

# Introduction to Bibliometrics and Scientometrics

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# What is Bibliometrics?

- A field of study which uses mathematical and statistical techniques to study publishing and communication patterns in the distribution of information (Diodato, 1994).
- Mathematical and statistical analysis of patterns that arise in the publication and use of documents.
- Publications as used in bibliometrics refer to scientific information sources/resources.

# What is Bibliometrics...Ctd?

- The use of published scientific literature (articles, books, conference proceedings, etc.) for measuring research activity e.g. output volume, science 'quality', interdisciplinarity, networking (Grant, 2015)
- New knowledge created by scientists is embedded in the scientific literature; by measuring scientific literature, we measure knowledge and the ways it is produced.

# Bibliometrics vs. Informetrics

- Sometimes used interchangeably but there is a distinction between the two concepts.
- Informetrics deal with analysing the patterns in the production and use of any form of information. Bibliometrics deal with published information.
- Thus, bibliometrics can be considered as a subset of informetrics.

# What is Scientometrics?

- Scientometrics applies bibliometric approaches to science (physical and natural sciences excluding social sciences).
- Scientometrics also goes beyond the usual realms of bibliometrics e.g. when it considers the politics or development of science.
- Policies on scientific research at all levels also fall within the ambit of scientometrics.

# The three Metrics Compared

- Informetrics deals with all forms of information – scientific and non-scientific.
- Bibliometrics deals with all scientific publications in all fields of study.
- Scientometrics deals with scientific publications in the disciplines in natural and physical sciences.
- Scientometrics is confined; bibliometrics is wide while informetrics is overall.

# Descriptive vs. Evaluative Metrics

- Descriptive metrics deal with measuring the production of publications in a given field for the purpose of comparing the amount of research in different countries; the amount of research produced during different periods of time; the amount of research output produced in different subdivisions of the field; or a combination of all the above.

# Descriptive vs. Evaluative Metrics...Ctd

- Evaluative metrics assesses the quality and impact of scientific publications.
- Evaluative metrics focuses particularly on the evaluation of scientific activity, and more, in particular, on quality aspects of scientific performance (Narin, 1976).
- Such a study is often made by counting the references cited by a large number of research workers in their papers.



# Historical Background

- The term bibliometrics was coined by Allan Pritchard in 1969. He defined it as “the application of mathematics and statistical methods to books and other media of communication”.
- However, the concept is much older as it can be traced back to 1896 when Campbell used statistical methods to study subject scattering in publications.

# Historical Background...ctd

- This was followed by a 1917 study by Cole and Eales who statistically studied the growth of literature in comparative anatomy between 1550-1860 through bibliographical citations.
- In 1923 Hulme proposed the use of counting of publications to understand the development of science and technology.
- Ranganathan proposed librametry in 1948.

# Foundations

- Bibliometrics is based on the assumption that the majority of research findings are published as articles in academic journals and are read in that context by other researchers who then go on to cite these articles in their subsequent articles.
- The more citations an article receives, the greater the impact this can be taken to have had.

# Foundations...ctd

- Bibliometrics involves measuring the number of published academic articles by a certain group of authors and the number of times these articles are cited, as well as studying the statistical connections between different articles, authors and subjects.
- Although there is no absolute consensus about bibliometrics, it is gaining prominence on the research scene.

# Sources of Bibliometrics Data

- Thomson Reuters Citation Indices:
  - Science Citation Index Expanded
  - Social Sciences Citation Index
  - Arts and Humanities Citation Index
- Pubmed/Medline
- Scopus
- Google Scholar
- Institutional repositories

# Application

- Ranking of universities and departments based on scientific production.
- Evaluation of publications and other information resources.
- Assessment of factors which influence information production, flow and use.
- Analysis of trends in the themes and consumption of information and knowledge.

# Application...ctd

- Evaluation of the effectiveness or impact of information services.
- Conducting a quantitative analysis of academic literature.
- Identifying areas of research strengths and weaknesses.
- Identifying top researchers or scientific journals.

# Limitations of Bibliometrics

- Citation patterns can differ greatly between disciplines.
- Some disciplines such as the arts, humanities and social sciences rely less on publishing in journals yet bibliometrics commonly focuses on journal article citations.
- A paper may be cited in a negative rather than a positive way yet the citation would still be counted.



# Limitations of Bibliometrics...ctd

- The tools used to gather bibliometric data do not cover all research areas and do not index all publications. Results will vary depending on the tool you use.
- Manipulation of the system by researchers inappropriately self-citing, citing colleagues, splitting outputs into many articles etc can distort the data.

# Tips for Success

- Always compare like with like
- Don't rely on a single bibliometric tool
- Be aware that some disciplines rely less on publishing in journals than others and will therefore fare less favourably.
- Put the data in context using a combination of metrics and other qualitative information where appropriate.