Chapter 3

Methodology of the study

The purpose of this chapter is to explain the research methodology that will be used in this study. This chapter describes about the research design, data collection methods, instrumentation, sampling procedures, scope and coverage, population, sample and data analysis involved with the study. In addition, this chapter also gives a brief description of the departments involved in the study. Many factors are taken into consideration for the measurements of qualitative attitudes. Academic output of Faculty Members depends on their individual, institutional, environmental and psychological factors. This study aims to measure and rank the research productivity of the Faculty Members on the basis of the publications.

3.1 Data collection method

The research study is based on survey method. The literature is reviewed at depth so that there is a better understanding of the subject and data gathering instruments. It is very important that the data must be acquired accurately, methodically, under the right conditions and with minimum interruption. A structured questionnaire having both close ended and open ended questions was designed to collect data. In some situations when it was not possible to be filled by Faculty Members the information was gathered from their respective websites. Emails were also sent to Faculty Members although it was found that the response from emails is less as compared to direct observation. The data collected is tabulated and presented in the next chapter of data analysis and interpretation. If the researcher needs information available in existing manuals, then interviewing is unnecessary except where the manual is not up to date. If additional information is needed, on-site observation or a questionnaire may be considered. As such various data collection tools are used for this study. Each tool has a special function and depends on the information needed. A mixture of questionnaire, interview methods and websites were appropriate instruments for the study. The questionnaire content was based on the research objectives listed in Chapter 1. The questionnaire included different types of question such as dichotomous question (Yes \ No), multiple choice question and opinion questions. Every question is framed that it should be easy to understand and take little time of the Faculty Members to provide the needed information. Latest technology affords to solve problems of conventional data collection for survey research. The web pages, emails and telephonic survey are detailed and economic.
3.2 Main instruments for data collection

**Questionnaire**

Questionnaires are the most common instruments for data collection. In this method a list of relevant questions pertaining to the survey is prepared and sent to the respondents. The questionnaire contains questions and provides space for answers. Request is made to the informants through a covering letter to fill up the questionnaire and send it back within a specified time.

Following principles are considered while framing the questionnaire:

1. Covering letter: The scholar conducting the survey introduces and state the objective of the survey.
2. Number of questions in the questionnaire are small.
3. The questions in the questionnaire are arranged logically.
4. Questions are short and simple to understand.
5. Personal questions are avoided.
6. Includes both open-ended and close ended questions.

The questionnaire in the present study incorporates questions on the following sections and they are:

- Personal Information about the Faculty Members.
- Departmental details of the Departments under study.
- Publication details
- Research problems

**Personal Interview**

In this method of collecting data, there is a face-to-face interpersonal role situation in which a person called the interviewer asks a person being interviewed and questions are designed to gather information about a problem area. The interview is the oldest and most often used device for gathering information. Awad (2007) It is used for main two purposes 1) as an exploratory device to identify relations or verify information and 2) to capture information as it exists. The interviewer asks questions pertaining to the survey and collects the desired information. Here the response is more as people are willing to supply more information when approached personally. Information collected by this method is more accurate as the interviewer can clear the doubts of the informants and above all supplementary information about the informants personal
characteristics and environment are also covered as such information is very useful while interpreting results. Then the interview proceeds with asking questions properly, obtaining reliable responses and recording them accurately and completely. Regarding the arrangement of interview, it should be arranged so that the physical location, time of the interview and order of interviewing assure privacy and minimal interruption. Appointments are made well in advance and a fixed time period adhered to as closely as possible.

**Websites**

Internet is a worldwide network of networks connecting millions of users, spread across continents, exchanging terabytes of information that covers everything from sports to space, all at a very low cost. The internet is connected via the computer users all over the world. Each computer is connected to the internet using its own unique identification called as address. This addressing system is called the Internet Protocol (IP) addressing system.

Websites are internet based navigational system, an information distribution and management system. A website is a system for organizing, linking and providing point-and-click access among related internet files, resources and services. The point-and-click access is due to the underlying hypertext or hypermedia approach of the web search engine. Hypertext refers to computer-based documents in which cross-references are embedded within documents and other entries. Each cross-reference is a pointer to another document or to other actions, lists or menus. This approach enables a user to move from one place in a document to another in a non-sequential manner. The documents are not just text but it involves multimedia options like graphics, photographs, audio and video or the combination of all. Bajaj and Nag (2012) mentioned that there are more than 1 Billion websites today on internet. Websites can be divided into two broad categories – static and interactive. Interactive sites are part of the Web 2.0 community of sites and allow for interactivity between the site owner and site visitors. Static sites serve or capture information but do not allow engagement with the audience directly.

Oxford advance dictionary (2010 ) A place connected to the internet, where a company or an organization or an individual puts information.

In this study websites is one of the main instruments for data collection. After collection of the preliminary data from the Faculty Members, some information were missing as it was not possible for the Faculty Members to remember all the publications in the period 2000-10. Moreover they were busy with their other academic works so the researcher went 3-4 times to collect the questionnaire from the Faculty Members. In
such a situation Departmental websites were of great help and provided the relevant information. The websites of the respective departments included in the study is given in the Table 3.1 below.

**Table 3.1: Websites of the Departments**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Department</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Department of Statistics, Allahabad University</td>
<td><a href="http://www.allduniv.ac.in">http://www.allduniv.ac.in</a></td>
</tr>
<tr>
<td>2.</td>
<td>Department of Statistics and Operation Research, Aligarh Muslim University</td>
<td><a href="http://www.amu.ac.in/science/statistics">www.amu.ac.in/science/statistics</a></td>
</tr>
<tr>
<td>3.</td>
<td>Department of the statistics, Banares Hindu University</td>
<td><a href="http://www.bhu.ac.in/science/statistics">www.bhu.ac.in/science/statistics</a></td>
</tr>
<tr>
<td>4.</td>
<td>Department of Mathematical Statistics, Delhi University</td>
<td><a href="http://www.du.ac.in/index/statistics">www.du.ac.in/index/statistics</a></td>
</tr>
<tr>
<td>5.</td>
<td>Department of Statistics, Hemvati Nandan Bahuguna Garwal University</td>
<td><a href="http://www.hnbgu.ac.in">www.hnbgu.ac.in</a></td>
</tr>
<tr>
<td>6.</td>
<td>School of Mathematics and Statistics, Hyderabad University</td>
<td><a href="http://mathstat.uohyd.ernet.in/people/Faculty">http://mathstat.uohyd.ernet.in/people/Faculty</a></td>
</tr>
<tr>
<td>7.</td>
<td>Department of Statistics, Indira Gandhi National Open University</td>
<td><a href="http://www.ignou.ac.in">www.ignou.ac.in</a></td>
</tr>
<tr>
<td>8.</td>
<td>Department of Statistics, Manipur University</td>
<td><a href="http://www.maniuniv.ac.in/Department">www.maniuniv.ac.in/Department</a></td>
</tr>
<tr>
<td>9.</td>
<td>Department of Statistics, North Eastern Hill University</td>
<td><a href="http://www.nehu.ac.in/Department">www.nehu.ac.in/Department</a></td>
</tr>
<tr>
<td>10.</td>
<td>Department of Statistics, Pondicherry University</td>
<td><a href="http://www.pondiuniv.edu.in/Department">www.pondiuniv.edu.in/Department</a></td>
</tr>
<tr>
<td>11.</td>
<td>Department of Statistics, Central University of Rajasthan</td>
<td><a href="http://www.curaj.ac.in">www.curaj.ac.in</a></td>
</tr>
</tbody>
</table>
Websites were most useful to fulfill the other important objective of the study. To find the impact of the publications, published by the Faculty Members. Impact of publications is the referred publication which are indexed in the citation databases of Web of Science (WS) and MathSciNet (MSN).

The webpage of the citation database Web of Science is given in the Figure 3.1 below.

**Figure 3.1 : Webpage of Web of Science**
The webpage of the citation database MathSciNet is given in the Figure 3.2 below

**Figure 3.2: Webpage of MathSciNet**

3.3 Scope and Coverage

Central Universities of India

In India, “University” means a University established or incorporated by or under a Central Act, a Provincial Act or a State Act and includes any such institution as may, in consultation with the University concerned, be recognized by the University Grants Commission (UGC) in accordance with the regulations made in this regard under this Act. Central universities are established by the act of Parliament. Currently there are 39 central universities in India and the list is given in the appendix II.

A University established or incorporated by a Central Act. The Central Government provides grants to UGC and establishes Central Universities in the country. The Central Government is also responsible for declaring educational Institutions as “deemed-to-be University” on the recommendation of the UGC.

Role of Central University

Universities in India played a very important role for vibrant society and also for the continuation of its rich democratic tradition. The higher education system in India is one of the largest system in the world, the responsibility rests on the Central Government to devise policies with a view to improving the quality of higher education in India. Improving the quality and access of higher education and research in India has become all the more important keeping in view the growing need of qualified human resource in various
sectors of the economy. The central government lays special emphasis on research and development carried out in technical and other academic institutions.

Central government is responsible for major policy changes relating to higher education. One of the most important tasks is the establishment of central universities across the length and breadth of the country through the acts of legislations posed by the education system. The central universities admit students and provide job opportunities in the field of both teaching and non-teaching on all India level. The central universities have always reflected a national diverse character in the composition of the students, teaching and non-teaching staff.

The Central government is responsible for arranging, allocating and distribution grants for the growth and maintenance of the Central Universities in India. The Government of India initiated a planned development of higher education in the country with the establishment of University Grants Commission (UGC). In 1953 the UGC became a statutory organization by an act of Parliament 1956 for the coordination, determination and maintenance of standards of higher education. The UGC Act 1956 empowers the commission to allocate and disburse grants to the higher education institution in India. The UGC provides grant for both plan and non-plan schemes to the Central Universities. Currently there are 39 Central Universities in India and the list is given in Appendix II.

3.4 Population of the Study

Out of the 39 central universities, 14 central universities have the Department of statistics. Out of the 14 Departments, 11 Departments were used for conducting the detailed survey, as the other 3 Departments were approved by the University but not operational during the time of study. The population of the study included the publications of the Faculty Members engaged at the Eleven Central Universities of India during the period 2000-2010 is given in the Table 3.2.
Table 3.2: List of Statistics Departments

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Allahabad University</td>
</tr>
<tr>
<td>2.</td>
<td>Aligarh Muslim University</td>
</tr>
<tr>
<td>3.</td>
<td>Banaras Hindu University</td>
</tr>
<tr>
<td>4.</td>
<td>Delhi University</td>
</tr>
<tr>
<td>5.</td>
<td>Hemvati Nandan Bahuguna Garhwal University</td>
</tr>
<tr>
<td>6.</td>
<td>Hyderabad University</td>
</tr>
<tr>
<td>7.</td>
<td>Indira Gandhi National Open University</td>
</tr>
<tr>
<td>8.</td>
<td>Manipur University</td>
</tr>
<tr>
<td>9.</td>
<td>North Eastern Hill University</td>
</tr>
<tr>
<td>10.</td>
<td>Pondicherry University</td>
</tr>
<tr>
<td>11.</td>
<td>Central University of Rajasthan</td>
</tr>
</tbody>
</table>

3.5 Department Profiles

A brief profile of all the 11 Departments will be covered in this sub section.
1. Department of Statistics, Allahbad University

The statistics unit was started as Department of Mathematics and Statistics in 1968. On August 21, 2000, the Department was separated from Mathematics and become Department of Statistics. It provides research programmes in all branches of statistics.

The Department conducts the following programmes in

i) UG     ii) PG and     iii) D.Phil in statistics

The Department has 3 Faculty Members, 2 are Professors and 1 is Assistant Professor.
2. Department of Statistics and Operation Research, Aligarh Muslim University

The Department was started in 1953 and the teaching of statistics at PG level started in 1958. The Department publishes the journal ‘The Aligarh Journal of Statistics’ yearly that has a high academic repute. The Department changed its name and become Department of Statistics and Operation Research in 1989. The Department receives special assistance programme from UGC since 2009. The Department has a computing laboratory for research scholars and a smart class for PG students.

The Department conducts the following programmes in i) M.Sc and ii) M.Phil/Ph.D in Statistics.

There are 14 Faculty Members in the Department out which 11 are Professors and 3 are Assistant Professor.
3. Department of Statistics, Banaras Hindu University

Figure 3.5: Department Webpage of Banaras Hindu University (BHU)

The Department of the statistics was established in the year 1950 and the teaching of statistics at post graduate level was started in 1962. The Department is under Faculty of Science. The University Grants Commission supported the Department in the form of Special Assistance Programme (2009-14) and Department of Science and Technology, New Delhi helped it under its FIST Programme (2004-09). Besides, there is a Centre of Population Studies functioning under the Department created by population Council, USA in 1969. The present building of the Department is situated at the ground, first floor and second floor of the old Three Year Degree Course (T.D.C.) building in the Faculty of Science complex which is now popularly known in the University as Sankhyiki Bhawan.

Currently the Department offers courses in i) M.Sc. Statistics and ii) Ph.D Programmes.

Presently, the Department consists has 11 Professors and 3 Assistant Professors.
4. Department of Mathematical Statistics, Delhi University

Figure 3.6: Department Webpage of Delhi University (DU)

The Department of Mathematical Statistics was established in July 1957. In 1987, the Department of Mathematical Statistics was re-named as the Department of Statistics. The Department imparts rigorous training and exposure to the students by introducing the latest state-of-the-art in the programming language and computer software to enable the students to perform statistical data analysis. There is a good collection of books in the Departmental library with latest titles in various areas of statistics. Two computer laboratories with latest computing systems and related equipment have been setup in the Department for the use of students, research scholars and teachers. The Department has its own placement cell operating since academic year 2005-06 to look after the job opportunities of the alumni.

The Department is running the post-graduate (M.A./M.Sc.), M.Phil. and Ph.D. Programmes in Statistics.

There are 4 permanent Faculty Members, 1 is Professor and 3 are Associate Professors.
The Department of Statistics of H.N.B. Garhwal University established at Srinagar and Tehri campus in 1978 with the teaching of undergraduate classes. In 2000 Statistics was also introduced at Master’s level. Later on teaching of statistics was also introduced at undergraduate level at the other campus of Pauri. The Department since inception has been actively engaged in research in the field of Operations Research and Demography. The Department has also completed two major Research Projects sponsored by U.G.C. and C.S.O. At present Department is also running a project of DST Sponsored (Women Scientist Scheme (WOS) for Research in Basic/Applied Science. The Department specializes in the field of Operations Research and Demography.


There are 2 Faculty Members one Associate Professor and one Assistant Professor.
6. School of Mathematics and Statistics, Hyderabad University

Figure 3.8: Department Webpage Hyderabad University (HU)

The Department of statistics and mathematics was established in the year 1978. The Department was renamed as School of Mathematics and Statistics in 2013. The school receives recognition from various funding agencies. DST has selected this school under its FIST (Funds for Infrastructure in Science and Technology) (Level II) scheme. This grant is to support research in areas under Cryptology, Modeling & Simulation and Dynamical Systems. The school is also chosen by the UGC for support under COSIST (Committee for Strengthening Infrastructure in Science & Technology) programme. It is also a recipient of the Special Assistance Programme (SAP) of the UGC. The National Board of Higher Mathematics, (NBHM) has recognized the Departmental library as a regional library of the NBHM. And thus provides library grant each year for subscribing journals in Mathematics and Mathematical Statistics.

The Department offers MSc. and PhD programmes in statistics.

Presently the Department has 18 Faculty Members out of which 6 are Professors, 6 are Associate Professors and 6 are Assistant Professors.
The Department was started in the year 2009.
Currently the programme of Post Graduate Diploma in Applied Statistics is conducted.
There are 4 Faculty Members in the Department, 1 is Associate Professor and 3 are Assistant Professor.
8. Department of Statistics, Manipur University

Figure 3.10: Department Webpage of Manipur University (MU)

The Department provides programmes in Ph.D and MSc. in Statistics

There are 3 Faculty Members in the Department, 1 is Associate Professor and 2 are Assistant Professor.
The Department of statistics was established in 2005.

The course offered by the Department are i) P.G. Diploma ii) M.Sc. iii) M.Phil / Ph.D. in statistics

The Department has 6 Faculty Members 1 is Professor, 2 are Associate Professors and 3 are Assistant Professors.
The Department of statistics was established in the year 2006. The Department is located in a well built building with all the modern facilities. It has a seminar room, Departmental library and one computer laboratory.


There are 8 Faculty Members in the Department. 1 is Professor, 2 are Associate Professors and 5 are Assistant Professors.
The Central University of Rajasthan has been established in February 2009 by an Act of Parliament, the Central Universities Act 2009.

The University started working temporarily from Jaipur and introduced PG programmes in 2009-10 namely M.Sc./M.A. Statistics(Actuarial) in collaboration with Malaviya National Institute of Technology(MNIT), Jaipur.

There are 5 Faculty Members in the Department, 1 is Professor, 2 are Associate Professor and 2 are Assistant Professor.

### 3.6 Citation Database

Citation databases are used to know the importance and assess the publications of the Faculty Members. Two databases Web of Science of Thomson Reuters which is multidisciplinary in nature and the other one is MathSciNet by American Mathematical Society that is in Mathematics discipline.
Web of Science

From the last 50 years, Thomson Reuters (http://apps.webofknowledge.com)) has comprehensively collected data across academic fields, from natural sciences to social sciences and humanities. The policy of indexing and storing of data is very consistent and reliable. A citation index for science was first described in 1955 by Eugene Garfield, the founder and chairman emeritus of ISI, in the journal Science. The result of the publication was the production of the Science Citation Index in 1961. The operating principle of a citation index is: If a researcher knows of a publication important to his or her work, a citation index would allow the researcher to identify journal articles published subsequent to that work which have cited it. Due to the enormous growth of publication, citation, communications, power and software applications, all has made bibliometrics a practical and even cost-effective pursuit. Web of Science includes the Science Citation Index, the Social Science Citation Index, the Arts and Humanities Citation Index, Index Chemicus, and Current Chemical Reactions, resulting in a truly multidisciplinary citation resource. Web of Science, covers 9,300 high-quality, core journals from every field, used by over 3,400 organizations and universities in more than 90 countries around the world,

- 100 years of abstract
- 54 million records covering 5,294 social science publications in 55 disciplines
- 760 million+ cited references
- 6.5 million records across 160,000 conference proceedings
- Multidisciplinary citation index
- All items such as articles, reviews, editorials, letters, book review etc

One can limit a bibliometric analysis to only articles and reviews, or choose to include the more marginal document types.

(Whitepaper 2008) Analysts in many nations issue bibliometric reports at regular intervals called science indicators studies. National Science Foundation (United States), the European Commission, L’Observatoire des Sciences et des Techniques (France), National Institute for Informatics (Japan). Other nations with active bibliometrics groups include Argentina, Australia, Belgium, Brazil, Chile, China, Israel, Italy, New Zealand, Portugal, Spain, Sweden, Switzerland and Taiwan. In almost all cases the citation and publication data of Thomson Reuters form the basis of their bibliometric analysis. As the data collection method is massive and systematic the citation analysis results are statistically significant. This is the reason that Thomson Reuters’ citation index, accessible via Web of Science, is used as the worldwide standard for bibliometrics.

The following steps are used to retrieve the relevant data
1. Using Advanced search feature, the country field tag India (CU = India) was used as the query command and the period of analysis covered (time span) was from 2000 to 2010. The citation database “Science Citation Index Expanded (SCI-EXPANDED)” was checked.

2. From the search results, the Web of Science Categories = (MATHEMATICS OR MATHEMATICS APPLIED OR STATISTICS PROBABILITY) were chosen to refine the search.

3. The analysis was further limited to only journal articles and conference proceedings and books.

4. Author search option was used eg. ‘Distinct Author Sets: chaturvedi ajit∗’

**MathSciNet**

MathSciNet (www.ams.org/mathscinet) is an electronic publication offering access to well maintained and easily searchable database of reviews, abstracts and bibliographic information for the mathematical sciences literature. Over 100,000 new items are added each year, most of them classified according to the http://www.ams.org/msc/ Mathematics Subject Classification. Authors are uniquely identified (by their MR Author ID), enabling a search for publications by individual author rather than by name string. MathSciNet contains almost 3 million items and over 1.7 million direct links to original articles. Bibliographic data from retro digitized articles dates back to the early 1800s. Reference lists are collected and matched internally from approximately 550 journals, and citation data for journals, authors, articles and reviews is provided. This web of citations allows users to track the history and influence of research publications in the mathematical sciences. MathSciNet contains bibliographic data and direct links for Ph.D. theses published in Mathematics, Applied Mathematics and Statistics from the ProQuest Dissertations & Theses database, the most comprehensive collection of dissertations and theses in the world.

The following steps to retrieve the relevant data

1. Publication results for Institutions eg. “(Institution Code=( 6-HYDR-DMS)) AND Pub year in [ 2000-2010]”

2. Publication results for Authors eg. “( Author =(chaturvedi, ajit)) AND Pub year in[ 2000-2010]”

**3.8 Administration of Questionnaire**

A letter detailing the study and its purpose was given to the Faculty Members by the researcher personally. Personal contacts were also used for the Faculty Members working in the different universities of India. As direct access to the Departments was difficult due to time and space constraints, a contact in each University was identified by the researcher to act as a liaison between researcher and Faculty Members. That information which was not able to be collected by the researcher personally, then with the help of web pages
and telephonic interviews data were gathered. The date for launch of the survey was 20 July 2011 and ended by April 2013.

3.9 Limitations of the study.

The study as has been mentioned will be limited to the Central Universities and no other central organizations nor any research institutes having the Department of Statistics neither any state or deemed universities been included under the purview of the study. Further, the study will be confined only to the publications such as articles in the peer-reviewed journals, books, etc and other research output like patent filling, editorials, research reviews etc will be excluded the study. Moreover, the publications of the faculties working exclusively in the Department of Statistics in the colleges affiliated to the Central University will be excluded from the study. Further limitation of the study is it is restricted to one decade i.e, 2000 to 2010.