CHAPTER 3

RESEARCH DESIGN & METHODOLOGY

The current chapter deals with explaining the research methodology used in the current thesis. The present study is conducted among the executives working in selected IT firms in Chennai. The study covers selected employees from the IT firms selected in random. The representation from each of the firm is not strictly followed due to the difference in size of the firm and the responsiveness from the executives for the data collection. A large sample size is ensured in order to avoid behavioral bias and to improve the validity and reliability of the findings of the study. Both private and public limited IT firms are considered for the purpose of study. Human resources are the key and intellectual appreciable assets in the technology firms. In addition, the procurement, nurturing and retaining them is key in the success of the technology firms. Hence, the tools used in the process of managing such invaluable assets are important. In this direction, the present study has lot of value and importance to the IT industry in specific and to the economy at large.

3.1 STATEMENT OF THE PROBLEM

Human resources are the most important assets in the organizations for its operations and sustainable growth. The intellectual capital management is key in the success of the firms in IT sector. The salient feature of IT sector is cut edged competition and technology up-gradation from time to time. The prime responsibility of the HR department is to identify the future needs and to procure the skilled employees and to train them to meet the requirements and to have sustainable development from time to time. In the process, Human resources planning, training, deployment, performance evaluation talent retention and audit of the employee management practices are important. The success of the firm is depending on the success of human resources management. This is possible through effective planning and evaluation of its activities. The HR audit is the process of doing such delicate
function in the organization. Hence, the review of literature is performed in this direction and found that, there is no concrete study measuring the impact of HR Audit on the performance of individual employees and the organization. Hence, the current study is relevant and contemporary to the topic. The study has been focused on “Impact of HR Audit Practices on the Performance of Employees in IT Firms, Chennai”.

3.2 SCOPE OF THE STUDY

The scope of the current study is limited to the IT firms operating in Chennai and its suburban areas. The IT firms in the study included both public Limited and Private limited firms. The operations of the sample firms are spread across all the domains and verticals of the IT and ITES services. The employees in the survey cover the range of age groups, experience groups, working at different levels of management. In addition equal opportunity is given to all the employees by sending a digital survey structured questionnaire for expressing their views on the topic and the various dimensions of impact of the same. The findings of the study may be applicable to the firms operating elsewhere in the same environment in the country. However the personal bias and perceptional differences may be exists. The primary aim of the present study could be suggest appropriate management strategies to improve the HR Audit practices and climate among the IT firm.

3.3 NEED FOR THE STUDY

There is both practical and theoretical significance of conducting a research study of this nature. The potential gains that can be realized if the human resources audit practices are conducted at frequent intervals and identify the strengths and weaknesses of human capital and taking measures to improve the same. It also helps in establishing employer -employee relationship within the IT firms represents the practical significance of this study. It has already been alluded to such a relationship which would be extremely beneficial for both parties. HR audit needs to be done as a holistic process and to find fault with the process and systems and mild indications to the employees about their performance gaps and highlighting the performance and potential skills of them in a positive note. Such
holistic process needs to be performed by the behavioural and experienced experts can yield better results in both short and long run. In a way, it helps to optimize the resources utilization with possible minimum cost. The importance of this topic to the employees was demonstrated by many people who worked in both Indian and Foreign managed IT firms.

The theoretical significance of this study is that there has been very little practice of HR audit among the Indian companies and conducted in a thumb rule manner. The HR department cannot be engaged in the process of audit, Audit teams should be external and courteous and expertise in human behaviour and interpersonal relations. The language and communication used to express the improvable areas should be in an encouraging and improving the level of response towards organizational culture and commitment. The performance and quality of services rendered should be improved through HR audits. The current research conducted in IT industries especially in both Indian and Foreign managed firms. Thus, these results will also facilitate knowledge-based recommendations that can be employed to better meet the expectations of the employees and the organization at large.

Combining the curiosity of understanding the changes in organizational environment and HR audit practices culture with how it affects employees would enable in gaining a better understanding of the effects of HR audit practices on employee performance and the organizational performance at large for the win-win situation. By comparing the results of this study with other research endeavors that have measured employee performance, some unique characteristics may be observed for those employees working in both Indian and foreign managed IT firms. Therefore, for the first time, this kind of research will reveal the impact of HR Audit practices and its impact on the individual employee performance in different dimensions and the organizational performance as a whole among the IT sector. In addition, the current research measures the role of individual/ personal, organizational, HR Audit climate/environment and Degree of HR Audit practices impact on the performance of the employees and the firm is measured. This can help the firms and individuals to use as a base document to improve the skills and efficiency at work, and for companies to improve the HR Audit practices climate.
This can pave a long way to grow in a sustainable manner with mutual understanding of the each one’s needs and with between co-ordination.

This whole concept evolved into two key ideas that formed the basis of this research endeavor. The purposes of this study were to:

(a) Gain insight into the current state of HR Audit climate and Practices among the IT firms

(b) Develop a greater understanding of the issues currently affecting HR Audit and its impact on the performance of the employees and the firms in IT Sector.

3.4 OBJECTIVES OF THE STUDY

The general objective of the present research is “Impact of HR Audit Practices on the Performance of employees in IT Industry. (An empirical analysis of personal, organizational and HR Audit Practices role in the performance of the individuals and the firm).

The specific objectives of the study are:

1. To Study the HR Audit Practices Climate and Environment in IT sector.

2. To examine the Demographic features (Gender, age, educational stream and experience) of employees of IT Sector

3. To Assess the Factors influencing HR Audit Practices in IT Sector.

4. To analyze the impact of Demographic variables on the Performance of the IT Professionals in the sample./Sample area.

5. To measure the impact of Organizational variables (management attitude, frequency of audit, focused area in HR) on the Performance of the IT Professionals in the sample./Sample area.

6. To find out the relationship between HR Audit Practice and Performance of the IT Professionals in the sample./Sample area.
7. To suggest appropriate management strategies to improve the HR Audit practices and climate among the IT firms.

3.5 HYPOTHESES

On the basis of the objectives of the study, the following hypothesis were framed and administered on the sample data.

i. There is no significant relationship between the demographic factors (Gender, age, educational stream and experience) with performance of an employee.

ii. There is no significant relationship between the demographic factors (Gender, age, educational stream and experience) with performance of a firm.

iii. There is no significant relationship between the organizational factors (management attitude, frequency of audit, focused area in HR) with performance of an employee.

iv. There is no significant relationship between the organizational factors (management attitude, frequency of audit, focused area in HR) with performance of the firm.

v. There is no significant relationship between the HR Audit practices with performance of an employee.

vi. There is no significant relationship between the HR Audit practices with performance of the firm.

vii. There is no significant difference between the perceptions of the employees with regard to factors influencing HRA Practices among the IT firms.

viii. There is no significant difference between the perceptions of the employees with regard to barriers in conducting the HR Audit practices among the IT firms.
ix. There is no significant difference between the perceptions of the employees with regard to perceived benefits HR Audit practices among the IT firms.

3.6 CONCEPTUAL FRAME WORK

![Figure 3.1 Impact of human resources audit (HRA) Practices on the performance of employees in IT firms, Chennai](image)

**Figure 3.1** Impact of human resources audit (HRA) Practices on the performance of employees in IT firms, Chennai

3.7 THE VARIABLES USED ARE

1. HR Audit Practices/degree of adoption - as Independent Variables

2. Demographic variables, Organizational variables, Climate and environment - as Mediating Variables

3. Performance of the Employee and Performance of the Firm - Dependent variable
3.8 SOURCES OF DATA

For the purpose of study, data required is collected from both primary and secondary sources. The primary data is collected from a structured questionnaire prepared and tested through pilot study. The secondary data is collected from both print and electronic sources. The print sources includes, magazines, newspapers, books, journals, reports, research based thesis, review reports, policy documents and other unpublished data from the libraries and milk producing firms in the sample area. The electronic sources includes, data bases, e-journals, web sources, websites of research companies, industry associations, government sites and other media sources.

3.9 DATA COLLECTION TOOLS

For the purpose of data required for the analysis and to test the hypotheses, the primary data is collected through a structured questionnaire prepared on the basis of review of literature and tested through pilot study.

3.10 STRUCTURE OF THE QUESTIONNAIRE

The questionnaire is prepared to cover all the aspects related to the problem statement of the study. The questionnaire is made in a comprehensive format using dichotomous scaling, multiple choice scaling with single response, Likert scales with numerical labels. The questionnaire consists of nine sections covering various dimensions of the study. Part-I, deals with the profile of the sample respondents, part-II, deals with the level of agreement on the factors influencing the HR audit practices in IT sector, Part-III, deals with the level of agreement on the HRA Practices impact on the various dimensions of individual performance, Part-IV, deals with the HRA Practices dimensions of impact on the Performance of a company, Part-V, deals with level of agreement on barriers in conducting HRA in IT firms, Part-VI, deals with level of agreement on the perceived benefits in conducting HRA in IT firms, Part-VII, deals with level of approval to the following suggestions to improve the HRA practices in IT firms. The questionnaire is
concluded with an open ended question asking, any other suggestions from the respondent to improve the HR audit practices in the IT sector. The questionnaire comprised two different kinds of questions in the form of multiple choices and Likert’s five-point scale type, in order to sustain the interest of the respondents and avert monotony. The questionnaire is divided into eight parts, each containing a mix of these questions to elicit responses and information required for the study which is shown in the table below.

Table 3.1 Showing Questionnaire Design and structure

<table>
<thead>
<tr>
<th>S.No</th>
<th>Major Divisions</th>
<th>Type of questions</th>
<th>MCQs</th>
<th>Likert’s 5-point</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demographic Profile of Employees in IT firms</td>
<td></td>
<td>22</td>
<td>-</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>Factors influencing the HR audit practices in IT sector</td>
<td></td>
<td>-</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>HRA Practices impact on individual performance</td>
<td></td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>HRA Practices impact on the Performance of a company</td>
<td></td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>barriers in conducting HRA in IT firms</td>
<td></td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>perceived benefits in conducting HRA in IT firms</td>
<td></td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>approval to the following suggestions to improve the HRA practices in IT firms</td>
<td></td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>Open ended question asking any other suggestions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>22</td>
<td>70</td>
<td>92</td>
</tr>
</tbody>
</table>

3.11 PILOT STUDY AND RELIABILITY TEST

The pilot study was conducted by distributing 125 questionnaires to executives from the IT companies in the sample area. Cronbach Alpha Test was used to determine the degree of consistency among the multiple measurements of each factor. It measures the inter-item reliability of a scale generated from a number of items. Ideally, the reliability coefficient above 0.5 is considered acceptable as a good indicator of constructing reliability (Nunnally, 1976), above 0.6 is treated satisfactorily (Robinson et.al., 1991), but alpha above 0.7 is considered sufficient
The questionnaire responses exhibited Cronbach-Alpha value of for each of the section is provided in the following table

Table 3.2 Showing reliability alpha values for each section of the Questionnaire

<table>
<thead>
<tr>
<th>S.No</th>
<th>Major Divisions</th>
<th>Type of questions</th>
<th>Corn Bachs Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demographic Profile of Employees in IT firms</td>
<td>22 MCQs</td>
<td>0.899</td>
</tr>
<tr>
<td>2</td>
<td>Factors influencing the HR audit practices in IT sector</td>
<td>- 15 Likert's 5-point</td>
<td>0.768</td>
</tr>
<tr>
<td>3</td>
<td>HRA Practices impact on individual performance</td>
<td>10</td>
<td>0.890</td>
</tr>
<tr>
<td>4</td>
<td>HRA Practices impact on the Performance of a company</td>
<td>10</td>
<td>0.789</td>
</tr>
<tr>
<td>5</td>
<td>barriers in conducting HRA in IT firms</td>
<td>10</td>
<td>0.826</td>
</tr>
<tr>
<td>6</td>
<td>perceived benefits in conducting HRA in IT firms</td>
<td>10</td>
<td>0.798</td>
</tr>
<tr>
<td>7</td>
<td>approval to the following suggestions to improve the HRA practices in IT firms</td>
<td>15</td>
<td>0.877</td>
</tr>
<tr>
<td>8</td>
<td>Open ended question asking any other suggestions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overall alpha score</td>
<td>10 70</td>
<td>0.896</td>
</tr>
</tbody>
</table>

3.12 RESEARCH METHODOLOGY

The present study is perceptional and qualitative in nature. The present study is described the profile of the IT firms and the environment prevailing and explore the some of the facts relating to HR Audit climate and Practice and the employees perceptions on the same and its relevance and relationship with the performance of the employees and the firm. Among the different IT hubs in Tamil Nadu, the Chennai city has been selected for the present study. A few and prominent IT firms in the sample are IBM, CTS, Accenture, Oracle, HP, Polaris, Infosys, HCL, Wipro, TCS, Tech Mahindra, Steria, iGate, Inautix and Saskan. In addition to that small and niche but competitive in nature and specialized in services are rendered by some other are considered for the purpose of study and data collection. Initially a pilot study was conducted with 125 questionnaires and the reliability for the same was calculated by using Corn Bach’s Alpha Score and found at 0.896 (89.6
Percent) as reliable. Ideally, the reliability coefficient above 0.5 is considered acceptable as a good indicator of constructing reliability (Nunnally, 1976), above 0.6 is treated satisfactorily (Robinson et.al., 1991), but alpha above 0.7 is considered sufficient (George and Mallery, 2001; Pallant, 2005).

Based on the same other IT firms were approached and met Human Resources Managers to get permission for the survey. Later final survey was started using the convenient sample technique (500 Questionnaires were distributed). The employees in the IT firms were not willing to share any information about the company and its practices. The myth of employees on the surveys was observed during the survey. Unless the purpose is clearly explained, majority of them were reluctant to respond. The employees were willing to express the reasons for change from one to other, the merits of the previous company where they employed and the other best practices of the competitor companies etc. In some of the IT firms, the researcher was allowed to meet the employees during training sessions and relaxation centers. It helped us to meet and explain the purpose of the survey to many at a time and create awareness and to obtain the data with ease.

The primary reason behind the adoption of convenient sampling technique is time and co-operation from the sample respondents to get the real and reliable and free consent of the respondent. Employees working in IT firms are traveling from far of places and tightly scheduled with personal and professional commitments. In some of the cases, the survey is conducted at the employee residence, where he or she is free to spend some time to share their opinions. The e-questionnaires also send to known sources through google docs and collected. Both physical and electronic questionnaires were consolidated by thorough review of the collected questionnaires. On review, it is found that, 58 questionnaires in total found unusable due to errors of omission and dual entries and 442 samples were found suitable for the study. Data analysis is carried out with the same. The data and information collected from respondents pertains to the year 2015.
3.13 SAMPLE ADEQUACY AND SAMPLE SIZE

Since the population is unknown, the sample is determined by using a qualitative technique of reasonability and justified with large sample size. The sample covers the entire sample area in terms of the prominent IT firms in Chennai city. The convenient sample technique is adopted to survey the employees working in the sample firms. The sample size and wide coverage are taken care, to avoid errors and validity issues relating to research. The sample size is determined by using the scientific method, by using the pilot study standard deviation of the sample of 125 respondents, by allowing the standard error at 5% level.

The sample size was determined by using the following formula

\[
\text{Sample Size (N)} = (\frac{ZS}{E})^2
\]

Where,

\[
Z = \text{Standard value corresponding to a confidence level of 95\% = 1.96}
\]

\[
S = \text{Sample SD from the pilot study of 125 samples = 0.554}
\]

\[
E = \text{Acceptable error = 5\% = 0.05}
\]

The sample size should be \( N = (\frac{ZS}{E})^2 \)

\[
= (1.96*0.554/0.05)^2
\]

\[
= 471.61 \text{ and rounded off with 500.}
\]

3.14 FRAME WORK OF ANALYSIS

To understand the demographic features of employees of IT industries, descriptive statistics and frequency distribution are worked out. Simple correlation has been used to establish the associate relationship among the identified demographic features with performance of the employees and the performance of
the firm dimensions. In order to identify the factors affecting individual performance and the performance of the firm, factor analysis has been adopted. In order to find out the role of individual factors on the performance of the firm and organizational factors affecting the performance of the employees, t-test and ANOVA is conducted. Similarly, to find out the relationship between the HRA practices and its impact on the performance of the employees and the firm is tested. The association between the demographics and the performance of the employees, the association between the organizational and HRA practices and the performance of the firm is tested through chi-square test. A factor analysis is administered to group the variables influencing the HR audit climate, practice and perceived benefits of the HR Audit and dimensions of impact of HR audit on the performance of the employees and the performance of the firm.

With a view to analyze the effect of demographic, organizational and HR audit practice dimensions on the performance of the employees and the performance of the firm, the multiple-regression model was formulated and carried out. Besides, mean score have been worked out for identifying the key dimensions of both demographic and organizational factors.

3.15 PROFILE OF INDIVIDUAL FIRMS

TCS (TATA Consultancy Services):

TCS (founded in 1968) is headquartered in Mumbai, India and is the leading company in IT services and IT consulting in India. Its founder was the much renowned J.R.D. Tata and is currently led by Mr. Natarajan Chandrasekaran at the CEO position. It has around 300,464 employees spread across 46 countries across the world. This company has also been added to the ‘Big 4’ most valuable IT services brands worldwide with IBM, HP and Accenture. TCS has been able to maintain its number 1 position in Indian IT industry since a long period of time and has also been ranked amongst the top worldwide. TCS and its 59 subsidiaries provide a range of information technology-related products and services including application development, business process outsourcing, capacity planning,
consulting, enterprise software, hardware sizing, payment processing, software management and technology education services. Hence, it has been building on more than 40 years of experience, and strives to add real value to global organizations through its domain expertise and world-class service.

**CTS (Cognizant Technology Solutions):**

Cognizant Technology Solutions is an American multinational corporation that provides custom information technology, consulting and business process outsourcing services. It is headquartered in Teaneck, New Jersey, United States. With over 50 delivery centers worldwide and approximately 211,500 employees as of December 31, 2014, Cognizant is organized into several verticals and horizontal units. The vertical units focus on specific industries such as Banking & Financial Services, Healthcare, Manufacturing and Retail. The horizontals focus on specific technologies or process areas such as Analytics, mobile computing, BPO and Testing. Both horizontal and vertical units have business consultants, who together form the organization-wide Cognizant Business Consulting (CBC) team. Cognizant is among the largest recruiters of MBAs in the industry; they are involved in business development and business analysis for IT services projects.

According to the 2011 financial statements, the major portion of Cognizant's revenues is derived from clients in the Financial Services (42.3%) and Healthcare (25.9%) industries. Other substantial revenue sources include clients from Manufacturing, Retail & Logistics (18.6%) and Communications, Information, Media & Entertainment and Technology (13.2%) industries. By geography, most of the revenue is derived from North America (77.2%) and Europe (19.2%). Cognizant is among the Top 10 companies receiving H-1B visas to bring immigrant workers to the United States. The company has been steadily increasing its U.S. work force.

**Infosys**

Infosys (founded in 1981) is led by the renowned Mr. NarayanaMurthy and is headquartered in Bangalore, India. It has global presence with 73 offices and
94 development centers in the United States, India, China, Australia, Japan, Middle East, and Europe, giving employment to around 160,405 employees worldwide. Infosys provides software development, maintenance and independent validation services to companies in banking, finance, insurance, manufacturing and other domains. From a capital of about US$ 250, it has grown to become a US$ 8.25 billion (FY14 revenues) company with a market capitalization of approximately US$ 31 billion. Apart from its IT service excellence Infosys has been ranked among the 'Top Ten Greenest Brands in India,' according to a consumer survey conducted in 2011 by Cohn & Wolfe. Infosys has been featured in the 'Green Brands' list for the third consecutive year. Hence, for over three decades, Infosys as a company focused on bringing to life great ideas and enterprise solutions that drive progress for clients.

WIPRO:

Wipro founded in 1945 by Mr. MH Premji (current CEO Mr. TK Kurien), has 146,053 employees spread across 61 countries. Wipro Limited is a global provider of comprehensive IT solutions and services, including Systems Integration, Consulting, Information Systems outsourcing, IT-enabled services, and R&D services. It is also a value added reseller of desktops, servers, notebooks, storage products, networking solutions and packaged software for international brands. To focus on core IT Business, it demerged its non-IT businesses into a separate company named Wipro Enterprises Limited with effect from 31 March 2013. This company offers services in healthcare, infrastructure etc. and contributed to around 10% of the profit. Wipro is presently ranked among the top 100 Technology companies in the world. It is the first Indian IT Service Provider to be awarded Gold-Level Status in Microsoft's Windows Embedded Partner Program and the first in the world to use six sigma.

Tech Mahindra

Tech Mahindra is part of the $12.5 billion Mahindra Group, in partnership with British Telecommunications plc (BT), one of the world’s leading
communications service providers. It was founded in 1986 and currently has its headquarters in Mumbai, India. The merger with Mahindra Satyam in the year 2013 has helped it climb the ladder from the number 5 to the number 4 as compared to last year’s statistics and hence now the complete entity has 89,500 employees, servicing 540 customers across 49 countries. It has some well-known famous personalities linked with its success, Anand Mahindra was its founder and current chairman and CP Gurnani holds the position of the CEO and MD. Its activities spread across a broad spectrum, including Business Support Systems (BSS), Operations Support Systems (OSS), Network Design & Engineering, Next Generation Networks, Mobility Solutions, and Security consulting and testing. However, The primary segment of the Company is business segment by category of customers is the Telecom Service Providers (TSP), Telecom Equipment Manufacturer (TEM), BPO and others, which includes non telecom vertical customers and the secondary segment is the geographical segment by location of its customers.

**HCL: (Hindustan Computers Limited):**

HCL Technologies Limited is one of the best IT companies in India. It offers wide range of software, infrastructure servicing and business process outsourcing. HCL was founded in 1976 and now it has footprint in 31 countries in the world. Diversified portfolio of services and strong customer base are its major strength. It is headquartered in Noida, India and it has 85,505 employees. The company has three business segments: software services, infrastructure services and business process outsourcing services. Engineering and R&D services, Custom application services and enterprise applications services are the subcategories of the software segment. Infrastructure segment provides services to organisations in chemical, energy and utility, life science, consumer electronics, banking, financial services, consumer product goods, hi-tech, insurance, healthcare and pharmaceuticals, manufacturing, media, telecom and tourism industries. This segment offers data centre services, cross-functional services, cloud computing services, information security services, end user computing services, network services and system integration services. Business process outsourcing segment offers next generation BPO services to its clients.
Mphasis:

Mphasis (then, Mphasis BFL Limited) was formed in June 2000 after the merger of the US-based IT consulting company Mphasis Corporation (founded in 1998) and the Indian IT services company BFL Software Limited (founded in 1992). It is a Bangalore based IT services company majority owned by Hewlett-Packard and is led by Mr. Balu Ganesh Ayyar as CEO. It has offices in more than 19 countries and in India it is present in almost 11 locations. Consistently Mphasis has delivered superior global Infrastructure Technology Outsourcing, Applications Services Outsourcing and Business Process Outsourcing services through a combination of technology know-how, domain and process expertise. The markets served by the company are financial services & insurance, healthcare, manufacturing, government, transportation, communications, and consumer & retail industries. In February 2014 the Mphasis Company changed its logo and the Brand Name as Mphasis Unleash the Next as it seeks to boost business other than from parent Hewlett-Packard, currently its largest client. With around 50,000 employees this is a growing company with a seemingly bright future.

Microsoft Corporation

Microsoft Corporation is the most valuable IT company in the world and it offers wide range of software products, hardware devices and services. The company also offers training to computer system integrators and developers. It was founded in 1975, when Bill Gates and Paul Allen developed an interpreter for programming language at Micro Instrumentation and Telemetry Systems. Now it is headquartered in Redmond, Washington and it has 99,000 employees. After the change in organisational structure in July 2013, the company has five operating segments: Devices and Consumer hardware, Devices and Consumer licensing, Devices and Consumer other, commercial licensing and commercial other. Devices and Consumer hardware segment provides Xbox gaming and entertainment consoles and accessories, its subscription and PC accessories and video game royalties. Devices and Consumer licensing segment offers Windows OS and related software, their licensing, Windows original equipment manufacturing licensing and Microsoft
office products for consumers. Resale of Windows store, Xbox live transaction, Windows phone store and advertising are the operating areas of Devices and Consumer other segment. Its commercial segments provide software and services for increasing the productivity and efficiency of organisations, teams and individuals. Microsoft Corporation has robust presence in software industry across the globe with offices in more than 100 countries. Its 16 businesses generate more than 1 billion revenue.

**Oracle Corporation**

Oracle Corporation is the second most valuable company in IT industry. The company provides enterprise software, computer hardware products and services. It operates across Middle East, Europe, Americas and Africa, and Asia Pacific regions. It is headquartered in Redwood Shores, California and it has 1,20,000 employees. In 1977 Larry Ellison, Robert Miner, Bruce Scott and Edward Oates established Oracle as a System Development Laboratories. In 1982, the company changed its name to Oracle Systems, now it is known as Oracle Corporation. Oracle has three business segments: software, hardware systems and services. Software segment provides wide range of software products which is designed to operate on both clustered server like cloud and single server. It also gives licences to customer with right to upgrade the software products and maintenance releases. Hardware segment provides different hardware systems and related services. The service segment offer cloud services, consulting services and educations services. Diversified geographical presence across 145 countries and strong customer base are Oracle’s core strength. The company adopted inorganic growth strategy and acquired number of companies for portfolio diversification.

**Mindtree:**

Mindtree (founded in 1999) is headquartered in Bangalore, India and has a corporate office in New Jersey, USA. The company with its 13000+ employees is led by Mr. Subrorto Bagchi and Mr. Krishnakumar Natarajan, the former as the Chairman and the latter as the CEO. The two were also the founders of the
company; they had the idea of starting up an IT services company and were already, in some sense, industry icons with Bagchi being the chief executive of Wipro’s R&D team and Natarajan being the chief executive of Wipro’s e-commerce division. Mindtree has been able to grow fast with around 28 offices located across USA, Netherlands, Sweden, UK, Germany, France, Switzerland, Belgium, Australia, Singapore, China, UAE and India. It follows a consulting driven approach and caters to over of 40 Fortune 500 enterprises. The core services of the company are in the areas of Agile, Digital, Analytics, Testing, Infrastructure Management and SAP.

**Polaris:**

Polaris (founded in 1993) has its headquarters in Chennai, India and has around 12,500+ employees spread worldwide. It is a provider of financial technology products, legacy modernization services and consulting for core banking, corporate banking, wealth & asset management and insurance. Arun Jain is the current CEO and Chairman and GovindSinghal is the current President and COO. In April 2013, Polaris launched its 8012 FT Design Center - the world's first Center dedicated to Financial Technology. 8012 FT Design Center is spread over 30,000 sq. ft and is located in the 22 acre Polaris campus on the IT Highway in Chennai. In a quest for knowledge opportunity, spanning over the last 2 decades (11 years as Polaris), Polaris has established its solutions and services footprint globally contributing to the realization of its business vision.

**SAP:**

SAP AG is a leading software company in the world which provides licenses for enterprise application software products, solutions, and cloud subscriptions. In 1972, former IBM engineers established SAP as a data processing company. In 1998 it was listed on the New York Stock Exchange. Now it has operations over 180 countries across Middle East and Africa, Americas, Europe, and Asia Pacific Japan. It is headquartered in Walldorf, Germany and it has 66,572 employees. SAP mainly has two business divisions: on premise and cloud. The on premise division provides on premise software, mobile software and services related
to this software. The cloud segment offers cloud software and related services like support services, professional services and educational services. SAP offers approximately 25 industry specific solutions and follows a vertical strategy. It has 11,500 partners all over the world.

**VMWARE:**

VMware Inc. engaged in offering virtualization and virtualization based cloud infrastructure solutions. The company is founded in 1988 and its major operation regions are Middle East, Africa, US, Asia Pacific, Europe and Canada. It is headquartered in Palo Alto, California and it has 14,300 employees. VMware’s virtualization technological solution can be categorised into two product group: cloud infrastructure and management, and end-user computing. Cloud infrastructure and management products consists of VMware vSphere, the company’s data center platform, which can be used to aggregate multiple servers, convert the storage infrastructure and networks into shared pool of resources. Its end user computing solution is use for ensuring secure access to application and data from a different devices and locations. VMware also offers loud application platform solutions for running and managing enterprise applications. VMware has served more than 500,000 customers. Pat Gelsinger is the present CEO and Joseph M. Tucci is the Chairman of the company.

**Steria:**

Steria has an heritage of more than 40 years in supporting leading European organisations, both public and private, leverage IT. They have built long-standing relationships by focusing on the customers’ business issues. It is reflected in their flexibility to partner with other technology providers, flexibility in business models and developing point solutions specific to an industry’s unique challenge. Steria brings this agglomerated experience and know-how to India. Today, Indian organisations are realizing the potential of IT and Steria can help both local and central governments operate more efficiently and cost effectively.
Steria has been in India for more than two decades as a services provider, but it is only in 2010 that the company took a decision to enter the Indian market strategically as the business environment is now appropriate for the solutions developed internationally. India is strategic to Steria. Today, India is where the real innovation is taking place and Steria has an opportunity to customize their offerings and solutions to the country’s unique needs. Steria now brings its cutting-edge solutions and services such as mobility solutions, airport management, biometrics & identity management, police command and control, applications testing and management, systems integration and Business Process Outsourcing. These solutions and their delivery models have been customised to the Indian context, as India is not about applying solutions off the shelf. The approach is simple: Steria is in India for deeper and long-lasting relationships, while also being the human face of IT for their clients.

Today, Steria leads European IT service providers in their India presence with 30% of its global headcount in India. Steria India has close to 5,500 employees in India across delivery centres in Noida, Chennai and Pune.

**Make the most of our market expertise to successfully implement strategic and organizational change**

Whatever your business plans and aspirations, we’ll help to get you there. From growth and cost-reduction plans, radical structural change and planned mergers or acquisitions, to staff measures, expansion and internationalization, your strategic projects will benefit from our pragmatic management approach. As your business consultancy we can help you set goals and define your strategic principles. And we’ll ensure their measurable and sustainable implementation by providing you with the concepts and process stages necessary for the successful and methodical implementation of change.

How do we achieve this? Right from the word go, our highly professional business consultants draw on extensive international programme and project management skills to help you both develop appropriate strategies and structure
highly complex situations to suit your needs. Our great strength lies in our ability to
effectively cost the proposed implementation, warn of risks and identify critical
paths at a very early stage. At the same time, our consulting teams can provide you
with general feasibility studies early on – both in terms of commercial viability and
practicality. When it comes to change management, our approach is to provide
system process support. That’s why we employ human resources experts to
accompany our change management projects. Our consulting teams demonstrate a
wealth of experience in business process management as well as extensive domain
knowledge and an excellent understanding of IT – all of it focused on helping you to
implement and sustain your business strategy.

iGate:

iGATE is a global leader in providing integrated technology and
operations-based solutions, headquartered in Bridgewater, New Jersey. As a trusted
partner to corporations in North America, Europe and Asia Pacific, iGATE provides
solutions to clients' business challenges by leveraging its technology and process
capabilities, underwritten by an understanding of domain and industry imperatives.

With revenues over US$ 1.2 billion, and a global employee talent capital
of over 33,484, we offer productized applications and platforms that provide the
necessary competitive and innovation edge to clients across industries, through a
combination of speed, agility and imagination. At a time when the technology
landscape is changing dramatically, we believe that these three attributes will be the
key guiding principles for us to navigate our way to higher value for all our stake
holders. Our core proposition of integrating technology and customer processes in a
proprietary way has conformed to the changing customer needs; the ITOPS
framework is proving to be the Holy Grail to align better with the new-age business
challenges of corporations. Under this framework, we build point solutions that
address explicit client issues taking into account the market and industry context.
Delving deeper into our client engagements over time, we have built strong expertise
in industry processes that enable us drive more innovation and technology
capabilities to solve business challenges. Our business solutions, integrated with
Data Analytics, Mobility, Digital technology and Cloud, are focused on the
following industry groups: banking and financial services; insurance; healthcare and life sciences; manufacturing; retail and consumer products; media and entertainment; energy and utilities, and product and engineering solutions.

IGATE adopts an egalitarian culture that encourages employees to question the status quo and debate newer and better ways of doing things at work. Our doctrines of growth are twined with Speed, Agility and Imagination; and our internal programs are designed to percolate the attributes of these tenets across all employees. We advocate the need for every employee to take responsibility of addressing any point of concern they see around them irrespective of their role in the Company. We believe that every employee is equally accountable for the performance of the Company across different areas. Beyond the realms of IQ and EQ, we propagate the need to build a Technology Quotient (TQ) where we constantly think of using technology to make lives better of our customers and other stakeholders. Our collective values are defined by three words: Character, Commitment and Competency. A sigma of each individual character pronounces the character of the Company. Our employee policies and HR modules are designed to campaign the need to have sterling character that breeds unquestionable integrity in everything we deliver. We propound the need to have a sense of belongingness to the work each one does. We lay utmost importance to being accountable to our deliverable, and bound by the vision of being committed to the success of all our stakeholders, internal and external. We create an ecosystem for employees to build the right competencies that are needed to build and enhance the necessary skill sets. We incubate a culture of constructive impatience that we believe, begets faster and smarter ways of getting things done. The company constantly strive to socialize our 5-A model. Assess – where we are; Aspire – where we want to be; Architect – what we need to do to get there. Act – to implement and Advance – to build a sustainable business model as a trusted partner to our clients and stakeholders. Its cultural ecosystem fosters a happy workplace environment providing a lot of scope to acquire and showcase several extra-curricular skill sets facilitating an all-round personality development. We strongly adhere to being socially conscious and
facilitate programs that ingrain in all employees the need to discover ways and means of giving back to the society we live in.

**Inautix:**

iNautix is a vital arm of Client Technology Solutions at BNY Mellon. In developing innovative technology solutions, we put clients at the center of everything we do. Through a collaborative effort, we partner with our clients to help them achieve their business goals. We are committed to continuously delivering excellence by improving performance, functionality and cost-effectiveness of our services. We empower our clients with our technological expertise and knowledge management capabilities that gives them the edge to focus on their core businesses.

**Leading through Innovation:** iNautix is renowned for willingness to challenge established practices and provide innovative approaches to projects. iNautix combines technical expertise with agility, experience, value, and flexibility to deliver technological solutions. iNautix is committed to the principles of ethical behavior and demonstrates the highest levels of quality, professionalism and service reliability in every endeavor. Application performance, availability and response times are critical factors for success in the highly competitive financial market. To ensure a prompt service response in today's rapidly changing market situations, the entire iNautix team works as a unified whole from start to finish by pooling their extensive domain experience & technology expertise to provide a competent range of service offerings including:

- Full Life-cycle Application Development
- Infrastructure Hosting Services
- Human Factors Engineering
- Product Validation Services
- Financial Systems Reengineering
• Technology Consulting

• Automating Processes

• Data warehousing and Business Analytics

**Service Philosophy**

iNautix is a vital arm of Client Technology Solutions at BNY Mellon. In developing innovative technology solutions, we put clients at the center of everything we do. Through a collaborative effort, we partner with our clients to help them achieve their business goals. We are committed to continuously delivering excellence by improving performance, functionality and cost-effectiveness of our services. We empower our clients with our technological expertise and knowledge management capabilities that gives them the edge to focus on their core businesses.

Taking great pride in the confidence and respect that we have earned, we relentlessly strive to improve the range and depth of our services.

iNautix Technologies India Private Limited is a group company of Bank of New York Mellon - a leading financial services provider. We provide technology development, business & technology operations and remote infrastructure management services for BNY Mellon and its subsidiaries. iNautix also develops and delivers comprehensive technology solutions and software development products for customers of BNY Mellon. Leveraging the resources based in Chennai and Pune, India, our parent organization BNY Mellon and other subsidiaries benefit from the proven track record of our more than 5000 consultants, analysts, and technologists.

As an innovation-focused company, we specialize in providing insightful and new age technology solutions to help meet our clients' business needs end-to-end. Since our inception in 2000, we have maintained a relentless commitment to develop products & solutions that are designed to improve operational efficiencies, make planning more dynamic & realistic, monitoring & evaluation simple, risk-free & methodical, increase productivity, enhance delivery performance and ensure
success for our clients. As a distinguished industry leader with a proven track record of success, iNautix excels at offering exceptional one-to-one services and innovative technological insights that matter. Guided by a client-first business philosophy from our parent organization, our unique spirit of creativity and innovation allows us to offer services that make our clients' businesses thrive and grow. iNautix operates out of three world-class facilities in Chennai & Pune - 1.73 lakh sq.ft. at Tidel Park, 1.85 lakh sq.ft. at Ascendas and 3.58 lakh sq. ft at Magarpatta SEZ, built to International specifications with the latest in ergonomic, employee-friendly amenities. Our 5000+ associates form a virtual extension of our client teams and work in tandem in developing game changing products and solutions that add value to business.

**Cutting-Edge Technology Services**

Application performance, availability and response times are critical factors for success in the constantly evolving and highly competitive capital markets. Its team of highly knowledgeable experts and professionals has deep domain experience that gives them a thorough understanding of the business parameters that drive the financial services sector. This helps us to deliver fully integrated, end-to end solutions that give our related companies, an edge over the competition. The company has expertise in building a wide array of financial systems including broker customer management platform, asset movement systems, back office processing systems, advisor platforms, retail client platforms and institutional platforms. We believe in creating touch points across the spectrum of interfaces to give institutions and individuals ease of use and drive businesses to higher levels of efficiency. The organization resonates to a higher calling in developing our people capabilities with separate program management, project development, and people management functions. Our competence lies in bringing together the finest talent in the market and seamlessly integrating technology, strategy and innovative methodologies to craft customized solutions for our clients.
SASKAN:

Sasken is a leader in providing Engineering R&D and Productized IT services to global tier 1 customers in the Communications & Devices, Retail, Insurance and Independent Software space. Sasken’s deep domain knowledge and comprehensive suite of services have helped global leaders in verticals such as Semiconductors, Consumer Electronics, Smart Devices, Automotive Electronics, Enterprises and Network Equipment maintain market leadership. In the Retail, Insurance and Independent Software Vendor verticals, Sasken enables customers to rapidly re-architect their suite of IT Application and Infrastructure. Established in 1989, Sasken employs 2000+ people, operating from state-of-the-art centers in Bangalore, Pune, Chennai & Hyderabad (India), Kaustinen & Tampere (Finland), and Beijing (China). We also have a presence across Germany, Japan, South Korea, UAE, UK, and USA. Sasken has been listed in the National Stock Exchange and Bombay Stock Exchange since its initial public offering in 2005.

In the 25 years of our existence, we have established ourselves as pioneers in creating IP and solution accelerators that have been a part of over 200+ commercially shipped unique products of globally leading OEMs. With over 70 patents, we have been at the forefront of technology and enjoy a reputation of being a technology leader. Sasken’s solutions are backed by CMMI-DEV-V1.3-ML3, ISO 9001:2008, ISO 27001:2005 and TL 9000 certifications. Our proprietary quality management systems strengthen our business offerings and ensure client satisfaction. Sasken’s commitment to environment is highlighted by its ISO 14001:2004 certification.

Vision and Core Values

Sasken’s vision is to play a key role in enriching every communications experience. We believe that in focusing all our efforts and resources on this vision, we will realize our dream of becoming globally recognized as a Tier-1 leader in the communications industry. It is a knowledge-driven company that values transparent business practices and provides comprehensive solutions to help businesses achieve
their goals of rapid product innovation and profitability. Our core values revolve around passion and integrity. The management takes pride in being ethical and in nurturing an environment of openness in all business interactions. We respect the courage of personal conviction, andactively cultivate a spirit of inquiry and individual enterprise. Technology is our passion. The company is daring to explore new opportunities to find new ways to solve technical challenges. The company prides us as being forward thinkers, anticipating market changes ahead of the curve to help our clients stay competitive. At Sasken, everything the company can to sustain an environment that is conducive to incubating new ideas and creating powerful technology solutions that help our clients succeed.

3.16 TOOLS USED FOR ANALYSIS

The analysis part of the present thesis was made by using the various parametric and non-parametric statistical tests namely, Percentage Analysis, Chi-square Test, ANOVA, t-Test, and Multiple Regression Analysis.

Frequency analysis: Percentage refers to a special kind of ratio. Percentages are used in making comparison of two or more series of data. Percents are used to describe relationships. Percentage can also be used to compare the relative term, the distribution of two or more series of data. Since 500 have been chosen as sample size and it has been categorized in number of 125 each the collected data will be converting into percentage by adopting the following formula

\[
\text{Percentage} = \left( \frac{\text{No. of respondents}}{125} \right) \times 100
\]

Chi-square analysis: Chi-square test is used as a statistical tool in this study. Also it invokes no assumption about the form of original distribution from which the observations are made. In this method it is tested that whether two attributes considered are dependent or not. Chi – Square is an important non – parametric test and as such no test is necessary in respect of the type of population. We require only the degree of freedom (implicit of course the size of the sample) for using this test.
As a non-parametric test, Chi-square can be used (i) as a test of goodness of fit and (ii) as a test of independence.

χ² test enables us to explain whether or not two attributes are associated. In order for that we may apply the chi-square test either as a test to judge the significance of association between attributes, it is necessary that the observed as well as theoretical or expected frequencies must be grouped in the same way and theoretical distribution must be adjusted to give the same total frequency as we find in case of observed distribution.

Formula

\[ \chi^2 = \sum \left( \frac{(O - E)^2}{E} \right) \]

where \( O \) – Observed Frequency
\( E \) – Expected Frequency

**t-test**: A t-test is any statistical hypothesis test in which the test statistic has a Student's t distribution if the null hypothesis is true. It is applied when the population is assumed to be normally distributed but the sample sizes are small enough that the statistic on which inference is based is not normally distributed because it relies on an uncertain estimate of standard deviation rather than on a precisely known value.

Among the most frequently used t tests are:

- A test of whether the mean of a normally distributed population has a value specified in a null hypothesis.

- A test of the null hypothesis that the means of two normally distributed populations are equal. Given two data sets, each characterized by its mean, standard deviation and number of data
points; we can use some kind of t test to determine whether the means are distinct, provided that the underlying distributions can be assumed to be normal. All such tests are usually called Student's t tests, though strictly speaking that name should only be used if the variances of the two populations are also assumed to be equal; the form of the test used when this assumption is dropped is sometimes called Welch's t test. There are different versions of the t test depending on whether the two samples are

- Unpaired, independent of each other (e.g., individuals randomly assigned into two groups, measured after an intervention and compared with the other group), or

- Paired, so that each member of one sample has a unique relationship with a particular member of the other sample (e.g., the same people measured before and after an intervention).

If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis which usually states that the two groups do not differ is rejected in favor of an alternative hypothesis, which typically states that the groups do differ.

- A test of whether the slope of a regression line differs significantly from 0.

Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution.

**Analysis of variance (ANOVA):** Analysis of variance (ANOVA) is a collection of statistical models, and their associated procedures, in which the observed variance is partitioned into components due to different explanatory variables. The initial techniques of the analysis of variance were developed by the statistician and geneticist R. A. Fisher in the 1920s and 1930s, and are sometimes known as Fisher's ANOVA or Fisher's analysis of variance, due to the use of Fisher's F-distribution as
partition of the test of statistical significance. Partitioning of the sum of squares: The fundamental technique is a partitioning of the total sum of squares into components related to the effects used in the model. For example, we show the model for a simplified ANOVA with one type of treatment at different levels.

\[
SS_{\text{Total}} = SS_{\text{Error}} + SS_{\text{Treatments}}
\]

The number of degrees of freedom (abbreviated df) can be partitioned in a similar way and specifies the chi-square distribution which describes the associated sums of squares.

\[
df_{\text{Total}} = df_{\text{Error}} + df_{\text{Treatments}}
\]

The F-test: The F-test is used for comparisons of the components of the total deviation. For example, in one-way, or single-factor ANOVA, statistical significance is tested for by comparing the F test statistic

\[
F = \frac{\text{variance of the group means}}{\text{mean of the within group variances}}
\]

\[
F^* = \frac{MSTR}{MSE}
\]

where

\[
MSTR = \frac{SSTR}{I - 1}
\]

\[I = \text{number of treatments}\]

and

\[
MSTR = \frac{SSE}{n_T - 1}
\]

\[n_T = \text{total number of cases}\]
To the F-distribution with I-1, nT degrees of freedom. Using the F-distribution is a natural candidate because the test statistic is the quotient of two mean sums of squares which have a chi-square distribution.

Kruskal-Wallis one-way analysis of variance: Kruskal-Wallis one-way analysis of variance by ranks (named after William Kruskal and W. Allen Wallis) is a non-parametric method for testing equality of population medians among groups. Intuitively, it is identical to a one-way analysis of variance with the data replaced by their ranks. It is an extension of the Mann-Whitney U test to 3 or more groups.

Since it is a non-parametric method, the Kruskal-Wallis test does not assume a normal population, unlike the analogous one-way analysis of variance. However, the test does assume an identically-shaped and scaled distribution for each group, except for any difference in medians.

Method

1. Rank all data from all groups together; i.e., rank the data from 1 to N ignoring group membership. Assign any tied values the average of the ranks they would have received had they not been tied.

2. The test statistic is given by: \( K = \frac{(N - 1) \sum \frac{n_i (\bar{r} - \bar{r})^2}{n_i}}{\sum_i \sum_j (r_{ij} - \bar{r})^2} \),

where \( n_i \) is the number of observations in group i

\( r_{ij} \) is the rank (among all observations) of observation j from group i

\( N \) is the total number of observations across all groups \( \bar{r} = \frac{\sum_{i=1}^{g} \frac{1}{n_i} r_{ij}}{N} \),

\( \bar{r} = \frac{N + 1}{2} \) is the average of all the \( r_{ij} \).
Notice that the denominator of the expression for $K$ is exactly $(N - 1)$

$$\frac{N(N + 1)}{12}.$$ Thus, $K = \frac{12}{N(N + 1)} \sum_{i=1}^{g} n_i (\bar{r}_i - \bar{r})^2$

3. A correction for ties can be made by dividing $K$ by

$$1 - \frac{\sum_{i=1}^{g} (t_i^3 - t_i)}{N(N - 1)}$$

where $G$ is the number of groupings of different tied ranks, and $t_i$ is the number of tied values within group $i$ that are tied at a particular value. This correction usually makes little difference in the value of $K$ unless there are a large number of ties.

4. Finally, the p-value is approximated by $Pr(\chi^2_{g-1} \geq K)$. If some $n_i$'s are small (i.e., less than 5) the probability distribution of $K$ can be quite different from this chi-square distribution. If a table of the chi-square probability distribution is available, the critical value of chi-square, $X^2_{\alpha, g-1}$, can be found by entering the table at $g - 1$ degrees of freedom and looking under the desired significance or alpha level. The null hypothesis of equal population medians would then be rejected if $K \geq X^2_{\alpha, g-1}$. Appropriate multiple comparisons would then be performed on the group medians.

**Friedman Test:**

The Friedman test is a non-parametric statistical test developed by the U.S. economist Milton Friedman. Similar to the parametric repeated measures ANOVA, it is used to detect differences in treatments across multiple test attempts. The procedure involves ranking each row (or block) together, then considering the values of ranks by columns. Applicable to complete block designs, it is thus a special case of the Durbin test.
Classic examples of use are:

- $n$ wine judges each rate $k$ different wines. Are any wines ranked consistently higher or lower than the others?

- $n$ wines are each rated by $k$ different judges. Are the judges’ ratings consistent with each other?

- $n$ welders each use $k$ welding torches, and the ensuing welds were rated on quality. Do any of the torches produce consistently better or worse welds?

The Friedman test is used for one-way repeated measures analysis of variance by ranks. In its use of ranks it is similar to the Kruskal-Wallis one-way analysis of variance by ranks.

Given data $\{x_{ij}\}_{n \times k}$, that is, a matrix with $n$ rows (the blocks), $k$ columns (the treatments) and a single observation at the intersection of each block and treatment, calculate the ranks within each block. If there are tied values, assign to each tied value the average of the ranks that would have been assigned without ties. Replace the data with a new matrix $\{r_{ij}\}_{n \times k}$ where the entry $r_{ij}$ is the rank of $x_{ij}$ within block $i$.

Find the values:

$$r_{.j} = \frac{1}{nk} \sum_{i=1}^{n} r_{ij}$$

$$\bar{r} = \frac{1}{nk} \sum_{i=1}^{n} \sum_{j=1}^{k} r_{ij}$$

$$SS_i = \frac{n}{k} \sum_{j=1}^{k} (\bar{r}_{.j} - \bar{r})^2$$

\[ SS_e = \frac{1}{n(k-1)} \sum_{i=1}^{n} \sum_{j=1}^{k} (r_{ij} - \bar{r})^2 \]

The test statistic is given by \( Q = \frac{SS_t}{SS_e} \). Note that the value of \( Q \) as computed above does not need to be adjusted for tied values in the data.

Finally, when \( n \) or \( k \) is large (i.e. \( n > 15 \) or \( k > 4 \)), the probability distribution of \( Q \) can be approximated by that of a chi-squared distribution. In this case the p-value is given by \( P = \chi^2_{k-1} \left( \frac{Q}{\chi^2_{k-1}} \right) \). If \( n \) or \( k \) is small, the approximation to chi-square becomes poor and the p-value should be obtained from tables of \( Q \) specially prepared for the Friedman test. If the p-value is significant, appropriate post-hoc multiple comparisons tests would be performed.

**Factor Analysis- Principal Component method:**

Principal component analysis (PCA) is a statistical procedure that uses orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. The number of principal components is less than or equal to the number of original variables. This transformation is defined in such a way that the first principal component has the largest possible variance (that is, accounts for as much of the variability in the data as possible), and each succeeding component in turn has the highest variance possible under the constraint that it be orthogonal to (i.e., uncorrelated with) the preceding components. Principal components are guaranteed to be independent if the data set is jointly normally distributed. PCA is sensitive to the relative scaling of the original variables.

Depending on the field of application, it is also named the discrete Karhunen–Loève transform (KLT) in signal processing, the Hotelling transform in multivariate quality control, proper orthogonal decomposition (POD) in mechanical engineering, singular value decomposition (SVD) of \( X \) (Golub and Van Loan, 1983), eigenvalue decomposition (EVD) of \( X^TX \) in linear algebra, factor analysis,
Eckart–Young theorem (Harman, 1960), or Schmidt–Mirsky theorem in psychometrics, empirical orthogonal functions (EOF) in meteorological science, empirical eigenfunction decomposition (Sirovich, 1987), empirical component analysis (Lorenz, 1956), quasiharmonic modes (Brooks et al., 1988), spectral decomposition in noise and vibration, and empirical modal analysis in structural dynamics.

PCA was invented in 1901 by Karl Pearson, as an analogue of the principal axes theorem in mechanics; it was later independently developed (and named) by Harold Hotelling in the 1930s. The method is mostly used as a tool in exploratory data analysis and for making predictive models. PCA can be done by eigenvalue decomposition of a data covariance (or correlation) matrix or singular value decomposition of a data matrix, usually after mean centering (and normalizing or using Z-scores) the data matrix for each attribute.[3] The results of a PCA are usually discussed in terms of component scores, sometimes called factor scores (the transformed variable values corresponding to a particular data point), and loadings (the weight by which each standardized original variable should be multiplied to get the component score).

PCA is the simplest of the true eigenvector-based multivariate analyses. Often, its operation can be thought of as revealing the internal structure of the data in a way that best explains the variance in the data. If a multivariate dataset is visualised as a set of coordinates in a high-dimensional data space (1 axis per variable), PCA can supply the user with a lower-dimensional picture, a projection or "shadow" of this object when viewed from its most informative viewpoint. This is done by using only the first few principal components so that the dimensionality of the transformed data is reduced.

PCA is closely related to factor analysis. Factor analysis typically incorporates more domain specific assumptions about the underlying structure and solves eigenvectors of a slightly different matrix. PCA is also related to canonical correlation analysis (CCA). CCA defines coordinate systems that optimally describe the cross-covariance between two datasets while PCA defines a new orthogonal
coordinate system that optimally describes variance in a single dataset. Principle components creates variables that are linear combinations of the original variables. The new variables have the property that the variables are all orthogonal. The principle components can be used to find clusters in a set of data. PCA is a variance-focused approach seeking to reproduce the total variable variance, in which components reflect both common and unique variance of the variable. PCA is generally preferred for purposes of data reduction (i.e., translating variable space into optimal factor space) but not when detect the latent construct or factors.

Factor analysis is similar to principle component analysis, in that factor analysis also involves linear combinations of variables. Different from PCA, factor analysis is a correlation-focused approach seeking to reproduce the inter-correlations among variables, in which the factors “represent the common variance of variables, excluding unique variance”. Factor analysis is generally used when the research purpose is detecting data structure (i.e., latent constructs or factors) or causal modeling.

**Multiple Linear Regressions:**

In statistics, linear regression is a form of regression analysis in which the relationship between one or more independent variables and another variable, called dependent variable, is modeled by a least squares function, called linear regression equation. This function is a linear combination of one or more model parameters, called regression coefficients. A linear regression equation with one independent variable represents a straight line. The results are subject to statistical analysis. The theoretical multiple linear regression model assumes a possibly imperfect relationship between $Y$, the regress and, regressors $X_1, ..., X_m$. A disturbance term $\varepsilon$, which is a random variable too, is added to this assumed relationship to capture the influence of everything else on $Y$ other than $X_1, ..., X_m$. Hence, the multiple linear regression model takes the following form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_m X_m + \varepsilon$$
Note that the regressors are also called independent variables, exogenous variables, covariates, input variables or predictor variables. Models which do not conform to this specification may be treated by nonlinear regression. A linear regression model need not be a linear function of the independent variable: linear in this context means that the conditional mean of Y is linear in the parameters β. For example, the model \( Y = \beta_1 X + \beta_2 X^2 + \varepsilon \) is linear in the parameters \( \beta_1 \) and \( \beta_2 \), but it is not linear in \( X \), a nonlinear function of \( X \).

### 3.17 OVERALL SIGNIFICANCE

SPSS will offer variety of statistical tests. Usually, though, overall significance is tested using what SPSS calls the Model Chi-square, which is derived from the likelihood of observing the actual data under the assumption that the model that has been fitted is accurate. It is convenient to use -2 times the log (base e) of this likelihood; we call this -2LL. The difference between -2LL for the best-fitting model and -2LL for the null hypothesis model (in which all the \( b \) values are set to zero) is distributed like chi-squared, with degrees of freedom equal to the number of predictors; this difference is the Model chi-square that SPSS refers to. Very conveniently, the difference between -2LL values for models with successive terms added also has a chi-squared distribution, so when we use a stepwise procedure, we can use chi-squared tests to find out if adding one or more extra predictors significantly improves the fit of our model.

### 3.18 LIMITATIONS OF THE STUDY

The present study has been focused with some of the constraints due to physical, behavioural and infrastructural issues. They are as follows,

1. The present study is conducted in the Chennai city and by using convenient sampling technique, hence, perceptual bias need to consider while adoption of the suggestion and comparing the results.

2. The sample size is limited to 442 due to time and physical constraints in meeting and obtaining the responses from the sample. For qualitative studies large sample with different sampling techniques can give more reliable results.
3. The findings of the study are drafted in accordance with the socio-economic conditions prevailing in the sample area of Chennai and its suburban.

4. The findings of the study are limited to the suitability and similarity of the demographical profile of the area and the sample i.e. Chennai city and the management style adopted in the local firms.

5. The behavioural bias needs to be adopted while adopting the observations to some other situation.

6. The perceptions represented may be purely personal opinion of the sample respondents and not representing the firm they belongs to or the firm they worked with in the previous years.

7. The level of understanding of the concept and its importance is not quantified and hence, the results may vary accordingly.

3.19 SCOPE FOR FURTHER RESEARCH

The present study has been focused on assessing the impact of HR audit practices on the performance of the individual employees and the organization as a whole. The dimensions of performance impact are measure on five dimensional scales. In addition, the study covers the factors influencing the HR audit practices in IT sector, barriers in conducting and benefits of HR audit practices in IT sector is studied. The similar studies can be conducted in other service sectors like hospitals, banks, schools and colleges, e-governance centres and many other public utility service centres. The ultimate objective of any business is to satisfy the clients and to protect the stake holder’s interests from time to time. The comparative studies of the firms in different sectors, different geographical locations can help to identify the common barriers and benefits of HR audit in the sample area and focused approach can be designed to curb the same. The HRA practice, procedure, manuals and the steps can be designed and compared the same with the existing practice formats and the gaps can be identified in the system in terms of professionally established systems and the actual market practices and the reasons for failure of the same in the market can be identified. Micro level studies can help in customization and effective implementation for the benefit of the society at large.