CHAPTER 4

RESEARCH METHODOLOGY

4.1 GENERAL

Research methodology is the blueprint of the research architect. The study aims to analyze the effectiveness of science communication through radio in Chennai. In the previous chapter, the researcher discussed the theoretical framework of the study from the perspective of science communication models besides developing a conceptual research model and hypotheses for the study. This chapter documents various considerations relating to the methodology of the study, essentially providing a framework to obtain answers to the research questions detailed in the first chapter. This chapter explain critically the various methods and procedures followed in the present study to enable the researcher to answer the research problems. An in-depth description of the methods and procedures followed in carrying out the research is furnished under the following heads.

4.2 Research Design

4.3 Research Method

4.4 Methods of Data Collection

4.5 Rationale for Selection of Study Area

4.6 Population and Sample

4.7 Research Instrument for Data Collection
4.2 RESEARCH DESIGN

Bless and Higson-Smith (1995) describes a research design as the ‘planning of scientific research from the first step to last step’ and ‘a programme to guide the researcher in collecting and analyzing and interpret observed facts’.

Research design as defined by Kerlinger (1995) is the plan and structure of investigation so conceived as to obtain answer to research questions. Ex post facto research design was followed for conducting the study. Robinson (1976) defined ex post facto research design as any systematic empirical enquiry into which the independent variables has not been directly manipulated because they have already occurred or they are inherently not manipulative. Keeping this in view, the adaptability of the proposed design with respect to the type of the study, variables under consideration, size of the respondents and the phenomenon to be studied, the ex post facto design was selected. And the study adopts descriptive research design. The main focus of this study is to find out how science information is disseminated effectively through All India Radio (Primary Channel), Chennai; Anna Community Radio (Anna CR), Chennai; Gyan Vani, Chennai; and private FM (Radio Mirchi), Chennai.
4.3 RESEARCH METHOD

Creswell and Clark (2007) have argued for the use of combined methodological approaches in social science research:

The combination of qualitative and quantitative data provides a more complete picture by noting trends and generalizations as well as in-depth knowledge of participants’ perspectives (p. 33).

This study uses ‘triangulation’ combining both qualitative and quantitative methods. The quantitative methods used were to find out the perception, use and level of application of the science communication through radio among the listeners. The qualitative methods used were adopted among the radio experts to find out the pattern of science communication through radio and how it could be improved.

4.4 METHODS OF DATA COLLECTION

Methods play a major role in every research. The study used primary and secondary sources for data collection. Primary data were collected from among the listeners and experts. The secondary data were collected from relevant literature, books, articles and other academic publications. The methodology used for gathering secondary data from literature has been that of the snowball approach. Journal articles and books have constituted the starting point for each of the four sections and from which more references have been collected. The information channels that have been used for the literature study have been the Anna University library, open public libraries, Google Scholar, other research online database and American Embassy Resource Centre.
The strength of study research provides the use of multiple method of collecting data called triangulation. It is an inductive procedure to reduce the misinterpretation and concern about validity of the communication. Multiple perceptions are used to clarify meaning, and verify the repeatability of an observation and interpretation (Merriam 1998). Although in these types of studies repeatability is impossible, it is also useful to deal with problems of convergent and divergent facts.

This study combined dissimilar methods to interpret three units of analysis comprising the organization, the programme content and the audience. Here is an account of various methods and techniques used in performing the research. The various techniques used are:

(1) Textual analysis conducted for science programmes
(2) Survey research for listeners
(3) In-depth interviews conducted for scientists (in industry, the academic community and government), science programme producers, journalists dealing with science and technology, academics and content providers.

To pursue a study of this nature, qualitative methods of research such as textual analysis, surveys with their focus on measurements of data in terms of quantity, amount, intensity or even frequency would limit researcher’s ability to examine the views of respondents (Denzin and Lincoln 1994). Quantitative studies tend to insist on the measurement and analysis of causal relationships between variables not processes (Denzin and Lincoln 1994). The qualitative research approach consisted of textual analysis and in-depth interviews. Textual analysis, survey research and in-depth interview were seen as very appropriate for examining the applicability of participatory model to science communication in radio. It covers the research design,
sample design, questionnaire design and statistical tools used by the researcher.

4.4.1 Textual Analysis

The first technique for understanding the role played by the radio in covering science information is textual analysis. The researcher used this technique because it allowed him to classify the programmes objectively and systematically according to explicit rules and clear criteria. The goal is to produce valid measure of programme content. The analysis is made systematically. Analysis was made on the basis of explicit rules which enable researchers to obtain the same results from the same documents.

This study considers the radio content of the selected radio stations. This study covers the time period from November 1 to 30, 2012. Most analysis on radio involves multistage sampling. This process typically involves two stages. In the first stage, the science communication programmes covered by the radio stations were identified. In the second stage, three types of programmes namely health, energy and environmental issues were selected for the analysis. The units of analysis were the format of the programme, duration, science content, the treatment of the message, the appropriateness of the message, timing of the programme, the facilitators of the programme etc. The programme categories include:

- Interview
- Panel discussion
- Lecture
- Science quiz
- Live phone-in talk shows
- Public Service Announcement (PSA)
- Drama
- Radio cartoon
4.4.2 Survey Research

Survey research comprises a cross-sectional in design in relation to which data are collected predominantly by questionnaire or by in-depth interview on more than one case (usually quite a lot more than one) and at a single point in time to collect a body of quantitative or quantifiable data in connection with two or more variables which are then examined to detect patterns of relationship between variables (Bryman 2004).

Jacqueline and Marcia (2011) offer an excellent definition of surveys:

Survey research is a method for collecting and analyzing social data via highly structured and often very detailed interviews or questionnaires in order to obtain information from large numbers of respondents presumed to be representative of a specific population (p. 37).

Descriptive Surveys

The descriptive survey was used in the study. The descriptive surveys describe the population being studied. These surveys seek to obtain information about demographic factors such as age, gender, marital status, occupation, race or ethnicity, income and religion and to relate this information to opinions, beliefs, values and behaviours of some group of people. For example, radio broadcasters conduct surveys to find out how popular their programmes are.
A descriptive survey is unique in the number of variables employed in the research. Like other types of research, descriptive research can include multiple variables for analysis (Borg and Gall 1989). Good example, McKenna’s (1993) study on the relationship between attributes of a radio programme and its appeal to listeners. The focus of descriptive surveys is on present day behaviour. Descriptive research is a type of research designed to clearly define a problem: not concerned with the reasons or causes underlying the problem. Case study of a radio station and description of an opinion leader’s views on some science issue are some examples of descriptive research.

4.4.3 In-depth Interview

The in-depth interviews (mixed interviews) were conducted among the programme executives in AIR - Chennai ‘A’, Gyan Vani in Chennai, Anna CR and private FMs in Chennai. Scientists (in industry, the academic community and government), science programme producers, academics and journalists dealing with science and technology. In this study, the researcher interviewed 30 experts about their views on public communication. Four science experts volunteered from each radio station for a face-to-face (i.e. one-on-one), 20 to 30 minutes, in-depth interview.

The interviewees were able to provide detailed information concerning their views, opinions, experiences and feelings on the involvement of people in programming at the station (Bryman 1988; Wimmer and Dominick 1991). Interviewees were deliberately selected to represent a range of science communicator roles including marketing, public relations, journalism and education. Selection was also based on their ability to represent a range of science sectors including not-for-profit, consultancy, corporate and government. Three interviewees had a formal science education and two came from a communications background. This selection reflected the range of roles held by science communicators, and allowed for an array of views and techniques to be discussed.
Each science communicator interviewed worked in a management role and was involved in converting scientific material into a form suitable for their intended audiences. Interviews were conducted in the interviewees’ work environments and lasted from 40 minutes to just over an hour. A plain language statement was provided to each interviewee and their consent was obtained so that they could be identified in this study.

The interview had two main parts. The first section looked at the interviewee’s education and work experience background. The answers provide an insight into the path they took to become professional science communicators and why they were attracted to the profession. The second section looked at the specialized skills and techniques they use to interpret the science they work with. Open-ended questions were used as a template for the interviews because they allowed respondents freedom in their answers and the opportunity to provide in-depth discussion (Wimmer and Dominick 1994). Further, open and closed questions were asked as required. Each interview was tape recorded and transcribed to provide a wealth of qualitative data.

Triangulation of the data in the present study is in the sense of making use of ‘multiple and different sources… to provide corroborating evidence’ (Creswell 1998), rather than in a literal sense. Creswell (2003) uses the term ‘mixed methods’ for a research strategy that has moved forward from the original conception of triangulation of qualitative and quantitative data sources for the purposes of increasing validity. The present study may, therefore, be described as a concurrent mixed methods study, which uses different forms of data collected during the same time span with the aim of integrating these in the interpretation of overall results (Creswell 2003).

4.5 RATIONALE FOR SELECTION OF STUDY AREA

The study area is confined to Chennai. The study area covered Kannigapuram, Mailai Balajinagar, Venkatapuram, Nehru Nagar, Velachery, Kotturpuram, Chitra Nagar, Kabali Thottam Canal, Vannandurai, Mylapore,
and Saidapet in Chennai. AIR, Anna CR, Gyan Vani, and a private FM (Radio Mirchi) have been taken for the study purpose and the broadcasting area of those stations concerned coincide on the aforementioned areas. Hence, by considering these factors the researcher anticipated that usage of radio is high; hence, it would be worthwhile to evaluate the effectiveness of radio regarding science communication.

4.6 POPULATION AND SAMPLE

This section discusses the selection of a suitable sampling procedure and the sample composition in respect of the population considered for the study. Population is defined as the complete set of units of analysis that are under investigation, while element is the unit from which the necessary data are collected.

A purposive sampling procedure was used for selection of radio stations. AIR: Chennai ‘A’, Gyan Vani, Anna CR and a private FM (Radio Mirchi) in Chennai were selected. AIR: Chennai ‘A’ has a coverage area of about 100 km; Gyan Vani, 75 km; Anna CR, 15 km; and private FM (Radio Mirchi) 15 km. It may be noted that these four stations have been chosen because they are the first among radio stations in Chennai. Judgment sampling has been used to select primary (region) and secondary (location) sampling unit, and simple random sampling for tertiary (household) sampling unit and element.

Sample Size – Respondents

The respondents were selected on the basis of simple random sampling. A total of 600 respondents who are radio listeners were selected for the study.

Sample size determination is the act of choosing the number of observations to include in a statistical sample. The size of the sample is an
important feature of any empirical study in which the goal is to make inferences about a population from a sample. The sample size used in a study is determined based on the expanse of data collection. Sample sizes are judged based on the quality of the resulting estimates. With relevance to the present study there was no means to calculate the proportion of the radio listeners in Chennai. Hence, it was needed to rely upon the mean value of the population of Chennai which would be considered as paradox of the population. Thus, the size of sample is being determined approximately with corresponding correlation with the mean of the population (2012) of Chennai (See Appendix 4 for an overview of Chennai).

The justification for the sample size is found in an interesting research on clean energy and the need for science communication foregrounded by the Clean Energy Council of Australia in its report of April 2012. The report titled *Wind Energy Community Research in Victoria, New South Wales and South Australia* uses a sample size of 1200 (n=1200) respondents to do research in two phases. For one phase, however, there were only 600 (n=600) respondents, drawn randomly from metropolitan areas and regional areas containing wind farms in Victoria, New South Wales and South Australia. The sample was also weighted by age, gender and location. Some questions appeared in the survey for both research phases and were, therefore, answered by n=1200 respondents. Questions unique to a particular research phase were answered by n=600 respondents (Clean Energy 2012).

Since this study focuses comparatively on a smaller region comprising metropolitan, urban and slum areas, the sample size was restricted to 600 respondents (n=600). These areas, it may be reiterated, come under the broadcasting territory of the AIR, Anna CR, Gyan Vani and private FM (Radio Mirchi).
4.7 RESEARCH INSTRUMENT FOR DATA COLLECTION

This section explains the research instrument which is used for the data collection of this study.

Survey Research

The questionnaire was conceived to collect the related information. Data Capture Format consisted of five major sections as follows:

- **Section I of the Questionnaire** – Demographic variable and educational qualification
- **Section II of the Questionnaire** – Variable dealing with radio usage i.e. the media access and exposure
- **Section III of the Questionnaire** – Variable dealing with radio listening habits and effectiveness
- **Section IV of the Questionnaire** – Variable with science related information and its impact
- **Section V of the Questionnaire** – Variable with attitude towards radio and perceived usefulness.

Section 1 regarding the basic information about the educational, income, occupational status of the respondents; the second section of the questionnaire consisted registering in the information of the usage of the radio like duration of listening to radio both during week days and holidays, preferences of the radio stations and the programme; third section capturing the information regarding the knowledge of the respondents on science programmes across various stations; fourth section, of obtaining the information regarding the utility of the programmes to the respondents; and
last section, tracing the perceptions of the respondents on science programmes.

Questionnaire has demonstrated acceptable levels of reliability and validity using relevant scales. Questionnaire was designed with some scaling techniques to obtain the relevant data.

In the questionnaire, both the comparative and non-comparative scales were deployed. With comparative scaling, the items are directly compared with each other, non-comparative scaling each item is scaled independently of the others. Constant sum scale is an ordinal level technique and it is a non-comparative sampling type.

Most of the questions in Section 1 formulated under these criteria with regard to Section 2 interval scaling was applied to capture the periodic relevance of listening as to capture the time bound of the listeners in the same section usage of radio. Pair wise comparison scale was adopted in order to derive measurements provided the data derived from paired comparisons possess an appropriate structure.

Section 3 contains the same level of the scaling as mentioned in the previous section and inferred between items from the responses to obtain scale values.

Section 4 represents the same as in the section two. In fifth section Likert scale was used as respondents are asked to indicate the amount of agreement or disagreement (from strongly agree to strongly disagree) on a five-to-nine-point scale. Similar format is used for multiple questions.

This procedure of categorical scaling can easily be extended to a magnitude estimation procedure that uses the full scale of numbers rather than verbal categories.
The responses from the experts in the structured interview generated further questions for analysis on a three-point scale: agree, neutral and disagree.

The Likert style approach was chosen because it is very simple to use and has the ability to gauge reactions. It also provides greater uniformity style the scale consisted of a number of statements where respondents chose and results that could be easily quantified (Wimmer and Dominick 1994).

The number of statements are deliberately kept to a minimum to limit the time and effort required by respondents (Wimmer and Dominick 1994). The Likert style statements are constructed around very broad issues such as education, jargon, complexity and techniques.

4.8 PILOT STUDY

The simplicity of the questions and good structure of the questionnaire are important factors to consider. For this purpose, the initial questionnaire was reviewed by nine experts in the field of science communication – scientists, science broadcasters and academicians. Modifications and corrections were carried out based on the feedback. Thus face validity was established.

The survey instrument was pilot tested in December 2012 with 40 respondents in four locations in Chennai to check for clarity and simplicity. The respondents for the pilot study were the radio listeners who consisted of students, self-employers, office workers, retired people, etc. The respondents reported that the questionnaire was understandable and without ambiguity. One section of the questionnaire administered during the survey addressed the problems and solutions.
The results of the pilot study were encouraging:

- All the participants were willing to engage in the interview process
- Lengths of the interviews were consistent
- The process was not too arduous for the participants
- Gaps in data gathering were identified and rectified
- Language was reviewed to make the questions clearer to the participants
- The respondents were asked whether they expect any area of scientific or technological interest to be broadcast in the AIR, Anna CR, Gyan Vani and private FM (Radio Mirchi) – Chennai, programmes.

From the pilot study, reliability was established. And from the pilot study and from the feedback received, the instrument was fine-tuned to obtain more pertinent information. The final questionnaire instrument and interview instrument, which resulted from this pilot work, can be found in Appendixes 1 & 2.

### Table 4.1 Schedule for Survey Research and In-depth Interview

<table>
<thead>
<tr>
<th>Method</th>
<th>Time Period</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot interviews</td>
<td>October 2012</td>
<td>AIR, Anna CR, Gyan Vani and private FMs: Science communicators (n=8)</td>
</tr>
<tr>
<td>Main interviews</td>
<td>November 2012</td>
<td>AIR, Anna CR, Gyan Vani and private FMs: Science communicators (n=30)</td>
</tr>
<tr>
<td>Pilot survey</td>
<td>December 2012</td>
<td>Chennai: General people (n=40)</td>
</tr>
<tr>
<td>Main survey</td>
<td>January and February 2013</td>
<td>Chennai: General people (n=600)</td>
</tr>
</tbody>
</table>
Field Work

After satisfactorily completing the pilot study, the final version of the corrected questionnaire was administered to the sample respondents. The field work was carried out in the month of January 2013.

4.9 DATA ANALYSIS

The data gathered through textual analysis, survey research and in-depth interview were analyzed systematically. The demographic and exploratory variables were clearly described leaving no room for ambiguity.

4.9.1 Description of the Variables

Descriptions of the variables are as follows:

Demographic Variable

Demographic variables included in the study are: Gender, Age, and Educational Qualification.

Actual Usage

Measurement along two dimensions:

(1) Frequency of use (How often is radio used)
(2) Usage (Hours per week using radio).

Other Exploratory Variables

The variables considered for the study fall under the following categories:
Independent Variable

The independent variables in this study are:

- Content
- Formats
- Time of broadcast
- Area of broadcast.

Dependent Variable

The dependent variables in this study are the following:

- Reach
- Effectiveness
- Level of perception
- Utility
- Understanding about science.

4.10 CONTENT VALIDITY AND RELIABILITY

In this study, the responses received through in-depth interviews and survey research would be subjected to the criteria of validity and reliability.

Content validity means that all aspects of the attribute being measured are considered by the instrument (Bailey and Pearson 1983). In this study, the feedback from the experts during the pre-test and the respondents involved in the pilot study indicated that the questionnaire items covered key features of their respective designated constructs, thus proving the content validity.
In this study, validity and reliability are determined by a few statistical tests. The Cronbach’s alpha test (Cronbach 1951) was used to statistically measure the internal consistency and reliability of the questionnaire (Botosan 1997; Huck and Cormier 1996). Cronbach’s alpha ranges between (0) to indicate no correlation between the parts of the questionnaire and (1) to indicate perfect correlation between these parts. Although the alpha test is not of significance, Botosan (1997) suggests that 0.70 is an acceptable level, and Huck and Cormier (1996) indicate that 0.80 or above is the preferable level.

4.11 STATISTICAL TOOLS AND TESTS USED

The data collected from the respondents were scored, tabulated and analyzed using suitable statistical methods. Frequencies and percentages were used to interpret the categories of personal, socio-economic characters, preferences of programmes, uses, problems and suggestions. SPSS software was used to submit the coded data to statistical tests to find statistically significant differences. The data from 600 respondents were coded and entered into SPSS version 19.5 for statistical data analysis. Since there are possibilities of error in data entry, an independent volunteer was asked to check the codes and for errors and corrections.

Chi-square and Multiple regression are applied to find out the major factors that determine the effectiveness of science communication through radio.

With regard to application of the statistical tools, the researcher needs to run the frequency test and check the data; the researcher has chosen suitable statistical tools for the various objectives. Results of the analyses and justification for the choice of particular test are given in Chapter 6. The tests used are given below:
4.11.1 **Multiple Regression Model**

Multiple linear regression analysis is used to study the combined influence of all the independent variables in explaining the variation on the dependent variable and to identify the variables which contributed significantly towards the variation in the dependent variable. When the numbers of variables which explain the dependent variables are more than one, multiple linear regression analysis can be used.

\[ Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_pX_p + E \]  
\[(4.5)\]

Where,

- **a** = the Y intercept
- **b_1, b_2, \ldots, b_p** = the partial regression coefficients.
- **E** = the error term

As in the case of simple linear regression, omit **E** from the equation. The value **b_1** measures the change in the mean value of **Y** per unit change in **X_1** holding **X_2, X_3, \ldots, X_p** constant.

The specification of the model is:

\[ Y_i = B_0 + B_1 X_{1i} + B_2 X_{2i} + B_3 X_{3i} + B_4 X_{4i} + B_5 X_{5i} + U_i \]  
\[(4.6)\]

Where,

- **Y_i** = Effectiveness of science communication
- **X_{1i}** = Leisure time
- **X_{2i}** = Broadcasting time
- **X_{3i}** = Formats
\[ X_{4i} = \text{Interest} \]
\[ X_{5i} = \text{Usage} \]
\[ U_i = \text{Random disturbance term.} \]

### 4.11.2 Chi-square Test

Chi-square is a non-parametric test used to see the association between two qualitative variables. It can be analysed with the help of the following formula:

\[
X^2 = \frac{n (O_i - E_i)^2}{\sum_{i=1}^{E_i}} \quad (4.7)
\]

Where,

- \(X^2\)- Chi-square
- \(O_i\) - Observed frequency
- \(E_i\) - Expected frequency
- \(i\) - any definite value (\(i = 0, 1, 2, 3\ldots n\))

Degrees of Freedom

\[ df = (r - 1) (c - 1). \]

If chi-square calculated value is less than the chi-square table value or theoretical value, then we conclude that test not significant and vice versa.