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Alternative Metrics as a New Perspective for Measuring Scientific Activity in Light of Technological Changes

القياسات البديلة كرؤية جديدة لقياس النشاط العلمي في ضوء التغيرات التكنولوجية

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Abstract

Scientific research has moved from the narrow and closed circle of official scientific publishing channels to an open and free environment enabled by Web 2.0 technologies. The digital ecosystem has expanded the audience interested in scientific output, reaching groups beyond researchers themselves, as they now contribute to discussing research or redistributing it through interactive platforms. Consequently, these new forms of scholarly communication require new approaches to measuring impact, known as alternative metrics. This article aims to introduce alternative metrics as a new perspective for assessing scientific activity in light of technological changes, by highlighting alternative measurement indicators and tools, and clarifying the relationship between alternative and traditional metrics.

Introduction

For nearly forty years, specialists in bibliometric studies have focused on tracking, indexing, and analysing a specific type of indicator in scientific measurement, one that, although simple, has proven powerful in research evaluation. Robert Merton described this as "the peer recognition ball." (Marton, 1988).

Bibliometric indicators, also referred to as *traditional metrics*, rely primarily on citation indexes, which are used by measurement specialists as indicators of the value and credibility of scientific output. Despite their simplicity, these indicators remain strong tools for establishing the legitimacy of research work. However, data show that only about 15% to 20% of academic researchers in the United States have published peer-reviewed articles (Cronin & Sugimoto, 2014). This means that a significant proportion of research output does not undergo peer review, creating a gap that excludes a considerable body of scientific and scholarly contributions.

The development of communication technologies has created an interactive environment that has generated new traditions of scholarly communication among researchers. Web 2.0 participatory platforms have become fertile ground for scientific publishing, removing restrictions and moving research beyond the confines of formal publication channels, making it more open and accessible. Many researchers now turn to scientific blogs to publish, share, and discuss their work on social platforms such as Facebook, Twitter, and Mendeley. From this context emerged the concept of *alternative metrics* as a new method for evaluating scientific research.

This raises several key questions: What are *alternative metrics*? To what extent do they contribute to offering a new perspective on measuring the impact of scientific activity? And what is the future of these metrics as a modern trend in research evaluation?

1–The Concept of Alternative Metrics

1–1–Origin of the Term

The term *alternative metrics* emerged as an attempt to

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counter the excessive simplification of the traditional scientific metrics that have been in use for decades, which focus primarily on journal articles and citation counts. In simple terms, alternative metrics refer to new methods of measuring scientific activity within a specific environment, particularly one that is connected to the Web 2.0 ecosystem

The early efforts to track the activity of scientific research published online date back to 2004, when The British Medical Journal (BMJ) began monitoring the online engagement and activity surrounding its scientific articles. Following this initiative, both the Journal of Medical Internet Research (JMIR) and the Public Library of Science (PLOS) adopted similar practices by developing indicators to measure the activity and reach of their scientific articles across multiple sources, and by making these indicators publicly available on their respective websites (Abu-Saud, 2015)

The term Altmetrics (alternative metrics) first appeared in September 2010 in a tweet by Jason Priem [see Figure 1]. Priem chose the term alternative metrics instead of Article-Level Metrics (ALM), as the latter failed to encompass all forms of measurement.

The use of the term spread rapidly; however, it also faced some opposition from those who proposed alternative expressions they considered more accurate or representative, such as Influmetrics (impact metrics), Social Media Metrics, Complemetrics (complementary metrics), and *Webometrics* (web-based metrics). (Priem, 2015).

Figure 1. Jason Priem's tweet about the term *Altmetrics (alternative metrics).*

Source :https://twitter.com/jasonpriem/status/25844968813

1–2–Definition of Alternative Metrics

Although more than a decade has passed since the term began to circulate, *alternative metrics* has not yet been included in either specialized information science dictionaries or general ones. All existing definitions reflect individual efforts to clarify the meaning and scope of the concept. Among the most notable is the definition proposed by Jason Priem, who described alternative metrics as:

"The study and use of metrics that measure the impact of scholarly research based on the online activity surrounding that research through web-based tools and environments."

Alternative metrics are considered a branch of both scientometrics and webometrics, but they are limited to specific web tools and environments rather than encompassing the entire web. (Priem, 2015).

Alternative metrics focus on measuring scientific activity and are considered a subfield of scientometrics. Since they also assess online activity, they are part of web-based metrics, also known as webometrics. However, what distinguishes alternative metrics is their narrow focus on specific web tools and environments, rather than encompassing the entire web.

Galligan defines alternative metrics (Altmetrics) as new measures for assessing the impact of scientific content based on its dissemination through social web platforms such as Twitter, reference management sites like CiteULike, or collaborative reference tools such as Mendeley.

These metrics aim to provide a new alternative for measuring impact, differing from the traditional Journal Impact Factor (IF), which is no longer sufficient to meet the demands of the current digital environment in which scientific research is published. (Abu-Saud, 2015).

Alternative metrics have also been defined as methods for evaluating the impact of elements of scholarly communication by assessing their presence, contributions, and mentions across social media platforms and other online communication channels. (Faraj, 2017)

What can be concluded, then, is that alternative metrics constitute a branch of both webometrics and scientometrics, yet they focus specifically on certain web environments, namely social media platforms and Web 2.0 tools. The data collected for measurement typically take the form of numerical values or graphical representations and include: the number of page visits, the number of downloads and accesses to the publication or full text, the number of likes, shares, or recommendations on social networks, the number of times publications are added to favorites or shared on social bookmarking platforms, the number of articles saved or imported into bibliographic

management software, and the number of times the publication or information is mentioned in newspaper articles, social networks, blogs, and open encyclopedias.

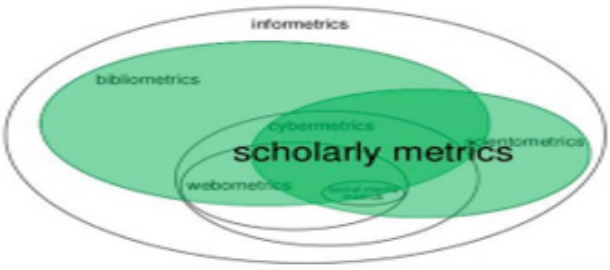

Figure 2: Alternative Metrics as a Branch of Scientometric Measures

1–3–Reasons for the Turn Toward Alternative Metrics: (Abu-Saud, 2015)

There are several interconnected reasons that have led many researchers, organizations, and various scientific institutions to turn toward the use of alternative metrics. It can be said that these reasons are, in fact, the advantages offered by alternative metrics when compared to traditional measurement methods. These reasons can be summarized as follows:

- The limitations of traditional metrics in responding to changes in the environment and nature of scientific research, especially regarding the speed at which the impact of research and the activity surrounding it can be detected. Therefore, it became necessary to adopt alternative metrics to provide real-time indicators of research impact, something that traditional measures could not offer previously.
- The evolution of the scientific research environment to include new forms of intellectual output that were not previously recognized. Examples that highlight the importance of alternative metrics in showing the impact of new scientific content include the Figshare data repository and the GitHub software repository, both of which use altmetric applications to share, evaluate, and track information related to their content among users. Researchers or institutions can thus use these indicators to demonstrate the added value of the data or software they contribute to these repositories.
- Inclusiveness: Inclusiveness is one of the most important advantages provided by alternative metrics, not only in terms of the diversity of new forms of scientific content they cover, but also in the variety of sources from which indicators are derived. This diversity enhances the inclusiveness of the metric.
- Openness: Openness here refers to broadening the evaluation framework beyond a specific group of experts or peers, as is the case in traditional peer review, to include many other groups who have an interest in scientific content.

1–4–Types of Alternative Metrics

There are several classifications of alternative metrics depending on the perspective or criterion used. Some categorize them according to the element through which research outputs are tracked, as follows: (Wadjeeh hamdi Mustapha, 2019)

- Alternative metrics that track works through the Uniform Resource Locator (URL).
- Alternative metrics that track works through the Digital Object Identifier (DOI).

Others classify them according to the type of activity, such as viewing, liking, commenting, sharing, downloading, saving, endorsing, and other forms of engagement or mentions. It should be noted that most, if not all, alternative metric tools now cover all activities that take place across social media networks and provide every possible number and statistic.

Thus, the purpose of these classifications is to highlight the capabilities offered by different altmetric tools and to enable comparative evaluation among them in ways that benefit the research and academic community, while taking into account both the advantages these metrics offer and the challenges they face.

2–Alternative Metrics as a Tool for Measuring Scientific Research:

2–1–Indicators of Alternative Metrics

Any form of openly accessible scientific output that has a URL or a Digital Object Identifier (DOI) can be discussed and shared online. These discussions and shares take several forms, and these forms are used as indicators within alternative metrics. They include: (Altmetrics, 2024)

- Attention Score: Refers to the number of people who have been exposed to or engaged in some way with a particular research study or article. This exposure or interest typically occurs through mentions in blogs, on Twitter, page views, and article downloads.
- Dissemination Metric: Helps to understand where and why a particular article has been discussed or shared,

whether among other researchers or at a general public level.

- Impact and Influence Indicator: Some data collected through alternative metrics indicate that a study brings about change in a specific scientific field or has tangible effects on society in general. Such data include references to the research in policy documents or comments from experts and practitioners in the relevant field. Each of these dimensions can provide a more precise measure of a study's scientific value than citation counts alone. Alternative metrics are also distinguished by their ability to delve deeply into the numbers provided by bibliometric and webometric measures, offering evidence of the impact of research and scientific articles by considering the qualitative data accompanying quantitative metrics, such as who is saying what about a given study, and in which part of the world the research has been cited, reused, read, or shared.

2–2–Alternative Metrics Tools: (niso, 2024)

Alternative metrics tools collect researchers' scientific outputs on the web and measure their impact on a regular basis. According to the classification of the National Information Standards Organization (NISO), these tools are divided into two types:

Data-providing tools: These take the form of interactive publishing sites used as alternative metrics for research outputs, such as social networks, bibliographic management sites, and collaborative platforms.

Examples include:

Twiter - Mendeley - Facebook

GitHub - SlideShare - Figshare

Data-aggregating tools: These are managed by service companies that collect, quantify, and analyze scientific activity using quantitative data to demonstrate impact. They organize the data according to specific methods and approaches, and then provide detailed analytical information about the extent and nature of this activity. Some of the most well-known Examples include:

ImpactStory : https://profiles.impactstory.org

Among the open-source platforms, founded in 2011 by Jason Priem and Heather Puwar, is one that was initially named Total Impact. It is scientifically supported by the National Science Foundation and financially backed by the Alfred Pritchard Sloan Jr. Foundation.

This platform measures data based on the following sites:

- https://www.altmetric.com
- https://www.base-search.net
- https://search.crossref.org
- https://www.mendeley.com
- https://orcid.org
- https://twitter.com

Principles of the Platform:

- Reliance on open-source materials.
- Free availability of data to the extent permitted by the data provider.

Commitment to transparency and unrestricted communication.

The concept of this tool is based on creating researcher profiles that allow users to connect with multiple sources of scientific activity tracking, such as:

- Public Library of Science (PLOS): https://plos.org
- GitHub: A platform for sharing software and applications: https://github.com
- ArXiv: A platform for sharing preprint research before formal publication. https://arxiv.org
- PeerJ: A platform for sharing open-access scientific research: https://peerj.com
- Figshare: A platform for sharing research data and datasets. https://figshare.com
- Plume Analytics https://plumanalytics.com

Plum Analytics was founded in 2011 by Mike Buschman and Andrea Michalek with the aim of providing measures of research impact and making them available for use by both researchers and institutions. When used, it allows researchers to achieve the following objectives:

- Provide quantitative indicators to convince funding agencies of the relevance and value of a proposed study.
- Measure the value and activity of scientific research within a given institution and compare it with peer institutions.
- Identify outstanding or promising researchers for recruitment or participation in specific research projects.
- Promote a particular research study or the activity of a scientific institution.

In 2013, EBSCO decided to acquire Plum Analytics to integrate the available data into its database on research usage and activity, leading to the release of a new tool called PlumX.

PlumX labels different types of scientific content as Artifacts and classifies the activity surrounding these artifacts into five main categories, which are:

Usage	Refers to the number of downloads, views, and acquisition data within libraries and other sources. Data are primarily collected through statistics generated within the EBSCO database regarding the .use of scientific contributions
Captures	.Refers to adding contributions to a bookmark list
Mentions	Data are collected on scientific contributions by tracking their activity in blogs, comments, and refer-.ences in open encyclopedias such as Wikipedia
Social Media	.This category includes tweets, likes, and other social media engagement activities
Citations	Includes citations recorded for contributions through the Scopus and Web of Science (WoS) databas-es. Through the rapid analysis of these data categories obtained via PlumX, it can be said that this information reflects scientific activity at both formal and informal levels. In other words, it captures research activity through restricted sources available to subscribing institutions via EBSCO databases, .as well as open sources accessible to everyone

The PlumX tool relies on approximately 40 data sources to collect information on scientific activity, covering more than 20 types of scientific contributions (Artifacts). PlumX provides measurements of these contributions by presenting values for each of the five metric categories, referred to as the PlumX footprint or Plum

- Altmetric : https://www.altmetric.com

Founded in 2011 and headquartered in London, the company, through its various products dedicated to measuring and monitoring scholarly activity is considered one of the largest and most influential entities operating in this field. Approximately 5,000 articles are added and analyzed daily, equivalent to one activity record every seven seconds. According to Altmetric statistics, the number of captured attention indicators related to tracked research has reached nearly 10 million mentions, covering around 1.25 million articles and 2 million researcher or user pages.

The company aims to provide accessible data and metrics on scientific research and offers the following services:

- Rapid identification of the level of attention received by scholarly outputs for researchers.
- Identification of related research works as well as researchers with shared interests.
- Provision of accurate, accessible information on scientific research for institutions such as libraries, publishers, and

digital repositories.

- Enabling editors and reviewers to access public commentary on scholarly outputs under evaluation whenever needed.
- The metric data are displayed in the form of a coloured "Altmetric Donut," where the number in the centre represents the overall score assigned to the research output, while the surrounding colours represent the distribution of attention sources. The data are presented as a multicoloured circular graphic, with each colour corresponding to a specific source, as illustrated in the following figure.

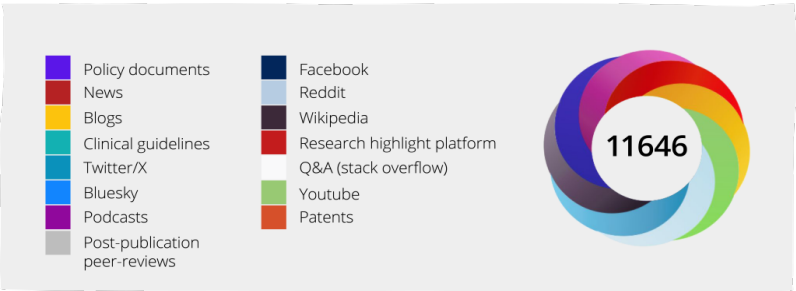

Figure 2: The Altmetric Donut (Alternative Metrics Donut)

SOURCE:https://www.altmetric.com/about-us/our-data/donut-and-altmetric-attention-score/

This tool relies on three main dimensions to determine the score assigned to a scientific output, namely:

Volume of Activity	The overall score increases with the amount of activity around the research output. Only unique mentions are counted—for example, multiple tweets from the same user count as .a single mention
Source Value	Each data source contributes a different weight to the score. A mention in a newspaper .adds more value than a tweet
Scholarly Responsibility	Higher value is added when engagement involves domain experts. For instance, a physician sharing an article with another physician adds more value than a publisher simply sharing .the link

2.3. Sources of Altmetrics Data Acquisition (Data Providers)

Altmetrics platforms and tools collect data from various sources across the global network by tracking attention, discussions, comments, and citations. These sources include:

- Public Policy Documents:
  Documents issued by governmental and public institutions that reference or cite scholarly work.
- Online Reference Managers:
  These platforms track the number of users who have saved scholarly works in their databases. They also provide qualitative data about researchers such as geographical locations, subject specializations, and research interests (e.g., Mendeley, Zotero).
- Post-Publication Peer-Review Platforms:
  Articles are reviewed by subject-matter peers after publication, as in PubPeer (https://pubpeer.com) and Publons (https://publons.com).
- Wikipedia:
  Altmetrics tools track citations received by scholarly works within the English version of Wikipedia.
- Open Syllabus Project (OSP) – https://www.opensyllabus.org:
  This project has collected over one million syllabi from courses taught in more than 4,000 educational institutions worldwide. It extracts bibliographic data and citations appearing within these syllabi and makes them publicly accessible through the Syllabus Explorer interface.
- Blogs:
  Altmetrics platforms monitor mentions of scholarly work in academic and non-academic blogs.

- Citation Data from Major Databases:
  Such as Scopus and Web of Science, which index formal scholarly citations.
- Social Media Networks:
  Platforms where scholarly content is shared, discussed, or linked, such as Facebook, Twitter, LinkedIn, Academia.edu, and ResearchGate.
- Multimedia Platforms:
  Websites hosting multimedia content that may reference scholarly work, such as YouTube and Reddit.
- Mainstream Media Outlets:
  These include news channels and non-academic magazines that mention research articles. Tracking is performed through RSS feed technology.

3–The Social Dimension of Altmetrics and Its Relationship with Traditional Metrics

3–1–The Social Dimension of Altmetrics: Measuring Impact or Influence

In recent years, there has been growing interest in scholarly research regarding the social impact of academic studies, which refers to their effects on society, culture, quality of life, community services, or public policy beyond the academic sphere. This impact is measured through social web platforms to assess the dissemination of research within social contexts. It is evident that social media and altmetric tools are widely used by scholars and institutions to enhance the visibility and reach of their research outputs. Consequently, all academic sectors must rise to this new challenge and prepare their infrastructures to accommodate these changes.

It may be premature to predict how these new media and metrics will transform scholarly communication and the sciences themselves, providing a clear forward-looking perspective. This uncertainty stems from the instability of these media, despite their effectiveness in increasing the visibility of scientific outputs. Nevertheless, an optimistic outlook offers a future-oriented view of collective perception, a form of collective intelligence shaped by people worldwide, alongside advanced technologies such as computers, sensors, robots, and other information-processing devices. However, it should be acknowledged that not everyone will embrace these developments in such a positive and idealistic manner.

The production of scientific publications is increasing steadily and continuously, with more than one publication being issued every second. These outputs can be disseminated and amplified across both traditional and new communication channels. Despite the numerous benefits, this trend can also create undesirable overload and noise, similar to an information explosion. Millions of scientists simultaneously generate billions of research papers, conversations, emails, blogs, tweets, and other communications, all of which are subsequently evaluated, discussed, cited, commented on, reposted, retweeted, and recorded by others. This phenomenon resembles a communication surge of almost uncontrollable magnitude that requires regulation and management.

It is important to distinguish between audiences in formal communication channels and those in social media. The former typically belongs to a homogeneous academic community that governs its specific field of expertise, whereas the latter is heterogeneous, making it difficult to accurately determine the “impact” factor.

With the spread of “buzz culture”, publications can now propagate widely and generate immediate interactions. Nevertheless, many traditionalists, including scientometricians, remain anchored to the old notion of linking bibliometric measurement exclusively to citation analysis, despite the fact that Price’s original definition of bibliometrics was always intended to be more comprehensive: “the application of quantitative (mathematical and statistical) methods.” (Umpenberger et al., 2016)

Consequently, it is not surprising that altmetrics have emerged as a natural response to the limitations of traditional methods in capturing all relevant sources for research evaluation. This is particularly the case when conventional indicators, such as the h-index and Journal **Impact Factor (JIF)**, are applied uniformly or misused.

3–2–Altmetrics and Traditional Metrics: Integration or Inclusion

The relationship between altmetrics and traditional metrics is an integral part of studies focused on measuring scientific activity and testing validity by comparing the results generated by both types of indicators. The external

impact of research can be inferred from citation counts alongside attention indicators recorded on social media platforms, supporting the statement made in the official altmetrics declaration. Altmetrics are described as an additional complementary dimension to citation data, enabling the measurement of the usage of published works immediately after their availability on the web.

Altmetrics are grounded in traditional citation metrics, with their correlation based on integration rather than exclusion. The integration of both approaches provides a deeper understanding of article usage over medium and long-term periods. Undoubtedly, the scientific community continually seeks to verify the efficiency of the metrics used in evaluating its activities and outputs. Efforts are consistently directed toward achieving objective and comprehensive measurement, which can only be realized through the integration of complementary approaches. (Umpenberger et al., 2016) Between altmetrics based on social media and traditional metrics based on citations.

Conclusion

The transformations resulting from communication technologies have imposed a new paradigm in evaluating scientific activity, beginning with the methods of scholarly communication. Traditional measurement approaches no longer encompass all dimensions of research activity, creating an urgent need for complementary alternatives to conventional metrics. This necessity led to the San Francisco Declaration on Research Assessment and the emergence of altmetrics. Altmetrics have quickly established their presence and attracted attention, prompting major publishers to integrate them into their databases and offer them as a service for researchers and institutions to track the impact of scholarly activity within interactive web environments. It can be concluded that altmetrics have become a complementary tool to traditional metrics, contributing effectively to the research evaluation process. They may even become an essential approach for measuring scientific output, especially with the ongoing expansion of open science initiatives.

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القياسات البديلة كرؤية جديدة لقياس النشاط العلمي في ضوء التغيرات التكنولوجية

ملخص

إن البحث العلمي قد خرج من دائرة مغلقة وضيقة للقنوات الرسمية للنشر العلمي إلى دائرة منفتحة وحرة التي توفرها تكنولوجيا الجيل الثاني، اذ ان المحيط الرقمي وسع من دائرة المهتمين بالإنتاج العلمي ليصل لفئات أخرى من غير الباحثين وذلك بالمساهمة في مناقشة البحث أو إعادة بثه عبر منصات تفاعلية. وهكذا فإن الأشكال الجديدة للاتصال العلمي تتطلب طرقا جديدة لقياس التأثير وهو ما أطلق عليه بالقياسات البديلة. يهدف هذا المقال إلى التعريف بالقياسات البديلة كرؤية جديدة لقياس النشاط العلمي في ضوء التغيرات التكنولوجية من خلال إبراز مؤشرات وأدوات القياس البديلة، مع تبيان العلاقة بين القياسات البديلة والقياسات التقليدية.

الكلمات المفتاحية
القياسات البديلة
النشاط العلمي
التأثير العلمي
مؤشرات القياس البديلة

Mesures alternatives: une nouvelle vision de la mesure de l'activité scientifique à la lumière des changements technologiques

Résumé

La recherche scientifique a progressivement évolué d'un modèle traditionnel, caractérisé par des circuits restreints et fermés de publication, vers un environnement ouvert favorisé par les technologies du Web 2.0. Cet écosystème numérique a considérablement élargi le public intéressé par la production scientifique, en intégrant des acteurs au-delà de la communauté académique, lesquels participent désormais à la discussion, à la diffusion et à la réappropriation des travaux de recherche à travers des plateformes interactives. Ces transformations des modes de communication scientifique ont engendré la nécessité de développer de nouvelles approches d'évaluation de l'impact, communément désignées sous le terme de métriques alternatives (altmetrics). Le présent article se propose d'examiner les métriques alternatives en tant que cadre analytique renouvelé pour l'évaluation de l'activité scientifique dans un contexte de mutations technologiques. Il met en lumière les principaux indicateurs et outils de mesure alternatifs, tout en analysant leur articulation avec les métriques bibliométriques traditionnelles.

Mots clés
Métriques alternatives (altmetrics)
activité scientifique
impact scientifique
indicateurs alternatifs d'évaluation

تضارب المصالح

يعلن المؤلف (المؤلفون) لا تضارب في المصالح

Competing interests

The author(s) declare no competing interests