

## Chapter 42

# Advancement and Application of Scientometric Indicators for Evaluation of Research Content

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### ABSTRACT

*To quantify science and to handle the scientific information, various methods are used. Researchers and scientists use varied techniques for fundamental concepts which are more or less auxiliary and corresponding to a certain extension with respect to their applications. Scientometrics, in this context, is a novel scientific field joining science and technology with information science and expending numerous mathematical, statistical, data mining techniques, and procedures to measure and quantify scientific information. The focus of scientometrics as a discipline is the literature of science and technology. The chapter thus aims to discuss the concept of scientometrics and its indicators that are employed to assess the quality of scholarly content. Further, the chapter also discusses the pros and cons of prominent scientometric indicators that are currently employed in assessing the performance of an individual researcher, institution, or country.*

### INTRODUCTION

The 20th century may be designated as the century of the growth and development of metric sciences (Kumar et al., 2009). There has been a tremendous development of metric based fields like Bibliometrics, Scientometrics, Librametrics, Technometrics, Sociometrics, Econometrics, Biometrics, Cybermetrics or Webometrics in this epoch.

Scientometrics can be considered as an analogous conception to bibliometrics. Scientometrics is a novel scientific field joining science and technology with information science and expending numerous mathematical, statistical, data mining techniques and procedures to measure and quantify scientific

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information. It can be perceived as a discipline of science that encompasses bibliometrics, informetrics, webometrics, librametrics and other metric sciences. As matter of fact, today when the phase of scientific and technological revolution is massive but funding resources are trifling, the measurement of eminence of research productivity is essential and acknowledged by many. The basic requirement is to endorse the progression of science as competently as possible, i.e. to in the best way upsurge the power/prize degree from the financing science (Fiala, 2013). The term scientometrics was introduced by Vassily V. Nalimov & Z. M. Mulchenko in 1969 as *Naukometriya* in Russian, meaning the study of the evolution of science through the measurement of scientific information (Glanzel, n.d.). As per Tague-Sutcliffe (1992) Scientometrics is concerned with the quantitative facets of science. The focus of scientometrics as a discipline is the literature of science and technology. Price (1961, 1963) defines Scientometrics as a science about science. It offers numerous perceptions, representations, and practices to researchers that when functional in an academic field helps to understand its fundamentals, position, knowledgeable core, and probable forthcoming progress. Wilson (1999) indicated that everything that encompasses quantitative features of science of science, science communiqué and science policy are in the content of scientometrics. While defining the term Van Raan (1997) also accentuated the quantitative learning of science and technology. Vinkler (2010) defined that Scientometrics cannot be circumscribed within the circle of a scientific discipline. He widened the description as quantitative study of people, sets, materials and phenomena in science and their relationships. Further, he adds that scientometrics also covers various other aspects like practices of researchers, socio-organizational arrangements, administration, procedures, national economy. He also specified that Scientometrics could be foundation of statistics and also can indicate the policy in science like performance checking, research precedence assortment, science-society or science-economics relative scholarships. Wilson (1999) considers scientometrics as an organized method to assess the past, present, and future progression of science as he believes that its origin is from the interest of trivial group of scholars in the subtleties of science.

## **BACKGROUND**

The term “Scientometrics” was not noticed in Western scientific circles until it was translated into English. The roots of Scientometrics lie in the survey piloted by Galton in 1874 among 180 prominent scientists in Britain in order to measure, comprehend, and define the eminence of significant scholars and their potentials (Godin, 2006). Then in 1900’s James McKeen Cattell, the Psychologist and Editor of *Science*, enthused by Galton measured scientific growth by observation and classification. He offered two important facets of scientific output: quality (i.e. worth as adjudicated by peers) and quantity (i.e. production). After that, in 1926 Lotka’s mathematical model to estimate the frequency of author’s publication in a field, in 1934, Bradford’s distribution law for articles through a set of journals.. Further the outline put forth by Price (1961, 1963) regarding the historical evolution of science and Bernal’s (1939) theory of the social function of science, idea of sociology of science by and Merton (1968, 1973) provided a back bone to the development of the field. Finally in 1969 the field was given a comprehensive name “Scientometrics” by the Russian mathematician Vasilii Nalimov. In 1977, this area took a great leap when a maiden issue of *Scientometrics* journal by T. Braun was available, and the term received an academic acknowledgement. And today, there are numerous journals dedicated to scientometrics and its related fields like, *Research Policy*, *Journal of Informetrics*, *Social Studies of Science*, *Journal of the American Society for Information Science and Technology*, etc.

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