CHAPTER I

INTRODUCTION

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1.0 PREAMBLE

Scientific publications may be defined as information relating to the outcomes of scientific researches, disclosed to the scientific public, having passed through a peer viewing process, recorded in permanently available form, and in a format based on tradition and common usage. The effectiveness of scientific research performance could be realized only through a proper communication system. Thus science and scientific communication are so interrelated that one influences the other in the information production. Among scientists and social scientists, it is widely accepted that public researches performed in academic and governmental research institutions are the driving forces behind high technology and economic growth. Research makes an important contribution to the economic growth of a nation. Such research output is used as the yardstick for measuring the quality and quantity of research done in a country. It can be seen that during the last few years, metric studies have been increasingly used to evaluate the research performance of the scientists and the growth of various disciplines of science. Hence it implies and induces the researchers to examine the nature and extent of contributions made by the scientists of a particular discipline of a country or a few major countries or for a particular period of time.

Scientometric tools can be used to measure and compare the scientific activities, at various aspects, of participating authors, institutions, countries and funding agencies and publishing channel. They can also be used to measure research collaborations, to map scientific networks, intellectual structure and to monitor the evolution of scientific fields. Scientometrics empirically describes the constantly changing relationship between science, technology and the research productivity. Scientometrics is concerned with the quantitative and qualitative features and characteristics of science and scientific
research. Using mathematical statistical methods to investigate the development and mechanism of science is a prominent area of a study. Such a study helps a) the science policy makers to frame the programmes in research activities, b) prioritize the research areas and c) funding agencies in decision making.

1.1 BIBLIOMETRIC

The term, Bibliometrics, was introduced by Alan Pritchard in 1969. Up to Pritchard (1969), bibliometric studies were called as ‘Statistical Bibliography’. The literature contains various definitions on the term. Pritchard (1969) explained the term as -“the application of mathematical and statistical methods to books and other media of communication”.

Bibliometrics is the technical name for ‘a range of analytical methods using Information-quo-information found organized in bibliographic description of reading materials such as books, periodical articles, reports, patents, softwares, designs, prototypes, and blueprints to develop descriptive statistics, multidimensional analyses, and graphical representations of the output of science’.

Bibliometrics is often used to:

Clarify and assist in the analysis and formulation of science policy by highlighting the networks of researchers or subjects that make up scientific research;

- Providing strategic analysis of the relative position of research performers;
- Sketching profiles of the activities and performance of individual centers;
- Graphically presenting studies of strategic or innovative subjects.
Publication counts, involving counting of scientific publications published by a researcher or a research group;

Citation counts, involving identifying the number of times a specific article is cited in other scientific journal publications to address questions of quality, influence, and the transfer of knowledge;

Co-citation analysis, identifying pairs or groups of articles that are cited together in other articles or publications to derive a 'cognitive structure' that can provide information on the direction and flow of scientific thought;

Co-word analysis, involving assigning keywords to a paper or article by a professional reader. The papers which have the same keywords and sets of words are linked to each other and such relationships are plotted via clustering technique and

Scientific mapping, involving developing a visual model or 'map' of the realm of scientific fields representing the structure of literature output of particular scientific fields."

1.2 SCIENTOMETRICS: ORIGIN

The study of scientific literature has a long history dating back to the early decades of the past century. However, since early 21st century, the field is growing at an enormous pace and attracts interest far beyond the walls of universities and institutions. Nalimov and Mulchenko (1969) coined the term “Scientometrics” which refers to “the application of quantitative methods which deal with the analysis of science viewed as an information process”. Initially scientometrics was restricted to the measurement of science communication whereas bibliometrics was designed to deal with more general information processes. Bibliometrics has developed into a prominent research field that
provides instruments for evaluating and benchmarking research performance. “Scientometrics” is mainly used for the study of all aspects of the scholarly literature.

1.2.1 Scientometrics: Meaning

Scientometrics is a field of science dealing with the quantitative aspects of individual researcher, team, funding, technological input and scientific output but which do not primarily fall within the scope of a particular discipline. The aim of Scientometrics is to reveal characteristics of scientometric phenomena and processes in scientific research for more efficient management of science. Scientometrics is also considered as bibliometric measurement for evaluation of scientific development, social relevance and impact of application of science and technology etc.

Scientometrics is a “quantitative studies of scientific activities as a discipline or economic activity”. ‘Scientometrics analyzes the quantitative aspects of the generation, propagation and utilization of scientific information in order to contribute to a better understanding of the mechanism of scientific research activities.’

Scientometrics is defined as the quantitative and qualitative evaluation and inter-comparison of scientific activity, productivity and progress. Scientometrics deals with the characteristics of the research variables and mapping of science.

1.2.2 Scientometrics: Progress

Scientometric research, the quantitative and mathematical study of science and technology encompassing both bibliometric and economic analysis, is expanding at an enormous pace. The origin of bibliometric research can be traced back to the beginning of the 19th century within areas such as law. Probably the earliest, most definable
research within the scientometric field was the work that gave rise to the laws of bibliometrics - Lotka’s law, Bradford’s law and Zipf’s law. These laws continue to be studied and form the basis of the development of the modern day scientometric literature.

The development of the Impact Factor, the work of Eugene Garfield (1955), is one of the most acknowledged happenings in the field of scientometrics. At that time, Derek De Solla Price was working on the study of the exponential growth of science and citation activity of scientific literature. He described the key elements of scientometric analysis including work on scientific communication pattern and the overall history and study of science itself. In 1960s, there was a tremendous growth in the scientometric literature and from this point forward the field of scientometrics developed and differentiated into several specializations. The term scientometrics gained wide recognition with the publication of the journal ‘Scientometrics’ by Tibor Braun of the Hungarian Academy of Sciences in 1978.

1.3 GOALS OF SCIENTOMETRIC ASSESSMENTS

- Determining the quantity and impact of information production for monitoring research activities.
- Obtaining information for granting starting or closing research projects.
- Studying the structure of science and scientific research.
- Investigating future trends for selecting research priorities and
- Analyzing local, national and international standing of organizations for science policy.
1.4 PROPOSED RESEARCH

Large quantum of research publications are being brought out and added to the existing information heap now-a-days. Such a situation warrants qualitative analysis of the literature being published through metric studies. Such studies help to identify the research performance, emerging research areas, collaboration pattern, citing and cited relationship, quality of publishing documents, journal and channel. Scientometric analysis has received an adequate attention and it has been widely applied to evaluate the research activities of the scientists and the growth of literature. It aims to integrate the cognitive or intellectual structure of research with a view to appraise the relations among the authors, institutions, journal articles and as a means of assisting the peer review procedure. Scientometric analysis of literature in various disciplines has been carried out by using primary or secondary sources to examine the quantitative aspects of literature growth in a particular field of knowledge. Quantitative measurement of publications, citations and other scientometric parameters have been largely applied and used in evaluating scientific research. It has been found from the analysis of reviews (Chapter II) that no such study has been conducted in the past on the literature output in ‘infertility’ research both at national and global level. Hence this study is proposed to examine the literature published on infertility research both quantitatively and qualitatively using data from Scopus database.

1.5 NEED FOR THE STUDY

Scientometrics has become a more powerful instrument of science policy worldwide. It determines the way to prioritize the project funding and assessment of institutional priorities, perspectives, and capacity at a great extent. The scientometric evaluation of research activities is a valuable method for the development of new
scientific and technological knowledge. The publications have become a major concern for the researchers, scientists, scholars and library professionals as they have to keep themselves abreast of new information in their field. As a whole, scientometrics becomes a very prospective research field in the general studies of science, providing powerful and effective instruments for analyses and evaluations in the sphere of science as a significant accelerator of the economic growth and social prosperity. Thus the present study “Research Output on Infertility Literature: A Scientometric Study” is an attempt to explore the characteristics of the research output in the field of infertility.

1.6 SIGNIFICANCE OF THE STUDY

Counting, measuring, comparing quantities, analyzing measurements and quantitative analysis are all perhaps the main tools of science. Peer review still represents the standard approach to research evaluation and decision about allocating resource for science. Experts reviewing the work of their colleagues should rightly be the basis of research evaluation. However it should be one of the several approaches for making policy decisions. One such approach is scientometrics which has turned as the main tool of the science and a quantitative analysis on itself. At it is very fundamental, this approach to research evaluation follows simply counting. The complexity is in the analysis and use of the numbers for the statistics which can be understood as indicators of achievement or lack thereof. Results of such research could provide a better sight on the scientific status of researchers in terms of the type and number of research articles they have published in infertility. Also the results can help the relevant authorities to develop better policies with active participation in the growth and development of infertility research in national and international arena.
1.7 STATEMENT OF THE PROBLEM

The title of the present research study is “Research Output on Infertility Literature: a Scientometric Study”. The study aims to measure the scientific productivity, global share of publications, the growth rate of literature, document and author pattern of publications, most productive institutions and countries and core journals, the impact of research and research network in the field of infertility research during the period of 30 years (1985 – 2014).

1.8 OBJECTIVES OF THE STUDY

I. To quantify the scientific productivity in the field of infertility during 1985-2014.

II. To identify the various characteristics of the published and cited documents.

III. To find out the publication performance of the countries in infertility research.

IV. To explore the scientific impact of the publications using citation indicators.

V. To determine the relationship existing between various Scientometric indicators

1.9 HYPOTHESES OF THE STUDY

On the basis of the objectives stated above, the following hypotheses are formulated for the study:
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<tr>
<th>Objectives</th>
<th>Hypothesis</th>
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<tr>
<td>I</td>
<td>1. There exists an exponential growth rate in infertility publications during the study period.</td>
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<td></td>
<td>2. The scientific productivity of authors in the discipline of Infertility research conforms to Lotka’s law.</td>
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<td>II</td>
<td>3. National / Domestic collaboration is dominating while International Collaboration among all the countries is increasing in infertility research publications.</td>
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<td>4. There will be an increasing trend in infertility literature in future.</td>
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<td>III</td>
<td>5. Research and clinical foundations are actively participating in the infertility research area.</td>
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<td>6. Scientists in developed countries are working in large teams.</td>
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<tr>
<td>Objectives</td>
<td>Hypothesis</td>
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<td>IV</td>
<td>7. Collaboration papers are the most cited documents among the researchers.</td>
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<td></td>
<td>8. There is an association between number of publications of the countries and their high citation impact.</td>
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<td>V</td>
<td>9. There exists a correlation between various Scientometric indicators like author pattern and number of publications, number of cited papers and number of publications, number of citations and number of publications.</td>
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<td></td>
<td>10. There exists a correlation between journal productivity and citations obtained, most productive journals and most cited papers and author pattern and cited papers.</td>
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1.10 METHODOLOGY: SOURCE FOR DATA COLLECTION

There are number of bibliographical databases such as PubMed, Scopus and Web of Science which provide medical bibliographical information. The factors like degree of data coverage, various search strategies available, existence of data saving &
exporting options were considered before selecting the source of data collection. Scopus database is an international multi-disciplinary database indexing over 21,800 titles from more than 5000 international publishers, including 16500 peer-reviewed journals, 367 trade publications, 400 book series and 6.4 million conference papers from proceedings and journals. It has a worldwide coverage of which more than half of the Scopus contents originate from Europe, Latin America and the Asia & the Pacific region. Scopus also offers author profile which covers affiliations, number of publications, citations for each document, citing and cited documents details. Thanks to wider coverage of journals from developed and developing countries, Scopus is expected to generate a better picture of the research indicators on selected areas of research.

The investigator has selected Scopus database since it satisfies the above criteria and covers 100% of Medline database. Hence, necessary bibliographical records were downloaded from Scopus database for this study. This study uses Scopus international database to extract relevant publications data on Infertility research for 30 years period (1985 – 2014). A total of 75098 records on infertility research were downloaded and analyzed.

1.11 SEARCH STRATEGY

The following search strategy has been used to retrieve data.


1.12 SCIENTOMETRIC INDICATORS USED IN THE STUDY
The following indicators were used in the scientometric analysis of infertility literature.

- Document type of the Published and Cited documents
- Author Pattern & Collaboration Analysis of Published and Cited documents
- Geographical Distribution of the Publications
- Continent-wise research output on infertility
- Most Productive Countries in infertility literature
- Most Productive Journals in infertility research
- Most Productive Institutions in infertility research activity
- Ranking of Most Prolific Authors
- Publication Activity Index (AI), Transformative Activity Index (TAI) and Relative Specialization Index (RSI)
- International Collaboration Indicators like International Cooperation Index (ICoi), Affinity Index (AFI) and Internationalization Index (INI)
- Research Profile of India in Infertility Research
• Qualitative indicators like Year-wise Published and Cited Papers with Citations, Authorship pattern Vs Citation Score and Citation Impact of Scientific productivity

• Citation Indicators of the Countries like Research Quality Index (RQI), Publication Efficiency Index (PEI), Relative Citation Index (RCI), Citation Per Paper (CPP) and Attractive Index (AAI)

• Highly Cited Publications and Citation Range of the Cited Publications

• Most Cited Journals in Infertility and their Citation Impact

• Author Productivity and Lotka’s law and Time Series Analysis

• Correlation parameters like Author pattern and Number of Contributions; Citedness and Publications; Publications and Cited papers; Number of Publications and Citations; Number of Cited Papers and Citations; Author pattern and Cited papers; Authorship pattern and Citations; Most Productive Journal and Most Cited Papers; Journal Productivity and Citations obtained and Papers by Productive Authors of India and their Citations

• Network analysis like Co-Author mapping, Co-Author mapping of Cited documents, Author Network of Indian Publication, Institutional network of Indian Publications and country Mapping of Indian Publications.

1.13 ANALYSIS OF DATA AND INTERPRETATION

For the purpose of data analysis, statistical tools like MS-Excel and SPSS (Statistical Package for Social Science) Version 17.0 were used. VOS viewer—the mapping software was used to generate network mapping of selected scientometric variables.
In addition to the frequency distribution and percentage analysis, various statistical tools like coefficient correlation and scientometrics indicators as described above have been employed in the process of analysis and interpretation of data.

1.14 LIMITATIONS OF THE STUDY

a) The study covers the infertility research output of only 30 years i.e. from 1985-2014.
b) The study brings under its preview only those publications which are indexed in Scopus Database.
c) The study does not include the indicators like Keyword analysis, Subject Analysis, Co-citation analysis and reference analysis.

1.15 REFERENCE STYLE

Both for rendering in-text citations and preparing list of references, American Psychology Association (APA) style 6th Edition was used in this study.

1.16 CHAPTERIZATION

The report of the present study is organized into five chapters and the details are given below.

**Chapter 1: Introduction** deals with the origin, definition and progress of Scientometrics as a field of quantitative study. It spells out information about the proposed research - need for the study, statement of the problem, objectives and hypotheses of the study, source of data collection, methodology and indicators used in the data analysis along with limitations of the study and referencing style adopted.

**Chapter 2: Literature Review** presents a comprehensive review of the related literature for the study under various headings like studies based on literature output of medical subjects, Institutional research output, global research output, national research
output, output on non-medical subjects, studies based on databases, individual journal
output, citation scores and individual researcher performance.

Chapter 3: Infertility - An Overview gives an introduction to the subject ‘Infertility’
and describes about determinants, epidemiology and causes of infertility. It also
presents information on the status of Indian infertility research.

Chapter 4: Data Analysis and Interpretation depicts a detailed analysis of
downloaded data in the light of metric indicators. The summarized information is
presented in the form of tables, charts and graphs along with proper interpretations.

Chapter 5: Findings, Suggestions, Discussion and Conclusion presents a summary
of the findings, suggestions, discussion, areas of further research and concluding
remarks.
1.17 CONCLUSION

This chapter has given a bird’s eye view of Scientometrics denoting various facets and indicators. Also, we can find the need and significance of the present study & objectives, hypotheses and limitations of the study here. The next chapter will outline a logically arranged compilation of 108 reviews collected by the researcher on various aspects of Bibliometrics / Scientometrics to serve as her guide posts in the research process.
REFERENCES


