CHAPTER 3
RESEARCH METHODOLOGY
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3.1 INTRODUCTION

“Most of what influences what we say and do occurs below the level of awareness. That’s why we need new techniques: to get at hidden knowledge – to get at what people don’t know they know” Observes Gerald Zaltman, Professor, Harvard University.

Research is nothing but a search of facts- answers to questions and solutions for problems. It is a purposive investigation and organized enquiry to find explanations to unexplained phenomenon, to clarify the doubtful propositions and to correct the misconception. Any process to be called research, the process should be controlled, rigorous, systematic, valid and verifiable, empirical and critical. The research can be classified broadly in three perspectives:

1. Application of research study
2. Objectives in understanding the research
3. Inquiry mode employed

But these classifications are not mutually exclusive that is a research classified with respect to some application can also be classified from perspectives of objectives and inquiry mode employed.

There are two types in research when the research study is done with application perspective
1. Pure/ Fundamental research\textsuperscript{3} – It is undertaken for increase in knowledge. It is conducted to satisfy curiosity such as: what makes things happen, Why Society changes. It is a source of most new theories, principles and ideas. It rarely helps anybody directly.

2. Applied research – It is use of fundamental research or past theories and methods for solving an existing problem. It involves the research techniques, procedures and methods which are applied to the collection of information about various aspects so that the information gathered can be used in other ways like formulation of policy etc.

There are four Methods of research related to research design, when the research study is done with a perspective of an objective.

1. Descriptive research – It’s main theme is to describe what is prevalent regarding a community, a phenomenon, a situation, an outcome etc.

2. Exploratory research – The main theme is to explore an association, a relationship.

3. Co relational research – The main theme is to ascertain whether there is any kind of relationship in the facts in the problem under consideration.

4. Explanatory research – The theme is to explain why a relationship is formed.
There are two types of research study when it is based on the inquiry mode type

1. Quantitative research – based on measurement of some quantity or amount
2. Qualitative research – it is concerned with quality phenomenon

In the present research, various constituent functions of a professional Institute are studied and how RFID could be used in these functions or applications is studied and explored. The data is collected through questionnaire which is designed in such a way, so as to quantify the opinion, beliefs, attitudes towards the objectives of the research. The variables are quantified with appropriate scaling techniques and the model is suggested which can be applied for these functions.

3.2 OBJECTIVES OF THE RESEARCH

3.2.1 The problem statement

RFID is being used in various applications in Industries, which are getting excellent Return on Investment. If RFID is used in the professional Institutes, will it be beneficial to the Institutes to improve its academic and administrative Governance? If yes, how and what way it should be implemented?

3.2.2 Objectives

3.2.2.1 Primary Objective

The Primary objective of the research is:
To explore the potential of implementing Radio Frequency Identification (RFID) technology in Professional Institutes in various application/functional areas to increase the overall working effectiveness of the institute and to suggest a framework model which would be helpful to those Institutes which intend to implement the technology.

3.2.2.2 Secondary Objectives

To understand the effectiveness of implementing the RFID technology, following sub-objectives are formulated:

1. To find out the various application areas where the stakeholders are facing problems with respect to time or accuracy.
2. To study the technical details of RFID and how it can be integrated with the current technology which in turn will be able to solve the painful areas of the institute.
3. To find out the association of RFID implementation in staff & students’ attendance & related issues and Institutes’ working effectiveness.
4. To find out the association of RFID implementation in library transactions/processes & stock checking and Institutes’ working effectiveness.
5. To find out the association of RFID implementation in guard patrolling and Institutes’ working effectiveness.
6. To find out the association of RFID implementation in asset checking and Institutes’ working effectiveness.
7. To attempt to propose a framework model for Institutes for implementing the RFID technology in various work areas considering both academic and administrative aspects.

3.2.3 Hypothesis of study

Construction of hypothesis is an important consideration in formulation of the research problem. Hypothesis brings clarity and focus to a research problem. Hypothesis testing can help the decision makers of the society or organization to understand the real scenario of the problem /situation and its corresponding probable solution so as to take appropriate decisions.

Based on the above objectives and sub-objectives the researcher has formulated the following hypothesis:

Main hypothesis of study:

H: The working effectiveness of the professional institute is correlated with implementation of RFID.

The components of the hypothesis

H1: The working effectiveness of the professional institute is correlated with maintaining staff attendance using RFID.

H2 : The working effectiveness of the professional institute is correlated with maintaining students’ attendance using RFID.

H3 : The working effectiveness of the professional institute is correlated with report generation using RFID.
H4 The working effectiveness of the professional institute is correlated with monitoring of guard patrolling using RFID.

H5: The working effectiveness of the professional institute is correlated with asset checking using RFID.

H6: The working effectiveness of the professional institute is correlated with implementation of RFID in library.

3.3 RESEARCH METHODOLOGY

3.3.1 Scope of study

All the constituent functions like staff and student attendance, report generation, asset checking, monitoring guard patrolling and library processes, which are considered for the working effectiveness of the Institute are common in all the Institutes conducting any professional course. But since RFID is relatively a new technology, the researcher thought that amongst various professional courses, the institutes conducting the Post Graduate technical course like MCA would adapt and implement the technology very fast so the scope is kept limited to the MCA Institutes only.

The present study is confined to the survey of the professional Institutes which fulfills the following conditions:

1. It should be an Institute affiliated to University of Pune under Management Faculty and recognized by AICTE, New Delhi, conducting MCA Programme.
2. It should have a minimum standing for three years with at least one batch of MCA passing out in or before year 2008.

The preliminary survey indicated that there are 18 such institutes fulfilling above conditions so the total population is 18. It was therefore decided to keep the scope confined only to these 18 institutes. The information was collected from total population i.e. census survey method has been applied for collecting the data.

The Universe therefore of the enquiry becomes the MCA institutes affiliated to University of Pune under Management Faculty, approved by AICTE, New Delhi, having a minimum of three years existence. The list of Institutes along with the respondent number is given in the table 3.3.2.

3.3.2 Limitation

The scope described above, created a limitation that, the results obtained may or may not be found in respect of the Institutes running other professional courses either in University of Pune or elsewhere in the country.

3.3.3 Identification of Stakeholders

The effectiveness of any organization depends on multiple factors as well as individuals working at various positions in the Institute. The organizational structure of such professional institutes in general is as follows:
Major strategic decisions related to finance, infrastructure are taken by Board of Trustees, but the recommendations are generally given by the Local Management Committee, since there are representatives from Industry, trustees, academics, teaching and non-teaching staff from the Institute and the Director of the Institute. The regular day to day working, problems, issues are handled by the Director. Director has to handle financial matters as per the decisions made by the Local Management Committee. The Director is supposed to present before the report of the Institute. This hierarchical structure gives the idea of general working of any professional institute. Considering the hierarchical structure, the respondents or stakeholders were identified by the researcher.
3.3.4 Categories of Respondents

Following 5 different categories of respondents were identified as the stakeholders, from whom the responses were collected by designing 5 different questionnaires.

Table 3.3.1: The distribution of the stakeholders
(from 18 MCA institutes)

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
<td>18</td>
<td>4.84%</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>296</td>
<td>79.57%</td>
</tr>
<tr>
<td>System Administrator</td>
<td>22</td>
<td>5.91%</td>
</tr>
<tr>
<td>Office-In-charge</td>
<td>18</td>
<td>4.84%</td>
</tr>
<tr>
<td>Librarian</td>
<td>18</td>
<td>4.84%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>372</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

The table 3.3.1 above brings out the details of the number of persons belonging to each category included in the census study.

The details of the Institutes and the type of stakeholders from whom the data is collected is given in the following table 3.3.2
Table 3.3.2: Details of the Institutes visited for collection of Primary Data

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Institute Name</th>
<th>Director</th>
<th>Office-In-charge</th>
<th>Teaching staff</th>
<th>System Administrator</th>
<th>Librarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B.P. Hivale Education Society’s Institute of Management Studies Career Development Research, Ahmednagar</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Dr. D.Y. Patil Pratishshan’s Pad. Dr. D.Y. Patil Institute of Master of Computer Applications, Akurdi, Pune</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Maharashtra Education Society’s Institute of Management &amp; Career Courses, Pune</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Institute Name</td>
<td>Director</td>
<td>Office-In-charge</td>
<td>Teaching staff *</td>
<td>System Administrator</td>
<td>Librarian</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------</td>
<td>------------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>4</td>
<td>Progressive Education Society’s Institute of Management &amp; Career Development (MCA), Nigadi, Pune</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Jayawant Institute of Computer Application, Tathawade, Pune</td>
<td>1</td>
<td>1</td>
<td>33</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Sinhgad Technical Education Society’s Sinhgad Institute of Management &amp; Computer Application, Narhe (Ambegaon), Pune</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 3.3.2: Details of the Institutes visited for collection of Primary Data (Contd.)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Institute Name</th>
<th>Director</th>
<th>Office-In-charge</th>
<th>Teaching staff *</th>
<th>System Administrator</th>
<th>Librarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Sinhgad Technical Education Society’s Sinhgad Instt. of Business Administration &amp; Research, Kondhwa, Pune</td>
<td>1</td>
<td>1</td>
<td>24</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Maharashtra Cosmopolitan Education Society’s Allana Institute of Management Sciences, Pune</td>
<td>1</td>
<td>1</td>
<td>23</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Choudhary Attar Singh Yadav Memorial Education Trust’s Siddhant Institute of Computer Application, Sudumbare, Pune</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 3.3.2: Details of the Institutes visited for collection of Primary Data (Contd.)

<table>
<thead>
<tr>
<th>Sr. No.</th>
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<th>Office-In-charge</th>
<th>Teaching staff *</th>
<th>System Administrator</th>
<th>Librarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Sinhgad Technical Education Society’s Sinhgad Instt. of Business Administration &amp; Computer Application, Lonawala, Pune</td>
<td>1</td>
<td>1</td>
<td>31</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>S.S.P Mandal’s Manaikchand Dhariwal Instt. of Management &amp; Rural Technology, Shirur, Pune</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Audyogik Shishan Mandal’s Institute of Business Management &amp; Research, Pune</td>
<td>1</td>
<td>1</td>
<td>22</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>C.H.M.E. Society’s Dr. Moonje Instt. of Management &amp; Computer studies, Nashik</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 3.3.2: Details of the Institutes visited for collection of Primary Data (Contd.)

<table>
<thead>
<tr>
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<th>Institute Name</th>
<th>Director</th>
<th>Office-In-charge</th>
<th>Teaching staff *</th>
<th>System Administrator</th>
<th>Librarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Sr. D.Y.Patil Inst. of Management &amp; Research, Pimpri, Pune</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Audyogik Tantra Shikshan Sanstha’s Institute of Industrial &amp; Computer Management &amp; Research, Nigadi, Pune</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Indira Institute of Management, Tathawade, Mulsi, Pune</td>
<td>1</td>
<td>1</td>
<td>17</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Sinhgad Technical Education Society’s Sinhgad Instit.of Management Vadgaon (Budruk), Pune</td>
<td>1</td>
<td>1</td>
<td>22</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 3.3.2: Details of the Institutes visited for collection of Primary Data (Contd.)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Institute Name</th>
<th>Director</th>
<th>Office-In-charge</th>
<th>Teaching staff *</th>
<th>System Administrator</th>
<th>Librarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Vidya Pratishshan Institute of Information Technology, Bhigwan Road, Baramati, Pune</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

* The number of teaching staff in an institute depends on the student’s Intake for that Institute.

3.4 DATA COLLECTION

3.4.1 Primary Data collection

For any research, gathering the information about a situation, person, problem or phenomenon is important. The information which is available in books, magazines, journals, websites etc. is secondary data but when the information is collected from the stakeholders or respondents directly as first hand information then that information is called primary data.

The researcher collected the data by Observation, interviewing and through separate questionnaire for five different types of respondents.
3.4.1.1 Questionnaire Designing

To understand the working of the Institutes with respect to the constituent functions and to find whether use of RFID would be helpful in these functions, the researcher designed the questionnaire.

A brief introduction about the RFID technology was included in each questionnaire for the respondents, RFID being relatively a new technology.

The questions in the questionnaire were divided into 4 sections as follows:

i. General questions dependent on the role of the respondent
ii. Work related Questions
iii. Questions on using Automatic Identification
iv. Questions on RFID

The questions in the questionnaire were based on various processes or functions which enabled the researcher to get the responses based on following constituent functions:

- Staff attendance
- Students’ attendance in classroom, lab, reading room, mess
- Various report generation
- Security Guard Patrolling
- Checking movable assets
- Library transaction/processes

In order to understand the future prospects of RFID in the Institute, the responses of the stakeholder to the questions are important so five types of questionnaires were prepared for five types of respondents i.e. Director,
Teaching staff, System Administrator, Office-in-Charge, Librarian. Each type of questionnaire was designed keeping a specific focus as given below.

1. The Director of the institute

   This questionnaire focuses on the questions related to decision making for the institute as well as the opinion about the use of the technology in the various applications or processes and activities.

2. Teaching staff

   This questionnaire will reveal the academic problems, pain areas, drawbacks or limitations according to the teaching staff. The day to day work done or activities performed by them.

3. Office in Charge

   This questionnaire will reveal the facts about the institute, general systems followed as well as Administrative problems faced by the administrative staff.

4. System Analyst

   From this questionnaire the technical advancement, communication line, media, operating systems used and the pain areas in their day-to-day working will be understood.

5. Librarian
This questionnaire basically focuses on issue, return of books, stock checking, security related issues and facts about the library along with the opinion of the librarian on automatic identification technology.

The questionnaire is designed in such a way that it would be easier to study the measures of effectiveness of the constituent functions from the questionnaire data & the interviews.

- General questions

Every questionnaire has general questions asking the personal information of the respondents. These questions were common to all the respondents. In addition to this, a question on awareness of RFID technology is asked in all the questionnaires. Institute related general questions also were asked to every respondent depending on the role of the respondent for eg., for teaching staff they are about the incoming & outgoing timing, for Office-In charge they are based on the first MCA batch commencement year (to crosscheck that the 1st batch is passed out in or before year 2008). In addition to this the questions on institute timing, office timing, other university recognized fulltime courses conducted in the Institute, approved intake, hostel , mess facility & Accreditation status are asked. The System Administrator questionnaire has questions on the general computational environment like Server in computer lab, Operating system, communication media: wired or wireless, just to understand the facilities or infrastructure available in the institute. In the Librarian’s questionnaire, questions based on library timing, information about bar coding are present.
• **Work related questions**

The second part of the questionnaire includes the questions based on the activities or the work assigned to the respondents. The questions enquired about the method they are using, the frequency of the activities done by them, time taken by these activities which are assigned to them, the accuracy of the work, reports which they need to maintain, any past incidence of theft and related security issues need to be considered.

• **Questions on using automatic identification**

The questionnaire also includes questions asking the respondents about the use of Automatic Identification in their work area, implementation status of Automatic Identification and Data Capture (AIDC) in their respective institute.

• **Questions On RFID**

Every questionnaire includes questions asking the respondents about the RFID technology awareness and their opinion about it’s use in their Institute in various work areas.

All the questions included in the questionnaire have the options with appropriate measurement scales so as to make it easier for the data analysis.

• **Measurement scale**

The measurement scales are classified according to their mathematical properties. The widely used measurement scales are⁴:
1. Nominal scale – used to assign a number or symbol to event in order to label them

2. Ordinal scale – used to rank items from highest to lowest, without stating how much greater or less than.

3. Interval scale – these are the scales adjusted in terms of some rule so as to establish the basis of making the units equal.

4. Ratio scale – these scale facilitate a comparison & have true or absolute zero measurement.

Scaling describes the procedures of assigning the numbers to various opinion, attitude. In such cases the questionnaire is designed so that,

i) The judgment /opinion on some characteristic can be placed on a scale defined for that characteristic.

ii) The individual’s responses gets a score on a scale.

Scaling techniques: There are scaling techniques which are often used in research, they are:

1. Rating scale: it involves qualitative description of a limited number of aspects of a thing. Under this there are two types

   a) Method of paired comparison – The respondents need to make choice between two things

   b) Method of rank order – The respondents need to rank their choices
2. Scale construction technique: In this technique an opinion scale is made in such a way that the responses of the respondent put him on a scale.

Depending upon the scale construction approach, the scales are developed like:

a) Arbitrary scale – for arbitrary approach
b) Differential scale – for consensus scale approach
c) Summated or likert scale – for Item analysis approach
d) Cumulative scale - for cumulative approach
e) Factor scale – for inter correlation of items indicating a common factor accounts for the relationships between items

The researcher used method of rank order, summated or likert scale. The questionnaire was designed with positive & negative questions and accordingly the weights are assigned to these questions on 5-point weight scale. Likert scale was used while formulating the questions based on the regular work done by the respondents with respect to specific to application.

The researcher ensured the reliability of the gathered information by considering some facts like:

- The type of the respondent (Director, teaching or non-teaching faculty)
- Consistency of data and answers collected from other resources
The validity of the data depends on the reliability of data. The result of any research study is powerful and valid if it gives the same result with repetitive observations. The process or a system will be unreliable if the repeated information gives different results.

3.4.1.2 Data collection

The data collection at every Institute used to start with the prior permission of the Institute Director, so that collecting the data, distributing the questionnaire and talking to the concerned individuals could be formal, official and authentic.

Primarily, the interview used to be conducted with office-in-charge to get the general information about the Institute like courses run in the institute, accreditation status, timing, year of commencement of the first batch etc. Subsequently the structured interviews based on the questionnaire used to be conducted for Director, Librarian and System Administrator. The questionnaire used to be distributed to the teaching staff. In some cases where the researcher could not meet the staff, the data was collected through telephonic interviews.

The blank questionnaire for all the 5 respondents is attached in the Appendix II.

- Pilot Survey

After designing the questionnaire, to validate it, a pilot survey was conducted for 42 respondents from 3 MCA Institutes. After the completion of the survey, the questionnaire was modified and finalized to get the
required information.

### 3.4.2 Secondary Data Collection

Secondary data used by the research include: white papers, published articles, books, research work done previously, relevant journals, magazines, online RFID discussion groups, forums. The researcher also visited various exhibition for understanding the latest products with the features and cost, the vendors and their clients etc,

The data which is gathered from the secondary sources can be divided into various categories as follows.

- **Books, journals & magazines**
  - Various books, magazines, journals are read for understanding the concepts from Radio Physics to RFID
  - Various books on research methodologies
- **Government publication**:
  - Various press releases on RFID
  - Extract from the Gazette of India for rules published regarding the frequency band usage (presentation on RFID Technology – a legal analysis, at “The 2nd Annual RFID India Infomedia India Conference 2008” by Karnika Seth)
- **Websites**
  - E-journals related to RFID
University of Pune & Directorate of Technical Education website for information regarding the Institutes affiliated to university of Pune
RFID groups & forums for discussions
Earlier research papers published worldwide

- Videos
  - Video clips showing the working and applications of RFID

- Exhibitions
  - Product exhibitions to understand the latest product details, vendor details

- Seminars, workshops & training course
  - Seminars & workshops and RFID training course are attended to understand the working, implementation of the products and to get the hands on experience of various products.

### 3.5 DATA ANALYSIS METHOD

After the data collection, the data was coded and proper weights were given. Cross tabulation was used wherever it was required and also Excel graphs were drawn to graphically display the analyzed data. SPSS version 10 was used to calculate the Spearman’s Rank correlation coefficient between the various constituent functions and the overall working effectiveness of the Institute.

A framework model for implementation was then prepared for the institutes interested in implementing RFID technology, which includes the applications like:
• Report Generation
• Daily attendance of staff
• Daily attendance of students
• Asset checking
• Guard patrolling
• Library transaction & book stock checking

3.6 VARIABLES USED IN THE STUDY

The term variable is used as a synonym for construct or the property being studied. In order to come to any conclusion in any kind of study, it is required to understand the variables which are part of the study.

To understand the working effectiveness of the Institute, the researcher has gathered the data related to the 6 constituent functions of the institute. Two variable then were identified for calculating correlation coefficient. One of the variables was identified from the question which was referring to the constituent function and the other was identified from the question which was referring to the RFID implementation for institute’s effectiveness. In this way the Spearman’s Rank Correlation Coefficient was calculated for all the 6 constituent functions.

3.7 STATISTICAL TECHNIQUES

To complete the research process, the statistical tools & techniques are required. Statistical tools help in analyzing the data and drawing conclusions & findings from the data gathered. The data need to be coded correctly so as to retrieve it as and when required for the analysis.
3.7.1 Statistical tools used

Spearman’s Rank correlation coefficient is used to validate the hypothesis. To show the major findings, the cross tabulation and various graphs and charts are used.

The software used for this research study are:

i. Statistical Package for the Social Sciences (SPSS) version 10
ii. Microsoft Excel 2007

SPSS is used for cross tabulation, calculating Spearman’s Rank Correlation Coefficient MS Excel is used to draw various graphs, frequency distribution charts & tables.

3.7.2 Cross tabulation

The cross tabulation between the two questions is used to find the frequency of certain types of categorical data and relationship between them based on the data collected. Graphs are drawn as and when it is required based on the tables for a better understanding of the data analysis.

3.7.3 Pearson’s Chi Square test and Spearman’s Rank Correlation coefficient

Person’s Chi square test\(^5\) is used when responses of the people have been measured on one categorical independent variable and one categorical dependent variable. It is a non-parametric analysis of data, without indicating strength or direction of the relationship between the variables,
likelihood-ratio and linear-by-linear association can be found out by Chi – square test.

As against, correlation is a statistical technique\textsuperscript{6}, which can show whether, and how strongly the pairs of variables are related. It is a bivariate measure of association (strength) of linear relationship between two variables. Charles Edward Spearman in 1904 proposed an important measure of correlation, which is called Spearman’s Rank correlation coefficient. This can be used when the distribution of the data is such that it is not possible to quantify it but only rank it in certain order on the basis of a certain attribute.

The spearman rank correlation coefficient is defined by the following formula:\textsuperscript{1}

\[
\gamma_s = 1 - \frac{6 \sum_{i=1}^{n} d_i^2}{n(n^2-1)}
\]

Where,

\gamma - Rank correlation co-efficient
\gamma_{1i} - Rank of the \textit{i}th X observation
\gamma_{2i} - Rank of the \textit{i}th Y observation
Then \(d_i = \gamma_{1i} - \gamma_{2i}\)
To validate the hypothesis, the variables were identified from the questions from the respondents’ questionnaire corresponding to the constituent functions. These identified variables are discrete categorical variables measured on ordinal scale, so *spearman’s Rank Correlation Coefficient (Rho, $\gamma_s$)* was thought to be the most appropriate test. If the value of $\gamma_s = 1$, there would be a perfect positive correlation, if $\gamma_s = 0$ there would be no correlation, if $-1 < \gamma_s < 0$ then would be a negative correlation and if $\gamma_s = -1$, it would be perfect negative correlation between two variables under consideration.

The researcher used the following steps to apply the Spearman’s Rank Correlation Coefficient for testing the hypothesis.

1. Storing the data w.r.t. each variable representing the constituent functions of the institute: Staff attendance, Students attendance, Report generation, Asset checking, Guard monitoring, Library along with the question based on Effectiveness of the institute.

2. Identifying positive & negative questions and based on it assign the weights 1 to 5.

3. Using the SPSS 10.0 statistical tool for finding out the value of the spearman’s Rank correlation $\gamma$ (Rho).
3.8 THESIS CHAPTERIZATION

The thesis is divided into 5 chapters. The details are as follows:

Chapter 1

INTRODUCTION

The Chapter 1 gives the background of the research, need for the study, technological details, the basic principle of RFID along with the required hardware devices, the legal, privacy and health issues and also discusses the National and International status of the Radio Frequency Identification technology. The chapter also talks about Radio physics, although more details about the same are given in Appendix I. The chapter gives the formulation of the study with the problem statement.

Chapter 2

LITERATURE REVIEW

The review of the literature done by the researcher is given in this chapter which starts with the comparative analysis. The attributes of various types of RFID readers and tags with the application are given along with details need to be considered at the time of implementation like the tag placement are covered in this chapter. To implement the RFID technology in professional institutes, the information about the working structure of the institute and the role of Controlling bodies is essential, which is discussed in this chapter.
Chapter 3

RESEARCH METHODOLOGY

The chapter describes the objectives of the research along with the hypotheses and scope of the study. The chapter then explains the research methodology used for this research. Covers primary and secondary data collection methods along with the questionnaire used for data collection. The questionnaire used for the research is given in Appendix II. The chapter talks about the Statistical tools and the test used to prove the hypotheses.

Chapter 4

DATA ANALYSIS

This chapter starts by giving the analysis of the questionnaire. The chapter further gives the analysis of the data collected. The analysis is supported with the tables, cross tabulation and graphs wherever required. In the last section the Kano Model is discussed with respect to Institute’s working effectiveness.

Chapter 5

HYPOTHESIS TESTING

The hypothesis chapter starts with the motivation behind the study and then describes the hypothesis and the components of the hypothesis by explaining the constituent functions which are considered while formulating the hypothesis.
Chapter 6

FINDINGS, SUGGESTIONS, LIMITATIONS AND FUTURE DIRECTIONS

In this chapter all the findings are summarized and the results are given in a form of conclusions. This chapter gives a brief idea about the whole research work and results along with the findings obtained through the survey and interviews with the respondents. The chapter also describes the framework model suggested by the researcher which will be beneficial for the institutes to implement RFID in their Institute. The model gives the details of the hardware required for implementation along with the necessary points to be noted while purchasing the hardware, while developing or purchasing the software and extra precautions to be taken while installing the hardware.

Bibliography

References of the books along with page numbers, journals, e-journals, magazines with issue number and the websites as well as the Product catalogues referred are given in the Bibliography.

Appendix I

Essentials of Radio physics

Appendix II

Questionnaire
Appendix III

Glossary of Commonly Used Terms in RFID

3.9 REFERENCES


