>
<th>Customer Filled</th>
<th>Employee Circulated</th>
<th>Employee Filled</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICICI</td>
<td>175</td>
<td>154</td>
<td>60</td>
<td>45</td>
</tr>
<tr>
<td>HDFC</td>
<td>120</td>
<td>88</td>
<td>50</td>
<td>38</td>
</tr>
<tr>
<td>AXIS</td>
<td>95</td>
<td>77</td>
<td>35</td>
<td>22</td>
</tr>
<tr>
<td>INDUSIND</td>
<td>110</td>
<td>84</td>
<td>35</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>403</td>
<td>180</td>
<td>129</td>
</tr>
</tbody>
</table>

*Source: Personal Survey*

Four private sector banks (ICICI, HDFC, AXIS, INDUSIND) were selected from Bikaner to Jaipur regions of Rajasthan. Multistage sampling was used for the present study. There are several stages in which the sampling process was carried out.

i. In the 1st stage, quota sampling was used. The sample size was picked proportionate to the population of the city.

ii. In the 2nd stage, bank branches were decided according to convenience sampling.

iii. In the 3rd stage, finally respondents were selected randomly from above selected branches.
Only four districts were selected from Bikaner to Jaipur regions of Rajasthan. The data was collected from 180 bank employees (Executive, Manager, Officer) through structured questionnaire method, E-mail, telephone survey and personal interview, Out of which 129 employees replied with full information. ICICI bank- 45, HDFC bank- 38, AXIS bank- 22, INDUSIND bank- 24. The data was collected from 500 bank customers (ICICI bank- 154, HDFC bank- 88, AXIS bank- 77, INDUSIND bank- 84) through structured questionnaire method out of which 403 replied it.

Table 4.2: Distribution of respondents among banks (District Wise)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Districts</th>
<th>No. of Respondents (Customers)</th>
<th>No. of Respondents (Bank Employees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ICICI</td>
<td>HDFC</td>
</tr>
<tr>
<td>1</td>
<td>Bikaner</td>
<td>41</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>Churu</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>Sikar</td>
<td>42</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>Jaipur</td>
<td>54</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>154</td>
<td>88</td>
</tr>
</tbody>
</table>

In Total =403

In Total =129

Source: Personal Survey

4.10. Parameters of the study:

Following are the parameters that influence customer’s preferences to adopt banking technology.

a. ATM Banking
   i. Convenient location
   ii. Ease of use
   iii. 24*7 Environment of operation
   iv. Variety of transactions at ATM network
   v. Accurate records of all transaction

b. Branch Banking
   i. Friendliness of bank personnel
   ii. Bank branch’s reputation
   iii. Time taken to process the transaction
iv. Working hours

c. Internet Banking
   i. Page set up/menu flow
   ii. Speed of page loading
   iii. Easy of use/navigation
   iv. Convenient hours of operation
   v. Variety of transaction
   vi. Real time access to information
   vii. Accurate records of all transaction
   viii. Support service (customer feedback/complaint management services)

d. Mobile/Tele-banking
   i. Call Answering Time
   ii. Flawless/Correct options
   iii. Understanding and replying queries quickly
   iv. Communication skill/positive approach
   v. Educate customers how to use options of different delivery channel

Following are the parameters are selected to study employee perception towards banking technology:

a. Relative Advantage
   i. Safety and convenience
   ii. Time and location constraint
   iii. Cost reduction
   iv. Time
   v. Daily responsibilities
   vi. Higher opportunities and sophisticated services
b. Complexity
   i. Constantly monitor the integrity of their security systems
   ii. Adequate and appropriate investments on hardware, software and banking application
   iii. Making trust among bank employees on security of networks, hardware and bank application
   iv. Training programs and promotional plans to provide e-banking culture in the bank.
   v. Trust among bank customers on their privacy.

c. Potential Risk
   i. Knowledge of the e-banking technology
   ii. Access to certain data should be minimized to keep data’s integrity
   iii. To understand the importance of information security
   iv. Bank’s employee’s need expertise and training.

d. IT Strategic Advantage in decision making process
   i. Information network to identify requirements in Information Technology
   ii. Use of specific selection criteria for the acquisition of new information systems
   iii. Financial tools in planning the acquisition of new information systems
   iv. Knowing the Information Technology used by your competition
   v. Impact of IT on different functions of bank
   vi. Disseminating Information on web page
   vii. Choice of Information Technology follows the evolution of your environment
   viii. Evaluating potential problems related with the implementation of a new system
   ix. Knowing the results of a financial feasibility study before the acquisition
   x. Identification of possible sources of resistance to change before implementation.

e. Innovation and Development
   i. Reduce your production costs
   ii. Make substantial savings
iii. Improve firm's productivity
iv. Improve the quality of products or services

4.11. Statistical techniques used

In this case the analysis and interpretation of data collected through primary as well as secondary sources have been worked out through the following tools and techniques:

1. Likert Scale

A Likert scale is a psychometric scale commonly used in questionnaires, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement.

An important distinction must be made between a Likert Scale and a Likert item. The Likert Scale is the sum of responses on several Likert items. A Likert item is simply a statement which the respondent is asked to evaluate according to any kind of subjective or objective criteria; generally the level of agreement or disagreement is measured. Likert scaling is a bipolar scaling method, measuring either positive or negative response to a statement.

Scoring and analysis

After the questionnaire is completed, each item may be analyzed separately or in some cases item responses may be summed to create a score for a group of items. Hence, Likert scales are often called summative scales.

Whether individual Likert items can be considered as interval-level data, or whether they should be considered merely ordered-categorical data is the subject of disagreement. Many regard such items only as ordinal data, because, especially when using only five levels, one cannot assume that respondents perceive all pairs of adjacent levels as equidistant. On the other hand, often (as in the example above) the wording of response levels clearly implies a symmetry of response levels about a middle category; at the very least, such an item would fall between ordinal and interval level measurement; to treat it
as merely ordinal would lose information. Further, if the item is accompanied by a visual analog scale, where equal spacing of response levels is clearly indicated, the argument for treating it as interval level data is even stronger.

**Statistical Tools:**

Statistical methods deal with the analysis and interpretation of data expressed in numerical terms. The statistical methods used in this research study are discussed as follow:

Chi square test, Kruskal Wallis test and one way Anova has been applied to find the relationship between different banking services and its adoption by customers and employees of the bank in their organizational use.

4.11.1. Non Parametric test

A. Chi square Test (

**Chi-square test for independence** is applied to evaluate group differences when the test variable is nominal, dichotomous, ordinal, or grouped interval. It is used to determine whether there is a significant association between the two variables. This test is applied to both customer and employee analysis.

For example, in an election survey, voters might be classified by gender (male or female) and voting preference (Democrat, Republican, or Independent). Chi-square test for independence was used to determine whether gender is related to voting preference.

The test procedure is appropriate when the following conditions are met:

- The sampling method is **simple random sampling**.
- Each population is at least 10 times as large as its respective sample.
- The variables under study are each **categorical**.
This approach consists of four steps:

(1) State the hypotheses.

(2) Formulate an analysis plan.

(3) Analyze sample data.

(4) Interpret results.

**State the Hypotheses**

Formulate an Analysis Plan

The analysis plan describes how to use sample data to accept or reject the null hypothesis. The plan should specify the following elements.

- Significance level. Often, researchers choose significance levels equal to 0.01, 0.05, or 0.10; but any value between 0 and 1 can be used.
- Test method. Use the chi-square test for independence to determine whether there is a significant relationship between two categorical variables.

**Interpret Results**

If the sample findings are unlikely, given the null hypothesis, the researcher rejects the null hypothesis. Typically, this involves comparing the P-value to the significance level, and rejecting the null hypothesis when the P-value is less than the significance level.

**B. Kruskal Wallis Test**

Kruskal Wallis is a non-parametric test (distribution-free) used to compare three or more independent groups of sampled data.

**Characteristics:** This test is an alternative to the independent group ANOVA, when the assumption of normality or equality of variance is not met. It can also be used when ordered outcomes exist. Ordinal data rather than interval or ratio data necessary to use
an ANOVA. This, like many non-parametric tests, uses the ranks of the data rather than their raw values to calculate the statistic.

**Test:** The hypotheses for the comparison of two independent groups are:

- **H\(_0\):** The samples come from identical populations
- **H\(_a\):** The samples come from different populations

The hypothesis makes no assumptions about the distribution of the populations. These hypotheses are also sometimes written as testing the equality of the central tendency of the populations.

**Procedure:**

1. Combine the observations of the various groups.
2. Arrange them in order of magnitude from lowest to highest.
3. Assign ranks to each of the observations and replace them in each of the groups.
4. Original ratio data has therefore been converted into ordinal or ranked data.
5. Ranks are summed in each group and the test statistic, \( H \) is computed.
6. Ranks assigned to observations in each of the \( k \) groups are added separately to give \( k \) rank sums.

Test statistic equation

\[
H = \frac{12}{N(N+1)} \sum \frac{R^2_j}{n_j} - 3(N + 1)
\]

\[
= 12 \sum \frac{R^2_j}{n_j} - 3(N + 1)
\]

In this equation

- \( k \approx \) the number of groups
- \( n_j \) = the number of observations in the \( j \)th group
- \( N \) = the number of observations in all the groups combined
- \( R_j \) = the sum of the ranks in the \( j \)th group
The sum of the ranks is calculated for each group, then the test statistic, H, is calculated. H is given by a rather formidable formula that basically represents the variance of the ranks among groups, with an adjustment for the number of ties. H is approximately chi-square distributed, meaning that the probability of getting a particular value of H by chance, if the null hypothesis is true, is the P value corresponding to a chi-square equal to H; the degrees of freedom is the number of groups minus 1.

The test statistic for the Kruskal Wallis test is H. This value is compared to a table of critical values for U based on the sample size of each group. If H exceeds the critical value for H at some significance level (usually 0.05) it means that there is evidence to reject the null hypothesis in favor of the alternative hypothesis.

C. One way analysis of variance (One Way ANOVA)

In order to check variability in response between samples, so that it can be ascertained if there exists considerable differences due to individual bank’s infrastructure, technology, services and customers, one ANOVA was used.

Analysis of variance (Analysis of Variance) is a general method for studying sampled-data relationships. The method enables the difference between two or more sample means to be analyzed, achieved by subdividing the total sum of squares. The purpose is to test for significant differences between class means, and this is done by analyzing the variances. The basis of ANOVA is the partitioning of sums of squares into between class (SSB) and within class (SSW). It enables all classes to be compared with each other simultaneously rather than individually; it assumes that the samples are normally distributed. The one way analysis is calculated in three steps, first the sum of squares for all samples, then the within class and between class cases. For each stage the degrees of freedom df are also determined, where df is the number of independent ‘pieces of information’ that go into the estimate of a parameter. These calculations are used via the Fisher statistic to analyze the null hypothesis. The null hypothesis states that there are no differences between means of different classes, suggesting that the variance of the within class samples should be identical to that of the between class samples (resulting in no
between-class discrimination capability). It must however be noted that small sample sets will produce random fluctuations due to the assumption of a normal distribution.

**Grand Mean**

The grand mean of a set of samples is the total of all the data values divided by the total sample size. This requires all of the sample data. It turns to find a one-way analysis of variance is the number of samples, the sample means, the sample variances, and the sample sizes.

\[
\overline{X}_{GM} = \frac{\sum x}{N}
\]

Another way to find the grand mean is to find the weighted average of the sample means. The weight applied is the sample size.

\[
\overline{X}_{GM} = \frac{\sum n \bar{x}}{\sum n}
\]

**Total Variation**

The total variation (not variance) is comprised the sum of the squares of the differences of each mean with the grand mean.

\[
SS(T) = \sum (x - \overline{X}_{GM})^2
\]

There is the between group variation and the within group variation. The whole idea behind the analysis of variance is to compare the ratio between group variance to within group variance. If the variance caused by the interaction between the samples is much larger when compared to the variance that appears within each group, then it is because the means aren't the same.

**Between Group Variation**

The variation due to the interaction between the samples is denoted SS (B) for Sum of Squares Between groups.

\[
SS(B) = \sum n (\bar{x} - \overline{X}_{GM})^2
\]
If the sample means are close to each other (and therefore the Grand Mean) this will be small. There are k samples involved with one data value for each sample (the sample mean), so there are k-1 degrees of freedom. The variance due to the interaction between the samples is denoted MS (B) for Mean Square Between groups. This is the between group variation divided by its degrees of freedom. It is also denoted by $S_b^2$.

**Within Group Variation**

The variation due to differences within individual samples denoted SS (W) for Sum of Squares Within groups. Each sample is considered independently, no interaction between samples is involved.

$$SS(W) = \sum df \cdot s^2$$

The degree of freedom is equal to the sum of the individual degrees of freedom for each sample. Since each sample has degrees of freedom equal to one less than their sample sizes, and there are k samples, the total degrees of freedom is k less than the total sample size: df = N - k.

The variance due to the differences within individual samples is denoted MS (W) for Mean Square Within groups. This is the within group variation divided by its degrees of freedom. It is also denoted by $S_w^2$. It is the weighted average of the variances (weighted with the degrees of freedom).

**F test statistic**

Recall that an F variable is the ratio of two independent chi-square variables divided by their respective degrees of freedom. Also recall that the F test statistic is the ratio of two sample variances, well, it turns out that's exactly what we have here.

$$F = \frac{S_b^2}{S_w^2}$$
The F test statistic is found by dividing the between group variance by the within group variance. The degrees of freedom for the numerator are the degrees of freedom for the between group (k-1) and the degrees of freedom for the denominator are the degrees of freedom for the within group (N-k).

**Summary Table**

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>Df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between</strong></td>
<td>SS(B)</td>
<td>k-1</td>
<td>SS(B)</td>
<td>MS(B)</td>
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</tr>
<tr>
<td><strong>Within</strong></td>
<td>SS(W)</td>
<td>N-k</td>
<td>SS(W)</td>
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<td></td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>SS(W) + SS(B)</td>
<td>N-1</td>
<td></td>
<td>.</td>
</tr>
</tbody>
</table>

Here the calculated value is compared with the tabulated values of each group. If F exceeds the tabulated value at some significant level (usually 0.05) it means that there is evidence to reject the null hypothesis in favor of the alternate hypothesis.

**4.12. Developing research Instruments**

The quality of research depends to a large extent on the quality of the data collection tools. In the research, the researcher used the closed ended questionnaire method. Closed Questions have a list of possible answer or options from which the respondents must choose. Closed questions may be used to get the respondents to express their opinions or attitudes by choosing rating points on scale. Using attitude scales in face-to-face interviews with literate respondents is most objectively carried out if various options for each answer are provided on various cards. The respondents can be asked to put the cards in the order preferred by them while making their choice. If the researcher only reads the options, the respondent might not consider all points equally and the scale will not accurately measure the attitudes.
**Advantages of closed questions:**

- It saves time.
- Comparing responses of different groups, or of the same group over time, becomes easier.

**4.13 Scope of the Study**

This study covers growing e-banking services in current scenario. In general, the study covers four private banks. The sample was selected from each bank group on the basis of multi stage sampling. To know the perception of customers and bank employees toward IT in bank. 403 customers and 129 employees of Bikaner to jaipur zone are surveyed.

**4.14 Limitation of the study**

- In order to determine the level of reliability of the study, it becomes necessary to state the limitations under which it has been conducted. The present study is affected from the following limitations.
  
- The part of the study has been based on primary data that has been collected randomly; therefore the result might have been affected by the sampling error.

- The poorer and incomplete responses and information given by the respondent could not be avoided.

- The present study has also been conducted on the basis of secondary data, and the study might be affected from the limitations of secondary data.

- There may have some response biasness of respondents because some of them were in hurry while data collection.

- It is further needed to continue the research work on such problem due to its changing scenario.
References:


3. www.allprojectreports.com

4. www.oppapers.com


6. www.scribd.com