CHAPTER I

INTRODUCTION

1.1 PREAMBLE

India is one of the top most developing countries in the field of Science and Technology. Indian Science has come to be regarded as one of the most powerful instruments of growth and development, especially in the emerging scenario and competitive economy. The high growth in research output in the recent decades is resulted in many related factors like national scientific polices, global developments and it is more specific in developing countries. The conventional models are retreating and online models are replacing them increasingly with high pace. Research output is evaluated in a number of ways by using various metrics tools. To analyze the quality of the research is to measure the number of times the work has been cited. Assessing the quality of the work is based on the type of the journal in which the paper of published. These measuring tools supported scientist to evaluate scientific output of both an institution and the individual researcher.

The quality of research involved in many factors i.e., prestige of the journal, frequency, editorial team, peer reviewing process, impact, number of downloads, hits and many more. To evaluate the output so many metrics from statistical analysis to altmetrics are used. Metric means quantitative measurements.
Science and technology have profoundly influenced the course of human civilization. Science has provided us remarkable insights into the world we live in. The scientific revolutions of the 20th century have led to many technologies, which promise to herald wholly new eras in many fields like Wireless Communication. This study provides the quantitative and qualitative analysis of the progress of Wireless Communication, as reflected in its publications output.

In the 21st Century there have been the developments of bibliometrics, Scientometrics, Webometrics and Informetrics. Library and information science has the capacity to assimilate relevant ideas from different fields of Knowledge. The scientometrics study of library and information science to standardize the techniques to understand the productive pattern of authors. Scientometrics is related to and has overlapping interests with bibilometrics, informetrics and webometrics.

1.2 **SCIENTOMETRICS: AN OVERVIEW**

Scientometrics is the study of measuring and analyzing science, technology and innovation. The term ‘Scientometric’ often used synonymously as ‘Bibliometric’, this originated in Russia. Scientometrics is quantitative methods of application in measuring science. The measurement involves counting artifacts to the production and use of information, and arriving conclusions from the counts. Scientometrics and Bibliometrics took a sharp rise since the late sixties. In seventies, when data collection was often still a matter of manual work, the field Bibliometrics was characterized by the personalities of enthusiastic researchers much in the way of a ‘hobby’ to later integrates interdisciplinary approaches as
well as mathematical and physical models on one side, and sociological and psychological methods on the other.

Scientometrics is related to and has overlapping interests with Bibliometrics and Informetrics. The terms Bibliometrics, Scientometrics, and Informetrics refer to component fields related to the study of the dynamics of disciplines as reflected in the production of their literature. There are many definitions for the term “Scientometrics” in the literature; Scientometrics is the quantitative study of the disciplines of science based on published literature and communication. This could include identifying emerging areas of scientific research, examining the development of research over time, or geographic and organizational distributions of research.

Tague-Sutcliffe (1992)\(^1\) defines Scientometrics as "the study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities, including, among others, publication, and so overlaps bibliometrics to some extent”.

Van Raan (1997)\(^2\) believes that scientometric research is devoted to quantitative studies of science and technology. It aims at the advancement of knowledge and the development of science and technology; it is also in relation to social and political questions. He divides the core interests of scientometric research to four interrelated areas:
• Development of methods and techniques for the design, construction, and application of quantitative indicators in important aspects of science and technology.

• Development of information systems in science and technology.

• Study of the interaction between science and technology.

• Study of cognitive and socio-organizational structures of scientific fields and developmental processes in relation to social factors.

“Scientometrics” is the English translation of the tile word of Nalimov’s classic monograph Naukometriy in 1969, which was relatively unknown to western scholars even after it, was translated into English. Without access to the internet and limited distribution, it was rarely cited. However, the term became better known once the journals Scientometrics appeared in 1978 (Garfield, 2007)³

Scientometrics was first defined by Nalimov (1971)⁴ as developing “the quantitative methods of the research on the development of science as an informational process”. It can be considered as the study of the quantitative aspects of science and technology seen as a process of communication. Some of the main themes include ways of measuring research quality and impact, understanding the processes of citations, mapping scientific fields and the use of indicators in research policy and management. Scientometrics focuses on communication in the sciences, the social sciences, and the humanities among several related fields:
Bibliometrics: “The application of mathematics and statistical methods to books and other media of communication” (Pritchard 1969). This is the original area of study covering books and publications generally. The term “bibliometrics” was first proposed by Otlet (1934).

Informetrics: “This study of the application of mathematical methods to the objects of information science” (Nacke, 1979, p. 220). Perhaps the most general field covering all types of information regardless of form or origin (Bar-Ilan, 2008; Egghe & Rousseau, 1990; Egghe & Rousseau, 1988; Wilson, 1999).

Webometrics: This study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web drawing on bibliometric and informetric approaches (Björneborn & Ingwersen, 2004, p. 1217; Thelwall & Vaughan, 2004; Thelwall, Vaughan, & Björneborn, 2005). This field mainly concerns the analysis of web pages as if they were documents.

Altmetrics: “This study and use of scholarly impact measures based on activity in online tools and environments” Priem (2014). Also called Scientometrics 2.0, this field replaces journal citations with impacts in social networking tools such as views, downloads, “likes”, blogs, Twitter, Mendelay, CiteULike. In this review we concentrate on scientometrics as that is the field most directly concerned with the exploration and evaluation of scientific research. In fact, traditionally these fields have concentrated on the observable or measurable aspects of communications – external borrowings of books rather than in-library usage; citations of papers rather than their reading – but currently online access and downloads provide new modes of usage and this leads to the developments in webometrics and altmetrics that will be discussed later. In this
In section we describe the history and development of scientometrics (de Bellis, 2014; Leydesdorff & Milojevic, 2015) and in the next sections explore the main research areas and issues.

1.3 PROPOSED RESEARCH / NEED FOR THE STUDY

Scientometric analysis of scientific publications is an important aspect of research endeavor in Information Science. It could be attributed to the fact that scientometric studies are used to identify the pattern of publication, authorship, citations, secondary journal coverage and so on. These factors can give an insight into the dynamics of a subject which consequently lead to better information handling and management.

In the wake of the recent developments and the new demands that are being placed on the wireless communication system, it is necessary for us to embark on some major science projects, which have relevance to national needs, and which will also be relevant for tomorrow's technology.

It is necessary is to examine the status of Wireless Communication Technology in the country, its strong and weaker areas of research, quantity & quality of research output, and dynamics of research across institutions, sectors, geographical regions and subjects. Such a study may prove useful for Indian science planners & policy-makers for gaining macro insights into the country’s Wireless Communication system.

On review of the literature it was found that, no such study has been conducted either at macro or micro level on the growth pattern of literature in the
field of Wireless Communication. A large number of articles in journals, research papers presented in conferences, reports and so on are published on Wireless Communication. Since there is a continuous generation of information in the field of Wireless Communication, it is found essential to study quantitatively the output of literature by applying scientometric tools/indicators. Hence it is proposed to study quantitatively the literature published on Wireless Communication by using the SCOPUS bibliographic database.

1.4 STATEMENT OF THE RESEARCH TITLE

“SCIENTOMETRIC ANALYSIS OF LITERATURE ON WIRELESS COMMUNICATION (1998-2012) USING SCOPUS DATABASE”

1.4.1 Explanation of the concepts in the Title

a. Scientometric analysis

Scientometrics is the science of measuring the “quality” of science. It is often done using bibliometrics which is a measurement of the impact of scientific publication. It includes all quantitative aspects of the science of science, communication in science, and science policy.

Scientrometrics used to mean communication process in science including social- culture aspects and appears to be almost synonymous to science of science. Scientrometrics can be treated as an analogue concept to bibliometrics. The term Scientrometrics is a field which applies quantitative methods to the study of science as an information process. Thus scientrometrics is a part of the sociology of science and has application to science policy making\textsuperscript{11}. 
b. Wireless Communication

The term “wireless” is often used to describe all types of devices and technologies that use space as a signal-propagating medium and are not connected by wire or cable. Wireless communication defined as the transmission of user information could be in the form of human voice, digital data, e-mail messages, video and other services. Wireless communication is revolutionizing almost every aspect of our daily lives. Through the wireless communication we can send and receive messages, browse the internet and access the corporate database anywhere at any time. Wireless communication is by any measure, the fastest growing segment of the communications industry. As such, it has captured the attention of the media and the imagination of the public. In addition, wireless local area networks currently supplement or replace wired networks in many homes, businesses, and campuses.

Many new applications, including wireless sensor networks, automated highways and factories, smart homes and appliances, and remote telemedicine, are emerging from research ideas to concrete system. The explosive growth of wireless systems coupled with the proliferation of laptop and palmtop computers indicate a bright future for wireless networks, both as standalone systems and as part of the larger networking infrastructure.

However many technical challenges remain in designing robust wireless communication that deliver the performance necessary to support emerging applications. In this I have describe current wireless systems along with emerging systems and standards.\textsuperscript{12}
c. **SCOPUS**

SCOPUS, a product of Elsevier Publishing Co., was commercially launched in November 2004 as "the world's largest abstract and indexing database," reputedly spanning the full spectrum of science-technology-medicine (STM) literature plus more limited coverage of the social sciences. This can be used to track, analyze and visualize the scientific communication in any discipline like Wireless Communication.

SCOPUS is a bibliographic database containing abstracts and citations for academic journal articles. It covers nearly 22,000 titles from over 5,000 publishers, of which 20,000 are peer-reviewed journals in the scientific, technical, medical, and social sciences (including arts and humanities).

As research becomes increasingly global, interdisciplinary and collaborative, it can make sure that critical research from around the world is not missed when it choose SCOPUS.

1.5 **OBJECTIVES**

The study has been designed with the following objectives:

i. To examine the growth of literature on Wireless Communication published during 1998 -2012.

ii. To identify and analyze the country wise production of Wireless Communication research output.

iii. To assess the extent of research in India on Wireless Communication.
iv. To study the authorship pattern

v. To study the implications of Bibliometric laws on Wireless communication research

1.6 HYPOTHESES

The following are the hypotheses formulated for this study:

i. There is a declining trend in the Relative Growth Rate (RGR) and correspondingly an increasing trend in the Doubling time (Dt) in Wireless Communication research.

ii. Collaborative research dominates in the field of Wireless Communication.

iii. The Wireless Communication research productivity confirms the implications of Bibliometric Laws

iv. There exists a significant level of difference between Wireless Communication research performance of Indian scientists and scientists of other countries.

v. Among the developing countries, India contributes substantially to the Wireless Communication research.

1.7 SCOPE AND COVERAGE

This study is confined to the literature covered in SCOPUS bibliographic and citation database covering the period of 15 years i.e. 1998 – 2012. Generalizations have been done based on the data pertained to the above
mentioned period. The findings of this study apply mainly to the fields come under the scope of Wireless Communication research.

In this study, the status and progress of Indian research output of Wireless Communication has been examined. This study also identifies the factors underlying its growth, stagnation and decline. It also examines India’s position vis-à-vis select developed and developing nations, in terms of its research output, citation visibility. Further the study describes the broad features of India’s wireless communication, in terms of size and growth of its publications output, type of institutions participating in wireless communication research, their pattern of research output, concentration and scattering of institutional productivity, performance across institutions, sectors, geographical regions and subjects, type of collaboration, and measurement of publications quality in terms of average impact factor and citations per paper.

1.8 METHODOLOGY

The flowchart presentation as given in the Figure 1.1 which serves as a methodology of this study.
The present study’s research methodology is designed as follows:

i. **Research Strategy**

The data has been extracted from SCOPUS international multidisciplinary database for this study and the following search strategy has been used to extract the data: \textit{TITLE-ABS-KEY} ("wireless communication") AND \textit{PUBYEAR} > 1997 AND \textit{PUBYEAR} < 2013”. The search was carried out on 25/12/2013 and refined to restrict the literature to articles, conference papers and reviews published in journals.

ii. **Data Extraction**

In this SCOPUS database that search criteria yielded 32299 articles in the field Wireless Communication which are attributed to the Wireless
Communication research. The information relating to Title, Author, Affiliations, Document type, and number of citations, source title and keywords, etc

iii. Statistical Tools

The following statistical tools were used for analysis of data of the present study. Arithmetic mean, percentages, averages and cumulative percentages were the statistical tools used in analyzing the data.

- Relative Growth Rate (RGR)
- Doubling Time (Dt)
- Citation Per Paper (CPP)
- ‘h’ – Index
- Collaborative coefficient (CC)
- Activity Index (AI)
- Co-authorship Index (CAI)
- Author Productivity
- Bibliometric Laws

iv. Data Analysis

All the available data collected from database analyze and processed with the help of MS-Excel and “Statistical Package for the Social Sciences” (SPSS) software packages.
1.9 CHAPTERIZATION

The thesis has been presented in six chapters

Chapter 1 provides the overview of scientometrics, objectives, hypotheses, need for the study and statement of the research title, scope and research methodology.

Chapter 2 presents the review of literature related to scientometrics / bibliometrics studies.

Chapter 3 provides a brief note on Wireless Communication as an academic discipline

Chapter 4 deals with the description of source database and research design which includes data collection, data processing procedures and explanation of various scientometric indicators/tools and techniques.

Chapter 5 discusses the results of the analysis and interpretation of data on Wireless Communication research output.

Chapter 6 provides a brief summary of the findings and observations, findings in relation to hypotheses and directions for future research.
REFERENCES


