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## UNLEASHING THE POTENTIAL OF METRIC TERMINOLOGIES IN LIBRARY AND INFORMATION SCIENCE RESEARCH

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# Unleashing the potential of metric terminologies in library and information science research

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**Abstract:** Metric terminologies hold immense potential for enhancing the rigor, precision, and replicability of library and information science (LIS) research. This article explores the untapped potential of metric terminologies in the realm of library and information science research. By delving into the significance of metrics, the study elucidates their role in enhancing the effectiveness and precision of scholarly communication. Investigating the diverse applications of metrics, from bibliometrics to altmetrics, the article underscores their utility in gauging research impact and shaping information dissemination strategies. Through a comprehensive examination, it unveils the myriad opportunities for leveraging metric terminologies to propel advancements in library and information science research, offering a nuanced perspective on the transformative power of metrics in the academic landscape. By embracing metric terminologies, LIS researchers can elevate the quality and impact of their contributions, propelling the field towards a more data-driven, evidence-based, and interconnected future.

**Keywords:** Bibliometrics, Scientometrics, Webometrics, Informetrics, Altmetrics, Wikimetrics, Blogometrics

## 1. INTRODUCTION

The twentieth Century is referred to as a result of the century of metric sciences as metriometrics science (Newton and Gomathi, 2017). In this era of dynamic information ecosystems, the role of metrics has gained prominence, providing a systematic approach to assessing, quantifying, and maximizing the impact of library resources and services. The contemporary research thrust areas of Library and information science based on measurement process (Chellappandi and

Vijayakumar, 2018). The library information science (LIS) landscape is undergoing a dramatic transformation, driven by the digital revolution and the increasing availability of new ways to evaluate library services. Metrics provide valuable insights into the impact, discovery and usefulness of research results, enabling informed decision-making and resource allocation. This concept paper aims to highlight the importance of metrics in LIS research are clear, it provides strategies for leveraging their potential to drive innovation and efficiency in the field.

## **2. CONCEPT**

Over the past few decades, research has experienced exponential growth, surpassing the available public funding in numerous countries. This trend has sparked discussions regarding the optimal utilization of research resources, especially in the realm of basic research, where immediate practical applications may not be readily apparent (Boreman, 2012). Research into scientific work is central to the pursuit of improving knowledge and innovation. Metrics are standardized tools for quantifying and measuring the impact, visibility, and quality of scholarly output. The concept of metric terminologies arises from the need to evaluate scientific work, and it is extensively utilized in the field of library and information science.

### **2.1. METRICS: AN OVERVIEW**

The significance of quantitatively measuring the attributes of familiar objects has been widely acknowledged as essential for deepening the comprehension of our surroundings. This concept has been effectively encapsulated by Lord Kelvin (Dhyani, Ng & Bhowmick, 2002). Metrics play an important role in organizations, serving as a powerful tool to set goals, deliver new features and releases to customers, determine the appropriateness of tests and trials, and efficiently allocate resources (Dmitriev and Wu, 2016).

### **2.2. MEANING AND DEFINITION**

The word 'Metric' derived from the Latin word '*metricus*' metrical, Greek word '*metrikos*' and French word '*metrique*' which means "measurement". A metric is a quantifiable measure used to assess, compare, and track the performance, progress, or quality of a particular process, system, or entity. Metrics are commonly employed in various fields, such as business, engineering, healthcare, and technology, to evaluate and improve outcomes, make informed decisions, and set goals (Merriam-Webster, n.d.).

## **2.3. USES OF METRICS**

Metrics serve as valuable tools for monitoring, analyzing, and improving performance across various aspects in different subject domains. When the term 'metrics' is added as a suffix to a field of activities, it indicates the application of mathematical or statistical measuring techniques to that field. This results in the creation of a new subfield, by merging the original term with 'metrics'. For example, 'biology' becomes 'biometrics', 'sociology' becomes 'sociometrics', 'psychology' becomes 'psychometrics', and 'economics' becomes 'econometrics' (IGNOU, 2017). In these fields various standard techniques of mathematics and statistics have been extensively used for better understanding of these subjects and their applications.

## **3. METRICS TERMINOLOGIES IN LIS RESEARCH**

In library and information science (LIS) research, various metrics and terminologies are used to measure and evaluate different aspects of information resources, services, and systems. Metrics are valuable tools for researchers, institutions, and policymakers to make informed decisions, benchmark performance, and track the impact of research activities. However, it's essential to use a combination of metrics and consider their limitations to gain a comprehensive understanding of research impact and effectiveness. Here are some key metric terminologies commonly employed in LIS research:

### **3.1. USE OF METRICS FOR RESEARCH DATA ANALYSIS**

Metrics play a crucial role in research data analysis by providing quantitative measures to assess various aspects of research output, impact, and efficiency. Here are several ways in which metrics are used in research data analysis:

#### **3.1.1. Publication Metrics:**

- **Citation Analysis:** Assessing the impact of research publications by analyzing the number of citations they receive. This helps researchers understand the influence of their work within the academic community.
- **Impact Factor:** Evaluating the prestige and visibility of journals by considering the average number of citations received by articles published in those journals.

#### **3.1.2. Author/Productivity Metrics:**

- **H-Index:** Quantifying an author's or researcher's productivity and impact by considering the number of publications and their respective citation counts.
- **Publication Count:** Simple counts of the number of publications produced by an individual or research group.

#### 3.1.3. **Altmetrics:**

- **Social Media Mentions:** Tracking the mentions and discussions of research outputs on social media platforms to gauge public engagement and interest.
- **Downloads and Views:** Examining the number of times a research paper or dataset has been downloaded or viewed online.

#### 3.1.4. **Usage Metrics:**

- **Downloads and Access Logs:** Monitoring the usage of digital resources, such as datasets, software, or publications, to understand their popularity and relevance.
- **Usage Statistics:** Analyzing how often library resources, including books and journals, are borrowed or accessed.

#### 3.1.5. **Web Analytics:**

- **Website Metrics:** Evaluating the performance of research-related websites, repositories, or platforms through metrics such as page views, unique visitors, and bounce rates.

#### 3.1.6. **Research Collaboration Metrics:**

- **Collaboration Networks:** Analyzing collaboration patterns among researchers and institutions to identify key players and foster collaborative research efforts.

#### 3.1.7. **Grant and Funding Metrics:**

- **Grant Impact:** Assessing the impact of research grants by measuring the outcomes and publications resulting from funded projects.

#### 3.1.8. **Research Impact Assessment:**

- **Research Impact Frameworks:** Using established frameworks to comprehensively evaluate the impact of research beyond citations, including societal impact, economic impact, and policy impact.

#### 3.1.9. **Data Analytics Metrics:**

- **Accuracy, Precision, and Recall:** For data analytics and information retrieval studies, metrics such as accuracy, precision, and recall are used to evaluate the performance of algorithms and models.

### 3.1.10. Library Collection Metrics:

- **Collection Usage Metrics:** Assessing the relevance and popularity of library collections through metrics like circulation statistics, user satisfaction surveys, and cost-per-use analysis.

## 3.2. DIFFERENT METRICS STUDIES IN LIS RESEARCH

In Library and Information Science (LIS) research, various metrics are studied to assess different aspects of library services, information resources, user behavior, and the impact of library activities. From Ranganathan's librmetrics to the most recent metric studies, all metrics can be categorized into three classes based on their respective time of inception (Wakat, 2019):

- **Classical metrics**
  - librmetrics, bibliometrics, scientometrics and informetrics
- **Neo-classical metrics**
  - Webometrics, Cybermetrics
- **Modern metrics**
  - Altmetrics and others i.e. Wikimetrics, Blogometrics, Open source metrics, journal metrics, Author metrics. Article level metrics

### 3.2.1. LIBRAMETRICS

Librametrics comes from 'Librmetrics' which was introduced by Dr. SR Ranganathan for the first time in 1948 at the Aslib's conference in Leamington Spa (Sangam, 2018). Before it, during his term as the librarian of the Madras University in 1925, he practiced various librmetric techniques in order to solve day-to-day library problems and streamline library activities, services for the betterment of users and library professionals. Ranganathan's suggestion for developing Librametry on the lines of biometry, econometry, and psychometry. The term 'Librametry' combines two words 'Libra' and 'Metry', where 'Libra' refers to 'library' and 'mestry' or 'metrics' which means measurement. In simple words, the measurement of Library-related activities is known as Librametric.

Librametrics refers to the application of quantitative analysis techniques specifically within library contexts. It encompasses various quantitative approaches used to assess library collections, services, usage, and impact. This could include studies focusing on citation analysis of library-related publications, usage statistics of library resources, assessment of library services through surveys and user feedback, and analysis of library catalog data, among other possibilities. Although the term 'librametrics' may not be commonly used, the application of quantitative methods within libraries for assessment and decision-making purposes is an important area of research and practice within LIS.

### **3.2.2. BIBLIOMETRICS**

Bibliometrics refers to the quantitative and qualitative analysis of publications, including books, articles, and other forms of media, using statistical and mathematical methods (Joshi, 2014). Bibliometrics is now considered a tool for science policy, providing indicators to measure productivity and scientific quality. This supplies a basis for evaluating and orienting R&D (Haeffner–Cavaillon and Graillet–Gak, 2009). In the field of library and information science, bibliometrics is very crucial (Parida, Singh, Nayak, 2022). The term "bibliometrics" comes from two Greek words: "biblio", which comes from the Greek word "biblion", which means "book", and "metrics", which comes from the Greek word "metrikos", which means "measuring". The term "bibliometrics" was coined by Alan Pritchard in 1969 (Patel et al., 2021; Nayak, Hari & Verma, 2021; Nayak et al., 2021). This evaluation method is truly impartial, enabling comprehensive comparison at both national and international levels. It has the ability to identify cutting-edge research across all fields.

Belgian-American mathematician and documentation scientist, Paul Otlet, also known as the forgotten founder of bibliometrics (Rousseau, 2014). In the early 20th century, Otlet introduced the term "bibliometrics" in his book "Traité de Documentation: Le Livre sur le Livre" ("Treatise on Documentation: The Book on the Book"), which was published in 1934. The foundation of a new field 'bibliométrie' has been started to measure all aspects related to the publication and reading of books and documents. In this seminal work, Otlet discussed various quantitative methods for analyzing bibliographic data, including citation analysis, bibliographic coupling, and co-citation analysis (Dutta, 2014).

### **3.2.3. SCIENTOMETRICS**

Scientometrics is a branch of information science that deals with the quantitative study of science, scientific research, and scholarly communication. It involves the application of mathematical and statistical methods to analyze various aspects of scientific activity, including publications, citations, collaboration networks, and research impact. Scientometrics aims to understand the structure, dynamics, and evolution of scientific knowledge and to assess the productivity, influence, and visibility of researchers, institutions, and scientific disciplines. Scientometrics is commonly known as the “bibliometric” analysis of science (Parida et al., 2022). Key aspects of scientometrics include: Publication Analysis, Citation Analysis, Collaboration Networks, Research Impact Assessment, Scientific Productivity and Performance, Mapping Scientific Landscapes, Evaluation of Research Policies and Funding etc.

The term "scientometrics" was first coined by the Russian scientist Vasily V. Nalimov in the late 1960s (Garfield, 2009). Nalimov used the term to describe the quantitative study of science and scientific communication. One of the pioneering figures in this regard was Derek J. de Solla Price, an American physicist and historian of science. Price's influential book "Little Science, Big Science" published in 1963, laid the foundation for the quantitative study of science by examining patterns of scientific growth, collaboration, and citation networks. His descriptions of “science of science” have led to the definition of scientometrics and he is famous as the father of scientometrics.

### **3.2.4. INFORMETRICS**

"Informetrics" is a term that is sometimes used interchangeably with "scientometrics" or "bibliometrics," but it also has its own specific focus within the field of information science. Informetrics primarily concerns itself with the quantitative analysis of information and its dissemination, usage, and impact across various contexts, including scientific research, scholarly communication, and information retrieval. Key aspects of informetrics include: Information Retrieval Analysis, Usage and Impact of Information Resources, Information Behavior and Communication, Knowledge Organization and Information Management, Digital Libraries and Information Systems, Information Policy and Governance etc.



The term "informatics" was coined by Walter W. Wriston, who was the President of IBM during the late 1960s and early 1970s. Wriston introduced the term "informatics" in 1967 as part of IBM's efforts to redefine the role of computers beyond traditional data processing. However, it's worth noting that the term "informatics" has been used in different contexts and disciplines over the years. In the field of computer science and information technology, informatics refers to the study of the structure, behavior, and interactions of complex systems, including computer systems, networks, and information processes (Alberts & Papp, 1997).

### **3.2.5. WEBOMETRICS**

Webometrics, a term that surfaced in the mid-1990s, is an amalgamation of "web" and "metric." The Web is a hypermedia system that enables users to access and retrieve information from interconnected documents, while metrics are a system of measurement. Webometrics covers a broad spectrum of web-based quantitative techniques, such as link analysis and web citation analysis, with a primary emphasis on the quantitative aspects of information available on websites (Chanchinmawia, Borgohain & Verma, 2021). A new approach was formulated by drawing inspiration from the field of bibliometrics. (Arunachalam, Koumpis & Handschuh, 2018). It is worth noting that Bjorneborn and Ingwersen have made significant contributions to the field of webometrics by redefining it as a sub-field of Cybermetrics, thus establishing a new framework for research and analysis. Furthermore, their incorporation of ideas from Bibliometrics and Scientometrics has facilitated a more comprehensive understanding of the field. The amalgamation of diverse fields of study is a testament to the interdisciplinary nature of research and its potential for innovation.(Bjorneborn & Ingwersen, 2004).

The term 'webometrics' was first coined by Almind and Ingwersen in 1997 in their paper titled "Informetric analyses on the World Wide Web: Methodological approaches to 'webometrics' (Chellappandi and Vijayakumar, 2018). In this paper, they proposed webometrics as a new area of research within the broader field of bibliometrics and informetrics, focusing specifically on the analysis of web-based information sources. Webometrics studies may involve various methods and techniques, including web crawling, link analysis, content analysis, and social network analysis.

### **3.2.6. CYBERMETRICS**

"Cybermetrics" is a term that is closely related to webometrics but with a broader scope. It refers to the quantitative analysis of cyberspace, which encompasses not only the World Wide Web but also other digital environments, platforms, and communication networks. Cybermetrics involves the application of mathematical and statistical methods to study various aspects of online activity, including information dissemination, social interactions, and digital communication. While the term "cybermetrics" is not as widely used as "webometrics," it emphasizes the multidimensional nature of online information spaces beyond traditional websites and hyperlinks. Cybermetrics encompasses a wide range of digital environments and platforms, including social media, online forums, digital repositories, and virtual communities (Harinarayan, 2018).

### **3.2.6.1. Different between Webometrics and Cybermetrics**

Webometrics and Cybermetrics are both subfields of information science that focus on the quantitative analysis of web-based information and digital resources. While they share some similarities, they have distinct focuses, methodologies, and applications:

#### **Definition:**

Webometrics is “the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the WWW drawing on bibliometrics and informetrics approaches.”

Cybermetrics is “the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the whole Internet, drawing on bibliometrics and informetrics approaches.” Björneborn & Ingwersen (2004)

#### **Focus:**

Webometrics primarily focuses on the quantitative analysis of the structure and content of the World Wide Web. It examines aspects such as website visibility, accessibility, and link structures to understand the dynamics of the web.

Cybermetrics, also known as web-based bibliometrics, focuses on the quantitative analysis of scholarly publications and digital repositories available on the web. It examines aspects such as citation patterns, authorship networks, and scholarly impact in the online environment.

### **Methods:**

Webometrics often relies on techniques such as web crawling, hyperlink analysis, and content analysis to gather data about websites and web pages. It may also involve the use of search engine algorithms and web mining techniques to collect and analyze web-based data.

Cybermetrics relies heavily on bibliometric techniques to analyze scholarly publications and citations in digital repositories, online journals, and academic databases. It often involves the use of citation indexes, bibliographic databases, and web-based bibliometric tools to gather and analyze citation data.

### **Applications:**

Webometrics is used to study the impact and visibility of academic institutions, researchers, and publications on the web. It can also be applied to analyze web-based communication patterns, social networks, and information dissemination.

Cybermetrics is used to assess the impact and visibility of academic research and scholarly communication in the digital environment. It helps researchers, institutions, and funding agencies evaluate the influence and reach of scholarly publications and track citation patterns in online scholarly communities.

In summary, while both webometrics and cybermetrics involve the quantitative analysis of web-based information, webometrics focuses on the structure and content of the World Wide Web, while cybermetrics focuses on scholarly publications and citations in the online environment. They use different methodologies and techniques to study different aspects of digital information and communication.

### **3.2.7. ALTMETRICS**

The term "altmetrics" refers to alternative metrics, which are alternative ways of measuring the impact and visibility of scholarly research beyond traditional citation-based metrics such as

citation counts and journal impact factors (Knowles, 2022). Altmetrics focus on capturing and quantifying the attention that scholarly outputs receive in various online platforms and social media channels, as well as other non-traditional indicators of impact. Altmetrics can include a wide range of data sources and metrics, including: Social Media Mentions, News and Media Coverage, Online Discussions, Downloads and Views, Bookmarking and Saving, Citations in Policy Documents, Post-Publication Peer Review etc. Altmetrics provide complementary insights into the broader impact and engagement of scholarly research beyond academic citations

The term "altmetrics" was first coined by Jason Priem and Heather Piwowar in a workshop at the 2010 Association for Information Science and Technology (ASIS&T) Annual Meeting. Since then, altmetrics have gained traction as a valuable tool for research evaluation, assessment, and communication in scholarly communities and academic institutions. Altmetrics are particularly useful for capturing the immediate and societal impacts of research, as well as the engagement and outreach efforts of researchers and institutions in the digital age (Brigham, 2014).

### **3.2.8. OTHERS**

Apart from altmetric, some other metrics are categorized under modern metrics. Those are Wikimetrics, Blogometrics, Open source metrics, journal metrics, Author metrics, Article level metrics etc.

**Wikimetrics** is a tool developed by the Wikimedia Foundation, the organization behind Wikipedia, to provide quantitative analytics and metrics for Wikimedia projects. It offers a platform for analyzing and visualizing data related to contributions, edits, and user activity on Wikimedia sites, including Wikipedia, Wikimedia Commons, Wikidata, and others. Wikimetrics is an amalgamation of wiki and metrics (Dutta, 2014).

**Blogometrics** is an analytical study based on bloggers and blogs in order to develop a ranking of bloggers that is based on citations to their academic research (Mixon & Upadhyaya, 2010). In other words, Blogometrics is Blog metrics refers to the method of measuring blog. It measures organic traffic, percentage of blog posts with organic traffic, average visitors per blog post, publish rate, keyword rankings, time on page, pages per session, bounce rate, conversion rate, leads and customers, page speed, inbound links etc.

**Open-source metrics** refer to quantitative measures used to evaluate various aspects of open-source software (OSS) projects, communities, and ecosystems. These metrics provide insights into the development, usage, and impact of open-source software, as well as the health and sustainability of open-source communities. Open-source metrics are essential for understanding the dynamics of OSS projects, fostering collaboration, and making data-driven decisions in open-source development.

**Journal metrics** are quantitative measures used to assess the impact, quality, and visibility of scholarly journals. These metrics provide valuable insights into the reputation, influence, and reach of academic journals within their respective fields. Journal metrics are widely used by researchers, publishers, funding agencies, and academic institutions to evaluate scholarly publishing venues, make informed decisions about where to publish research, and assess the impact of research outputs.

**Author metrics** are quantitative measures used to evaluate the productivity, impact, and influence of individual researchers in the academic community. These metrics provide insights into the scholarly output, citation impact, collaboration patterns, and overall research performance of individual authors. Author metrics are widely used by researchers, institutions, funding agencies, and academic publishers to assess the contributions and reputation of researchers within their respective fields.

**Article-level metrics (ALMs)** are quantitative measures used to assess the impact, usage, and visibility of individual scholarly articles. Unlike traditional journal-level metrics, which provide aggregate data for entire journals, ALMs focus specifically on the performance of individual articles within journals or other scholarly publishing venues. ALMs provide a more granular view of research impact and engagement by tracking various types of interactions and activities associated with specific articles.

#### **4. NEED OF METRICS STUDY IN LIS RESEARCH**

The study of metrics, or measurement, is essential in Library and Information Science (LIS) research for several reasons, such as:

- Performance Evaluation
- Evidence-based Decision Making
- Assessment of Impact
- Benchmarking and Best Practices
- Resource Management
- User-Centered Design
- Accountability and Transparency

Metrics play a vital role in LIS research by providing empirical evidence for decision-making, assessing impact and effectiveness, benchmarking performance, optimizing resource allocation, and enhancing user-centered services. Through the systematic study of metrics, researchers contribute to the continuous improvement and innovation of library and information services to meet the evolving needs of users and communities.

## **5. CONCLUSION**

The potential of metric terminologies in Library and Information Science (LIS) research is vast and multifaceted. Here are several ways in which metric terminologies can be harnessed to advance LIS research: Assessment of Library Services, Collection Development and Management, User Behavior Analysis, Information Retrieval Evaluation, Bibliometric and Scientometric Studies, Digital Libraries and Institutional Repositories, Research Evaluation and Funding Allocation, Open Access and Scholarly Communication. Finally, metric terminologies offer powerful tools for quantitative analysis, evaluation, and decision-making in Library and Information Science research. By leveraging these metrics, researchers can gain valuable insights into library services, user behavior, scholarly communication, and information ecosystems, ultimately advancing knowledge and innovation in the field.

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