

CHAPTER- 3

**RESEACH METHODOLOGY
AND RESEARCH DESIGN**

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RESEARCH METHODOLOGY AND RESEARCH DESIGN

3.0 INTRODUCTION

Human beings are the most intellectual form of animal life. Human intelligence is the greatest gift to mankind through which man can made impartial, empirical and logical analysis that may lead to the development of generalizations, principles or theories, resulting in products and control of events that may be consequences or courses or specific phenomenon. During earlier times human race has used mythology to explain the different phenomenon of everyday life. With the significant advancement of scientific era man became more curious to know about each and every phenomenon of life in a scientific way. Thus to interpret the result of the crude phenomenon of the ancient times they started manipulating things in a scientific approaches.

Before the advent of scientific era human beings have passed through several stages. During these stages they transferred their facts, figures and data from one generation to other until it could take shape of modern era. It took considerable amount of time and experimentation and evolved through the years as science itself evolved. Mans innovativeness has eventually lead to many magnificent discoveries. Today with the rapid, social, economic and technological changes people began to develop new knowledge and concept and with the help of science we can used many things like electricity, radio, television, telephone, computers, etc. in our daily life which leads to improve our living standard. These all discoveries are only possible through research.

3.1 CONCEPT OF RESEARCH

Research is a scientific undertaking which means logical and systematized methods, aims to discover new facts, or verify old facts and to analyze their sequences, interrelationship, casual explanations and the natural laws which govern them. Rapid

social, economic and technological changes of modern time are causes as well as effects of new discoveries, inventions, and findings in various walks of life. Scientific research leads to progress in various fields of life. New products, new facts, new concepts and new ways of doing things are being found due to ever increasing significant research in the physical, the biological, and the social and psychological fields.

3.1.1 Definition

Research is such a vast and multidimensional concept that ordinary definition cannot project its meanings completely. Research is endless quest for knowledge or unending search for truth. It brings to light new knowledge or corrects previous errors and misconceptions and adds in an orderly way to the existing body of knowledge. J. W. Best considered Research as more formal, systematic, intensive process of carrying on the scientific method of analysis. It involves a more systematic structure of investigation usually resulting in some sort of formal record of procedures and a report of results.

According to C.C. Crawford, "Research is a systematic and refined technique of thinking, employing specialized tools, instruments and procedures in order to obtain a more adequate solution of a problem than would be possible under ordinary means. It starts with a problem collects data or facts, analyses them critically and reaches decision based on actual evidence." D. Slesinger and M. Stephenson in the Encyclopaedia of Social Sciences define research as "*the manipulation of things, concepts or symbols for the purpose of generalizing and to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art.*" In short Research is a systematic attempt to obtain answers to meaningful questions about phenomena or events through the applications of scientific procedures.

3.2 RESEARCH METHODS AND DESIGN OF THE PRESENT STUDY

The design of the research project is popularly known as "Research Design". It is the arrangement of conditions which is necessary for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. The present study has been based on the related literature available in the library. Structured questionnaires were designed and distributed among the librarians and scientists of the laboratories to know the information requirements and use of

information by the scientists in the laboratory. This tries to explore the need of the library by the scientist in terms of information requirements. The scholar has been applying appropriate statistical techniques for data analysis. Simple Random Sampling method has been applied for data collection.

Bibliometrics study has been adopted to determine the trend of publications by the scientists/ science and technology communities working at CSIR laboratories of Northeast and Eastern India. With the help of SCOPUS database, the scholar has find out the publications trend. SCOPUS is the largest abstract and citation database of peer-reviewed literatures and quality web with smart tools to track, analyze, and visualize research.

The methodology and designs of this study has been discussed under the following headings:

3.2.1 Method of Research

To collect data from the scientists and Librarians a definite methodology is required. Based on the problem of the study, objectives and hypotheses of the study, the present study has been conducted through survey method. Structured questionnaires were designed and distributed among the Librarians and Scientists of the CSIR Laboratories to know the information requirements and use of information by the scientists in the laboratory. This tries to explore the need of the library by the scientist in terms of information requirements. The present study has been based on the literatures available in the library. The scholar has been applying appropriate statistical techniques for data analysis. Simple Random Sampling method has been applied for selection of sample to collect primary data for the study.

Bibliometrics study has been also adopted to determine the trend of publications by the science and technology communities working at CSIR laboratories of Northeast and Eastern India. Further, the scholar has explored the URL site of CSIR and NISCAIR to obtain primary source of information for the study including the personal visit to the Laboratories to scan the Annual Reports, Highlights, Vision Plan of individual laboratories.

3.2.2 Research Design

The design of the research includes the following outlines:

3.2.2.1 *Topic of Research*

The topic of the present study is, “**Information Use Pattern by Scientists Working at Selected CSIR Laboratories of Northeast and Eastern India: A Study**”.

3.2.2.2 *Area covered under the study*

The study has covered seven CSIR laboratories of North east and Eastern India. In North East India, there is only one CSIR laboratory which is presently known as North East Institute of Science and Technology (NEIST), Jorhat. In Eastern India there are six CSIR laboratories namely Central Glass and Ceramic Research Institute (CGCRI), Kolkata; Indian Institute of Chemical Biology (IICB), Kolkata; Central Mechanical Engineering research Institute, Durgapur; Institute of Minerals and Materials Technology, Bhubaneswar; National Metallurgical Laboratory, Jamshedpur and Central Institute of Mining and Fuel Research, Dhanbad. The present study will basically aim to find out information use pattern by scientists working at CSIR laboratories of North East and selected CSIR laboratories of Eastern India by distributing questionnaires among the scientists working at the selected laboratories.

3.2.2.3 *Sampling Design and Population Size of the Study*

The scholar has been applying appropriate statistical techniques for data analysis. Simple Random Sampling method has been applied for data collection. In the present study the total population is not very small, so the researcher has covered randomly selected population. The population has been identified through various sources like visiting the websites, searching literatures, etc. On the basis of different sources, the population has been divided into two categories:

- The first category of respondents was the Librarian/ librarian in-charge working at the selected seven CSIR laboratories on Northeast and Eastern India. This category of population was the information manager and information provider of the study from which the researcher has received much useful information about the resources, activities, services and users of the KRC's.

- The second category of the study was the Scientists/ Research Scholars of all the seven laboratories which are the information users as they are using the library services.

The researcher has approach the Librarian through the Director and necessary permission has been obtained to survey the scientists in the respective CSIR Laboratories. The researcher also has taken consent from the individual scientists for filling up the questionnaire. The researcher has distributed equal number of questionnaires among the scientists of each laboratory. For distribution of questionnaires the researcher has sent it to the CSIR laboratory through post and sometimes sends it through E-mail. The researcher also visited the laboratories personally and distributed questionnaires to those scientists who have given permission to fill up the questionnaire. There are seven CSIR laboratories in Northeast and Eastern India covered under the study. Total numbers of 350 questionnaires were distributed in the laboratories and finally 288 questionnaires were received back. The percentage of the responds is 82.29%. The **Table- 3.1** below shows the distribution of questionnaires and responses received from the scientists.

Table- 3.1: Distribution of Population and Responses Received

Sl. No.	Name of the Laboratories/ Institutes	Questionnaire Distributed	Responses Received
1.	Institutes of Minerals and Materials Technology (IMMT), Bhubaneswar	50	41
2.	Indian Institute of Chemical Biology (IICB), Kolkata	50	39
3.	Central Glass and Ceramic Research Institute (CGCRI), Kolkata	50	47
4.	Central Institute of Mining and Fuel Research (CIMFR), Dhanbad	50	38
5.	Central Mechanical Engineering Research Institute (CMERI), Durgapur	50	40
6.	National Metallurgical Laboratory (NML), Jamshedpur	50	37
7.	North East Institute of Science and Technology (NEIST), Jorhat	50	46

Source: Computed from surveyed data

The **Table-3.2** and **Figure-3.1** shows the number of questionnaires distributed and collected from each laboratory with percentage of responses.

Table-3.2: Questionnaire Distributed and Received from Each Laboratory with Percentage of Responses

Sl. No.	Name of the Laboratories/ Institutes	Questionnaires Distributed	Questionnaires Received	Percentage %
1.	IMMT, Bhubaneswar	50	41	82
2.	IICB, Kolkata	50	39	78
3.	CGCRI, Kolkata	50	47	94
4.	CIMFR, Dhanbad	50	38	76
5.	CMERI, Durgapur	50	40	80
6.	NML, Jamshedpur	50	37	74
7.	NEIST, Jorhat	50	46	92
Total		350(100%)	288	82.29

Source: Computed from surveyed data

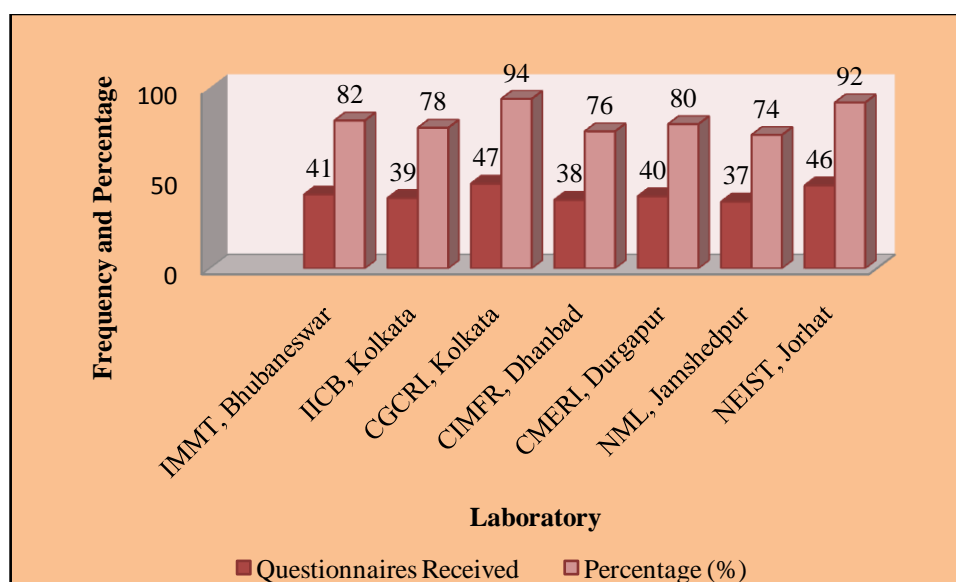


Figure-3.1: Questionnaire Distributed and Received from Each Laboratory with Percentage of Responses

The **Table- 3.2** and the **Figure- 3.1** reveals that overall 350 questionnaires have been distributed among the scientists of the seven CSIR laboratories of North East and Eastern India. Out of 350 questionnaires distributed the research scholar has received 288 responses and representing 82.29%. Further, The research scholar has distributed 50 questionnaires to each of the laboratories out of which total numbers of 41 (82%) of responses received from IIMT, Bhubaneswar; 39 (78%) responses found from IICB, Kolkata; 47 (94%) responses from CGCRI, Kolkata; 38 (76%) responses received from CIMFR, Dhanbad; 40 (80%) responses from CMERI, Durgapur; 37 (74%) responses received from NML, Jamshedpur and 46 (92%) numbers of responses received from NEIST, Jorhat.

The **Table-3.3** shows the designation wise distribution of questionnaire among the scientists and research scholars. Total numbers of 40 questionnaires were distributed among the scientists and 10 scientists are the different categories namely Scientist, Chief Scientist, Principal Scientist, Senior Scientist, Senior Principal Scientist, Outstanding Scientist, Women Scientist, etc. The research scholars include Research Associate, Junior Research Fellow (JRF), Senior Research Fellow (SRF), and Project Assistance.

Table-3.3: Distribution of Questionnaires Designation Wise

Laboratory Name	Scientist, Chief Scientist, Principal Scientist, Senior Scientist, Senior Principal Scientist, Outstanding Scientist, Women Scientist, etc.		Research Scholar (including Research Associate, JRF, SRF, Project Assistance)		Total Received
	Distributed	Received (N= 280)	Distributed	Received (N= 70)	
CGCRI, Kolkata	40	37 (13.21)	10	10 (14.29)	47
CIMFR, Dhanbad	40	28 (10.00)	10	10 (14.29)	38
IIMT, Bhubaneswar	40	32 (14.43)	10	9 (12.86)	41
CMERI, Durgapur	40	33 (11.78)	10	7 (10.00)	40
NEIST, Jorhat	40	38 (13.57)	10	8 (11.43)	46
IICB, Kolkata	40	31 (11.07)	10	8 (11.43)	39
NML, Jamshedpur	40	30 (10.71)	10	7 (10.00)	37
Total	280	229 (81.79)	70	59 (84.29)	288

Source: Computed from surveyed data

The **Table- 3.3** reflects that out of 50 questionnaires 40 questionnaires have distributed to the scientists and 10 questionnaires have distributed to the research scholars. The researcher has received back 37 (13.21%) and 10 (14.29%) questionnaires from the scientists and research scholars from CGCRI respectively, in case of CIMFR 28 (10%) received from scientists and 10 (14.29%) from research scholars, in IIMT, 32 (14.43%) from scientists and 9 (12.86%) from research scholars, CMERI 33 (11.78%) from scientists and 7 (10%) from research scholars, in NEIST 38 (13.57%) from scientists and 8 (11.43%) from research scholars, in IICB 31(11.07%) from scientists and 8 (11.43%) from research scholars and in NML 30 (10.71%) have questionnaires received from scientists and 7 (10%) from research scholars. Out of 280 questionnaires total responses received from scientists were 229 (81.79%) and out of 70 questionnaires the total responses received from the research scholars were 59 (84.29%).

In the present study, the questionnaires were distributed among the Librarians/ librarian in- charge of the institutions for primary information about the library activities and its users. Total numbers of 7 questionnaires were distributed to the Librarians of the KRC and received all the 7 questionnaires were received. The responds rate of the Librarian/ librarian in- charge is 100%. The **Table- 3.4** below is the Category wise distribution of questionnaires and responses received.

Table- 3.4: Category Wise Distribution of Questionnaires and Responses Received

Sl. No.	Category	Questionnaires Distributed	Questionnaires Received	Percentage %
1.	Scientists	350	288	82.29
2.	Librarian/ librarian in- charge	7	7	100

Source: Computed from Surveyed Data

From the **Table- 3.4** it is found that the respondent belongs to scientific category gives 288 (82.29%) numbers of responses. The other category of the respondents is Librarian/ librarian in- charge to whom total numbers of seven (7) questionnaires were distributed and all the 7 (100%) questionnaires were received back.

3.3 METHOD AND TOOLS USED FOR DATA COLLECTION

The data collection method is very important for conducting research. Among all the method of research the most suitable method for the present study is survey method. There are various tools for data collection which is appropriate for survey method. Based on need of the present study following tools are used in collecting data:

- ❖ Questionnaire;
- ❖ Interview; and
- ❖ Observation

3.3.1 Questionnaire

Questionnaire is the useful tool for collecting data during survey. In the present study researcher have developed two structured questionnaire both open and close ended questions and distributed to Librarians and users of the KRC under study. A pilot study has been employed before the actual data collection. The study has been conducted among the 10 scientists and the Librarian of the Northeast Institute of Science and Technology (NEIST), Jorhat and for that the researcher has personally visited and met the scientists and Librarian. Based on the clarification and responses found from them the researcher has finally distributed the questionnaires among the scientists and the Librarians/Library in-charge of each laboratory.

3.3.1.1 Designing of Questionnaires

The researcher was developed two types of questionnaires, one is for Librarian/ Librarian in-charge and another is for the scientists and research scholars to attain the objectives and hypotheses of the study.

❖ *Questionnaire for the Librarian*

The first set of questionnaire prepared for the Librarian includes fifty one (51) questions both direct and multiple choice questions. The questions are related to the general information about the Library, their activities, services, facilities, budget, latest technologies etc. and specimen of the questionnaire is given as Appendix III.

❖ *Questionnaire for the Scientists*

The second set questionnaire was prepared for the scientists to know the information use pattern of the scientists. The first four questions were based on the personal and professional data and the specimen of the questionnaire has been given as Appendix IV. The rest of the questions were multiple choice questions and divide into following Sub-headings:

- Scientists visit to the library;
- Purpose of visiting the library;
- Type of information scientists needed;
- Existence of the Department Library;
- Access the library from the Department or not;
- Type of document search;
- Access Internet;
- Duration of hours to access the internet;
- Use of search engines to access e-resources;
- Frequency of using Electronic Resources and other resources in the institute library;
- Purpose of use of electronic resources;
- Subscription of E-journal consortium;
- Purpose of using the Consortium;
- Type of E-resources accessed publisher wise;
- Get any assistance from the library personnel while accessing e-resources;
- Effectiveness of the E-Resources available in your Knowledge Resource Centre;
- Library providing the required document/ information;
- Satisfaction rate of the respondents;
- Difficulties faced by the users to use the resources of the library; and
- Suggestions for the improvement of the library facilities, etc.

The data collected from the questionnaire has been supplemented by the Interview and Observation methods of data collection.

3.3.2 Interview Method

Interview method of data collection is necessary to understand the target users. In interview method researcher has face to face interaction with the respondent and it gives information which one can never get from the questionnaire method. While conducting the present study the researcher has personally visited the laboratories and their KRC's to contact the Librarian/Library in- charge and also scientists for data collection. Interview method is the path by which Librarian can share their experience and problems and scientists can provide comments and suggestions for the better development of the library and their resources.

3.3.3 Observation Method

Observation means systematic viewing of phenomenon. It is the oldest and well established technique for data collection. Data collected through observation are used for formulation of findings. The researcher has personally visited the entire seven laboratories and observed the condition of the KRC's and also study the activities and services rendered by the KRC's to its users in order to fulfill their information need. The researcher has also observed the library collection, various channels through which the users can access information and difficulties faced by the users while accessing information.

3.4 SOURCES OF DATA COLLECTION

To find out the information use pattern by the Scientists of the selected CSIR laboratories, the following sources were used:

- The scholar has explored the URL site of CSIR and NISCAIR to obtain primary source of information.
- For the study the researcher has personally visited to the selected CSIR Laboratories to consult the Annual Reports, Highlights, Vision Plan of individual laboratories;

- The researcher has also consulted related literature published on CSIR laboratories for example, books, journals, conference article, theses and databases;
- Survey of Scientists and Librarians working at the selected laboratories by using questionnaire to know the information need and use pattern of the scientists; and
- References listed in many research papers, different websites have also been consulted during the study.

In the study, the data has been collected during the period of January 2014 to June 2015 from the Scientists and Librarians of the six laboratories. But in case of National Metallurgical Laboratory (NML), Jamshedpur the data has been received in July, 2016.

3.5 PROBLEMS FACED DURING STUDY

During the survey, the researcher has been faced many difficulties regarding collection of data. Our nation is largely dependent on the R & D activities of our scientists. The CSIR laboratories are the hub of the many important research and development activities which are necessary for our country and kept confidential. Therefore, due to security reasons, it is very difficult to get permission from the concerned authority to enter in the laboratories for consulting any survey or studies. Besides these, it is also difficult to get the responses from the Scientists and also the Librarian/ Librarian in-charge as they are very much busy in their research and other academic and administrative work. The followings are some of the problems faced by the researcher during data collection:

- Some of the scientists were not present as they went to abroad. They were also out of station for attending meetings, conferences, lectures, research work and also some of them were taking leave for other reasons;
- Sometimes they were unwilling to fill up the questionnaires due to confidential reason. They think that the information they are providing may be used in other purpose their responses may be scrutinize by the concerned authority and it may affect their professional development;

- Sometimes the scientists were not able to give time for filling up and returning back the questionnaire;
- Some scientists did not want to fill up questionnaire manually and they were asked for sending the questionnaire through e-mail and they forgot to send back the fill up questionnaire; and
- If the researcher could select the whole population then it would created much difficulties due to the unavailability and unwillingness of the respondents to respond the questionnaire.

3.6 DATA ANALYSIS METHOD

The scholar tried her best to obtain responds from each and every scientist and librarian of the seven laboratories by sending questionnaires through post, e-mail, telephonic conversation and also personal visit to the laboratories. Despite of many visits the investigator could not be received from many scientists due to their unavailability and also unwillingness on their part to fill up the questionnaire. The scholar distributed 350 questionnaires to the respondents and 288 questionnaires have been received back from the respondents. The data collected through these questionnaires were organized and tabulated through MS-Excel by calculating percentages and the hypotheses has been tested by using ANNOVA test. The data is presented in the form of tables and figures along with a brief description.

To study the publication trend of scientists working at selected CSIR laboratories the scholar has used SCOPUS database for exporting the research output from the year 2007 to 23rd May, 2016.

3.6.1 ANOVA Test

Analysis of variance (ANOVA) tests is the testing of hypothesis that the means of two or more populations are equal. ANOVAs assess the importance of one or more factors by comparing the response variable means at the different factor levels. The null hypothesis states that all population means (factor level means) are equal while the alternative hypothesis states that at least one is different.

To perform an ANOVA, we must have a continuous response variable and at least one categorical factor with two or more levels. ANOVAs require data from approximately normally distributed populations with equal variances between factor levels. However, ANOVA procedures work quite well even if the normality assumption has been violated, unless one or more of the distributions are highly skewed or if the variances are quite different. Transformations of the original dataset may correct these violations.

3.6.1.1 Type of ANOVAs

- One-way: One fixed factor (levels set by investigator) which can have either an unequal (unbalanced) or equal (balanced) number of observations per treatment.
- Balanced Model may contain any number of fixed and random factors (levels are randomly selected), and crossed and nested factors, but requires a balanced design.
- General linear model expands on Balanced ANOVAs by allowing unbalanced designs and covariates (continuous variables).

The two hypotheses of the present study have been tested by using ANOVA test.

3.6.2 Bibliometric Analysis of the Research Output of the Scientists

Bibliometrics study has been adopted to determine the trend of publications by the science and technology communities working at CSIR laboratories of North East and Eastern India. With the help of SCOPUS database the scholar has been find out the publication trend. SCOPUS is the largest abstract and citation database of peer-reviewed literature and quality web with smart tools to track, analyze, and visualize research.

3.7 PRESENTATION OF DATA

The researcher has presented data in different ways which are as follows:

3.7.1 Preparation of Tables

The data from the study has been presented and analyzes in the form of tables.

3.7.2 Graphical Representation

To give the clear result of the analysis of data it is important to present the analyzed data with the help of graphical representations like bar diagrams, pie charts, line graph, figures, etc.

3.8 REFERENCING STYLE

The references are which have consulted and cited during the study are prepared mainly based on the APA style for all the type of information resources. The references has been listed in the thesis is in Alphabetical order.

3.9 CONCLUSION

To conduct any research activity it is necessary to undergo research methods and techniques. The present study is based on different methods and techniques and the researcher have used various tools for data collection from the target population. The researcher has adopted most suitable methodology to fulfill the objectives and testing the hypotheses of the study. For collecting information/data, the researcher has visited the laboratories/ institutions personally to observed the present situation of the KRC's, interview and distribute questionnaires to the scientists and librarian/ library in- charge working at the selected CSIR laboratories. The methodology adopted has been suitable for finding out the information use pattern by the scientists. The next chapter (Chapter 4) gives concept of information, use, user studies, information seeking behavior and information use pattern by the scientists.