Journal of Mathematics Instruction, Social Research and Opinion
Vol. 4, No. 3, September 2025, pp. 603 – 624, https://doi.org/10.58421/misro.v4i3.409
ISSN 2962-7842

A Review of Unconventional Citation Metrics for Scientific Publications

Shikha Gupta[1], Sakshi Wadhwa[2], Samarth Gupta[3]
[1]College of Business Studies, University of Delhi, India
[2]Centre for the Study of Law and Governance, Jawaharlal Nehru University, Delhi, India
[3]University of Delhi, India

Article Info

Article history:

Received 2025-03-25
Revised 2025-06-15
Accepted 2025-06-27

Keywords:

Bibliometrics
Conference
Evaluation
Journal Ranking
Scientometrics

ABSTRACT

Citation metrics play a crucial role in evaluating the impact and significance of scientific publications within the research community. Among the widely recognised indicators are the journal impact factor and the h-index, the latter often used to evaluate and rank academic conferences. Despite the prominence of these metrics, many scholars remain unfamiliar with a range of alternative measures available for assessing scholarly output. This review examines various citation-based metrics employed to assess scientific publications. Although some of these metrics offer distinct advantages, they have not yet been widely adopted by journals, funding bodies, or researchers. This review aims to provide a detailed overview of lesser-known citation indicators and to support researchers in making more informed evaluations of academic influence and research quality.

Corresponding Author:

Shikha Gupta
Professor, Computer Science, S.S. College of Business Studies, University of Delhi, India
Email: shikhagupta@sscbsdu.ac.in

1. INTRODUCTION

Citation metrics are key tools for measuring the impact of scientific publications, from journal articles to conference papers. They help evaluate the quality of individual works and the overall influence of authors or research groups. Well-known metrics, as noted by Gupta, Kumar, and Bhalla [1], include the Impact Factor (IF) [2], *h*-index [3], Eigenfactor (EF) Score [4], and SCImago Journal Rank (SJR) [5]. Suppose the average citations per article in a journal are measured, while the h-index reflects an author's productivity and citation impact. EF and SJR go further by considering the prestige of the citing journals, with EF focusing on a journal's field-wide influence and SJR weighting citations by the prominence of the sources.

While citation metrics provide valuable insights into the influence and reach of scientific work, it is essential to acknowledge their limitations. They should not be viewed as the only measure of a publication's quality or an author's or research group's productivity and impact. Beyond the widely used indicators discussed earlier, alternative metrics have also been proposed for assessing scientific output. This study highlights the characteristics and advantages of these less common metrics.

2. METHOD

This paper categorises citation metrics evaluation frameworks into three major groups. First, metrics that emphasise time-related aspects, such as the age of the journal, the number of citations within a stipulated period, and citation frequency in a specific period, etc. The second category, which deals with the evaluation mechanisms developed by institutions, includes two subgroups. The first caters to the frameworks developed by institutions in the Global North, while the second includes those from the Global South, which are more context-specific. In the case of the Global South, Brazil and India are selected primarily due to their prominence in their respective regions, while both are part of the Global South. A more detailed rationale is provided in the section that addresses this topic. Since the journal's scope limits the selection of all or many countries, which might result in a distinct full paper, the two key countries are selected. Instead of viewing these as arrivals to the Global North, the examples are added to show important efforts being made on the other side of the world.

After offering a critique of both, the paper moves towards the final category of h-index and its variants to emphasise the evaluation frameworks for author(s) publications. Since the paper has primarily dealt with assessing academic journals and conferences, it appeared inevitable to involve an assessment framework at the author level.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1 Metrics With Key Focus On Temporal Aspects

The following metrics place special emphasis on the time-related aspects of the articles in the journal. For instance, the duration and the recency of citations play a crucial role in the metrics for a journal. Therefore, the quality of a journal's citations involves a calculation of its age and related time-based aspects of publication and citations.

a. Cited and Citing a Half line

   Cited Half-life is the median age of the journals that were cited. Journal Citation Reports (JCR) calculates the cited half-life for journals cited at least 100 times by others in the citing year. The citing year is the window during which the JCR considers the citations to the publications. The Cited Half-life considers all the citations earned by the articles in the journal during the citing year. These citations are then sorted by the year of publication of the article. The number of years from the citing year that accounts for half the total number of citations is the cited half-life of the journal in the citing year [6]. If the cited half-life of a journal is five, this implies that half of the journal's cited articles were published more recently than five years ago.

   Citing Half-life is a measure of the recency of citations of the publications in a journal. Thus, the count of the number of years (starting from the citing year) accounts for 50%

of the cited references [6]. Thus, journal-publishing papers with more recent references will have a shorter citation half-life.

b. Citescore Metrics

CiteScore metrics comprise a set of eight indicators: CiteScore, CiteScore Tracker, CiteScore Percentile, CiteScore Quartiles, CiteScore Rank, Citation Count, Document Count, and Percentage Cited [7].

The citation count for journal J represents the total citations received over the past four years by documents published within that period. The document count refers to the total number of items published in those four years; for instance, the document count for 2020 includes publications indexed from 2016 to 2019. CiteScore reflects the average number of citations per document for a journal, calculated over four years. In this metric, citations form the numerator, while the total number of published documents is the denominator. CiteScore encompasses a range of publication types, including peer-reviewed articles, reviews, conference papers, data reports, and book chapters. The CiteScore Rank indicates that a journal is standing within its subject field based on its CiteScore value.

Percentage Cited indicates the proportion of the documents published in the last four years (that is, document count) that have received at least one citation (that is, are considered in citation count) in the selected year. The CiteScore tracker allows one to monitor the journal's score monthly, as the impact can change rapidly. The CiteScore tracker is computed similarly to CiteScore but for the current year. The calculation's numerator (citation count) is updated monthly with new citations. Once the new annual CiteScore value is fixed, the CiteScore tracker for the next year begins. CiteScore percentile indicates the relative position of a journal in its subject field and can, therefore, be used to compare journals within a discipline. The CiteScore percentile is calculated by taking all journals with a CiteScore in a particular subject field, such as S, and ordering them by their CiteScore from highest to lowest. Consider a journal, say J, in the subject S. Let C be the CiteScore for J, L be the number of journals in the subject area S with CiteScore < C, E be the number of journals in the subject area S with CiteScore equal to C, and N be the total number of journals in the subject area S. In this case, the CiteScore percentile is computed as,

$$CiteScore\ Percentile\ of\ Journal\ J = Round\left(\frac{L + 0.5 \times E}{N} \times 100\right)$$

Thus, the CiteScore percentile indicates how well-cited a journal is relative to the average score within its subject field. For example, a CiteScore percentile of 99% indicates that the journal is in the top 1% of its subject field. The percentile values of the journals in a subject are grouped into quartiles. CitesScore quartile is a group of publications in which the publications in the same group occupy a similar position within their subject categories. For each subject area in which a journal might be included, the journal may have a different quartile value. For example, publication A might be categorised in "Oncology," with a CiteScore percentile of 84% or quartile 1, and "Cancer Research," with a CiteScore percentile of 73% or quartile 2.

c. Source Normalised Indicator (SNIP)

While the Source Normalised Impact per Paper (SNIP) focuses more on average citations, citation frequency, and the journal's field, since it also involves the temporal aspect in limited but vital ways, it is placed in the temporal category. Introduced in 2010, it measures the average citations per publication while adjusting for the citation frequency typical within the journal's subject field. SNIP enables meaningful comparison between journals across different disciplines, as it corrects for variations in citation behaviour among fields. The SNIP score for a journal, denoted by J [8], is calculated using the following formula:

$$SNIP = \frac{RIP}{DCP}$$

Here, RIP refers to the 3-year raw impact per paper for journal J, representing the average number of citations in a given year (e.g., 2020) to papers published in the preceding three years (2017-2019). On the other hand, DCP, or Database Citation Potential, relates to the journal's subject field. This field includes all articles from the target year (such as 2020) that cite at least one paper from the journal J. The DCP is computed as the average number of references in these articles, considering only citations to works from the preceding three years and limited to journals indexed in the database.

Table 1. Top 10 Data Mining conferences ranked by Microsoft's field rating (2014 snapshot) vs Microsoft's Salience, h-index, prestige, citations, and publications rank for the same conferences

Conference Name	Field Rating	Salience Rank	h-index Rank	Prestige Rank	Citations Rank	Publications Rank
Knowledge Discovery and Data Mining (KDD)	122	1	2	16	3	3
International Conference on Data Engineering (ICDE)	144	6	6	33	6	4
International Conference on Information and Knowledge Management (CIKM)	67	7	7	37	7	5
IEEE International Conference on Data Mining (ICDM)	56	8	8	49	8	2
SIAM International Conference on Data Mining (SDM)	45	38	28	23	30	
Principles of Data Mining and Knowledge Discovery (PKDD)	40	41	22	59	27	54
Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD)	33	42	49	71	53	36
Recherche d'information Assistée par Ordinateur (RIAO)	28	>100	>100	>100	>100	>100

Research Issues on Data Mining and Knowledge Discovery (DMKD)	27	>100	>100	>100	>100	>100
Database Systems for Advanced Applications (DASFAA)	26	31	45	86	45	15

d. Article Influence Score (AIS)

For a journal, the Article Influence Score (AIS) is a citation measure derived from the EF value. AIS measures the average influence of each of the journal's articles over the first five years after their publication and is computed as,

$$AIS\ for\ the\ journal\ A = \frac{0.01 \times EF\ score\ for\ journal\ A}{X}$$

Where X is the number of publications in the last five years by journal A divided by the number of publications in the last five years by all the journals in JCR, the AIS value for a journal is normalised so that a benchmark journal in the JCR database has an article influence of 1. Thus, a journal with an AIS value of 5 has five times the influence compared to the JCR database benchmark journal. An AIS score greater than 1 indicates that each article in the journal has an above-average influence [6].

In addition, the Eigenfactor project computes the cost-effectiveness of a journal as the ratio of its subscription cost to its Eigenfactor score, that is,

$$Cost\ effectiveness = \frac{k \times Subscription\ Cost}{EF\ Score}$$

k is a normalising constant equal to 100 divided by the combined price of all journals in the field. The benchmark journal in the collection has a cost-effectiveness value of 1. The metrics explained in this section appear more technical and methodical, with the temporal aspect of citations playing a key role in determining the journal's ranking. The aspect of citations' age, time-based aspects, and frequency holds value and appears unbiased due to the adherence to a standardised format. However, a question can be posed as to whether the quality of a journal can be solely determined by these factors pertaining to duration, recency, and frequency. While this section outlines metrics for evaluating journals through a more technical and standardised method, the following section provides an overview of institutions that develop distinct metrics for bibliometric analysis. While the temporal aspect remains important according to their metrics, other factors are also considered.

3.1.2 Institutionally Developed Framework for Evaluation of Journals and Conferences: From the Global North

This section explains the various bibliometric analysis frameworks developed by institutions such as Microsoft Academic, the Australian Business Deans Council (ABDC), Leiden University's Centre for Science and Technology Studies (CWTS), and the Australian Computing Research and Education Association of Australasia (CORE). It is worth noting that, apart from Microsoft Academic, which encompasses various bibliometric indicators and includes journals, conferences, institutions, and other entities, and CORE, which focuses on conference evaluation, the frameworks developed by others

 https://doi.org/10.58421/misro.v4i3.409

primarily evaluate journals. The section begins with the Impact Per Publication (IPP) since it is the only one among those selected that caters to articles. At the same time, the rest have a broader scope, such as Excellence in Research Australia (ERA), which evaluates conferences and journals, and Microsoft Academic, which provides bibliometric indicators and rankings for authors, journals, conferences, and more. Meanwhile, CORE caters specifically to conferences. The section ends with an overview of a collaborative initiative for evaluation.

a. Impact Per Publication (IPP)

IPP is computed and maintained by Leiden University's Centre for Science and Technology Studies (CWTS), Netherlands, based on a customised version of the Scopus database developed by CWTS. IPP is a citation measure that has been available since 2014. Using the citation window of three years, IPP measures the average number of citations earned by an article published in a journal. IPP value for a journal J for the year 2018 is computed as,

$$IPP = \frac{\#\, citations\ in\ year\ 2018\ to\ paper\ published\ from\ 2015 - 2017}{\#\, papers\ published\ from\ 2015 - 2017}$$

Both CiteScore and IPP measure citations per document. Only CiteScore has been retained as a Scopus metric. This is because CiteScore provides greater transparency for Scopus users, as it is calculated based on the Scopus database available to users and encompasses all documents published in Scopus. On the other hand, the CWTS-customised Scopus database, which is based solely on articles, reviews, and conference papers, is used to compute the IPP score. Additionally, CiteScore allows for regular updates, as Scopus computes it. On the other hand, IPP is computed by CWTS through a more time-consuming process, so regular updates are impossible. Both raw impact per paper (RIP) and database citation potential (DCP) values include only those citing and cited articles that are Scopus document types, including articles, conference papers, or reviews [8].

Consider a journal J in the year 2020 for analysis. Let the total number of publications within the relevant subject field be N. Define NR as the count of references within these N articles that cite publications from 2017 to 2019 in journals indexed by the database. The DCPJ (Database Citation Potential for journal J) can then be calculated using the following expression:

$$DCP_j = \frac{N_R}{N}$$

To illustrate, suppose a journal published 100 articles from 2017 to 2019, and these articles received 150 citations in the year 2020. The resulting RIP for the journal in 2020 would be 150/100 = 1.5. Now, assume the journal published 60 articles in 2020 in its subject field. If these 60 publications contain 75 references to articles from 2017 to 2019 in journals indexed by the database, then the corresponding DCP value is 75/60 = 1.25. Hence, in this case, the SNIP for the journal in 2020 is calculated as 1.5/1.25 = 1.2.

b. Microsoft Academic Rankings: An umbrella for various bibliometric indicators

Microsoft Academic offers various bibliometric indicators, including citation counts, author h-index values, and rankings for authors, journals, conferences, and institutions. In its initial phases, it employed a proprietary citation-based metric known as the field rating [9] derived from its internal publication database to assess and rank scholarly entities. As noted by Effendy and Yap, the field rating metric bore conceptual similarities to the h-index in its approach to measuring research impact [10].

Since 2015, Microsoft Academic [11] has ranked the authors, institutions, and venues based on salience, prestige, citation count, publication count, and h-index [12]. The eigencentrality measure of the Microsoft Academic Graph (MAG) determines this ranking. In this framework, a publication will achieve a high ranking if it is highly cited by other highly ranked publications, if its authors are affiliated with highly regarded institutions, or if it is published by a prestigious venue in highly competitive fields [11]. Saliency measure can be derived for an author, an institution, a field, and a publication venue as the sum of all saliencies of their respective publications (provided all authors contribute equally to the publication) [11]. The eigencentrality measure can be susceptible to a temporal bias, as new publications may not have sufficient time to gain widespread recognition. Therefore, the saliency value of a publication decays over time if it does not continue to receive acknowledgements or if its authors, publication venue, and fields are not maintaining their saliency [11]. Authors, institutions, and publication venues can achieve higher saliency by producing many publications [12]. To account for the consistency of quality in the work produced, Microsoft Academic presents another measure called prestige, defined as the publication size-normalised saliency for an author, institution, or publication venue. Prestige is computed as the average of the saliencies of its publications [12].

Table 1 shows the current values for Microsoft Academic's salience, h-index, prestige, citations, and publications rank for the top 10 Data Mining conferences, ranked by Microsoft's field rating (2014 snapshot) values [11].

c. ERA Ranking

Excellence in Research Australia (ERA) 2010 refers to a classification of journals. Moreover, conferences are prepared by the Australian Research Council (ARC). Within the domain of Computer Science, this ranking emerged from a nationwide consultation involving various academic departments, resulting in a tiered system comprising three levels: A (highest), B, and C. Researchers nominate a proposed tier for each conference, which is then reviewed by a committee that determines the final classification through majority agreement. Although the broader ERA framework continues to evolve, the specific conference and journal rankings have not been updated since 2012, as they were deemed to have limited influence on the overall research assessment process [13].

d. Australian Business Deans Council (ABDC)

In April 2008, the Australian Business Deans Council (ABDC) established a ranking of over 2,400 business and business-related journals. It was aimed "to overcome the regional and discipline bias of international lists." ABDC represents 39 Australian university business faculties and schools and ranks the journals in most of the disciplines actively researched in these institutions. This ranking was created by grading the journals under the Excellence in Research Australia (ERA) project [14].

The ABDC journal quality list classifies journals into five categories: A*, A, B, C, and "not ranked". Journals rated as 'A*' are regarded as the top-tier outlets in their respective fields, known for publishing original, rigorous, and influential research that significantly contributes to academic discourse. These journals generally exhibit the highest impact factors and are recognised across reputable citation metrics. They also tend to have low acceptance rates and editorial boards comprising eminent scholars affiliated with globally reputed institutions. An 'A' rating signifies a well-respected journal within the discipline, marked by a competitive review process, selective acceptance, and an above-average impact factor relative to its peers. Journals in the 'B' category are recognised for their credibility within specific fields or subfields, though they typically have higher acceptance rates and a moderate citation impact than 'A*' and 'A' journals. The 'C' category includes peer-reviewed journals that meet acceptable scholarly standards but may have limited reach or reputation. This category may also include newer journals that are still establishing their academic standing [15].

e. Computing Research and Education Association of Australasia (CORE): For conferences only

Australian Computing Research and Education Association of Australasia (CORE) is an association of university departments of computer science in Australia and New Zealand. It has developed its ranking of computer science conferences. CORE 2008 is the oldest available CORE ranking for conferences, and CORE 2024 is the latest available dataset. The CORE Executive Committee manages the rankings. The committee periodically accepts requests for the inclusion of new conferences and the re-ranking of existing conferences. The academic committees decide based on objective data requested in the submission process [16].

CORE classifies conferences into four tiers: A*, A, B, and C. A committee manually established the initial draft ranking of the CORE, where the computer science conferences were classified into various tiers. The tiers were defined based on the acceptance rate and membership of the Program Committee (PC). Lower acceptance rates and PC members from top institutions were associated with higher tiers. Subsequently, researchers were allowed to submit requests to include new conferences or update existing conferences' rankings. A committee reviewed these requests and updated the CORE ranking. This process was repeated for multiple iterations.

A separate "Australasian" tier is used for conferences with a primarily Australian and New Zealand audience. Similarly, the "National" tier is used for conferences held primarily in a single country, with chairs from that country. The 'Regional' tier is for conferences that cover a region spanning multiple national borders. The ‘Unranked’ tier exists for conferences for which no ranking decision has been made.

A combination of metrics, including citation rate, acceptance rate, paper submission rate, the popularity and prestige of the conference organisers, and the composition of the program committee, is used to determine the CORE rankings. Conferences with lower acceptance rates and program committees comprising representatives from top universities are classified into top tiers [16]. However, a precise algorithm for the calculations is not exposed.

f. GII-GRIN-SCIE (GGS) Conference Ranking: A Collaborative Initiative

The GII-GRIN-SCIE (GGS) Conference Rating, introduced in 2014, is the collaborative initiative supported by the Group of Italian Professors of Computer Engineering (GII), the Group of Italian Professors of Computer Science (GRIN), and the Spanish Computer Science Society (SCIE). This initiative aims to establish a harmonised framework for evaluating the quality of publications at computer science conferences. The GGS rating is based on existing evaluations from sources such as CORE, Microsoft Academic, and LiveSHINE. This composite ranking is reviewed and updated regularly, typically every two years. Furthermore, each of the three contributing societies—GII, GRIN, and SCIE—disseminates the updated ratings within their academic communities for feedback and potential revision.

The rating labels the conferences into the following classes, decreasing order of importance: A++, A+, A, A-, B, B-, C. These classes are further clustered into four main tiers: classes A++ and A+ are labeled as "top-notch conferences," classes A and A- are labeled as "very high-quality events," classes B and B- are labeled as "events of good quality," and class C is labeled as "work in progress" [17].

This section presents the institutionally developed framework for evaluating journals and conferences, which considers distinct indicators for analysis and evaluation and often categorises them in hierarchical categories. On the one hand, in the case of ERA ranking, the lack of regular updates to specific journal rankings is considered a key drawback, as it is deemed to have limited influence on the overall research assessment process. On the other hand, the collaborative initiative of the GII-GRIN-SCIE (GGS) conference ranking updates at regular intervals and the use of more descriptive labels, such as “work in progress,” which appears non-derogatory, is noteworthy. While the lack of transparency in terms of algorithms presents a limitation for the CORE ranking, others, such as Microsoft Academic and ABDC, build and reinforce hierarchies of prestige, whereby lower acceptance rates, reputation, and high esteem appear to be considered measures of good quality.

In some ways, similar to the metrics mentioned in the preceding section, the institutionally developed evaluation framework also considers the time-based aspect. For instance, the year-based window holds importance in IPP and Microsoft Academic, with the Eigencentrality measure being biased for new publications, as mentioned above. Apart from drawbacks related to temporal and prestige-led hierarchical bias, the importance of Microsoft Academic lies in its broad scope of evaluation, whereby it accommodates indicators such as citation counts, author h-index values, and rankings for authors, journals, conferences, and institutions. Ultimately, it can be safely argued that time-based aspects remain important in nearly all evaluation frameworks.

While the institutionally developed frameworks in this section originated from the Global North, the following section provides details of similar frameworks from the Global South.

3.1.3 National Level Framework for Evaluation of Journals and Conferences: From the Global South

While the above section outlined frameworks developed by the Global North, this section aims to showcase those prepared by the Global South for the assessment of journals and conferences. The aim is not to portray these frameworks in tension with or as an alternative to the ones mentioned above, but to highlight how countries in the Global South have responded to the need for evaluation in specific ways while relying on the various available metrics. In this section, Brazil and India are the two Global South countries selected for their institutionally led evaluation framework.

While several other countries from the Global South belong to distinct regions (Brazil from South America and India from South Asia), and have geopolitical importance in their respective regions, they share close ties and a cordial relationship at the bilateral and plurilateral levels. Their membership in forums and alliances, such as BRICS, BASIC, G-20, G-4, IBSA, the International Solar Alliance, the UN, WTO, UNESCO, and WIPO, is also noteworthy, highlighting the similarity of their vision. Furthermore, the technical and scholarly cooperation between the two countries indicates their individual and collective growth in the scholarly field [18].

a. Qualis: For academic institutions and publication venues

Qualis is a ranking for scientific articles published in journals or conferences for Brazilian graduate schools. The Brazilian Ministry of Education established the Qualis system. Since 1998, it has been one of Brazil's seven criteria for evaluating graduate programs.

This metric is intended to assess and compare academic institutions and publication venues within Brazil rather than serve as a tool for ranking individual researchers [19]. The classification is revised annually and adheres to a set of guidelines established by the Coordenadoria de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), a federal agency operating under the Brazilian Ministry of Education.

The classification system relies on impact factor metrics and is structured into eight tiers: A1 (the highest), A2, B1, B2, B3, B4, B5, and C [20]. CAPES introduced a weighting mechanism that assigns equivalence values to articles across different levels to account for the quality of publication output. For instance, two B1-level publications may be equivalent to 1.2 A1-level publications in a given field. Likewise, one article in B1 and another in A2 may correspond to 1.4 A1-level publications. Similarly, three publications at the B2 level may be equivalent to 1.2 publications at A1 [20].

Farias, Storb, Storpirtis, and Leite [21] mention that the system is based on strata pre-established by the CAPES Board of Directors. In this system, the number of journals at level A1 is less than at level A2. Thus, a journal publishing many articles of moderate quality may be ranked higher than another journal that publishes a small number of high-quality articles. Combined, the total number of journals at levels A1 and A2 accounts for a maximum of 25% of the total number of journals in which the articles were published during the period under review. Similarly, the total number of journals at levels A1, A2, and B1 combined accounts for no more than half of the total journals [21].

Therefore, it can be argued that Qualis is not significantly different from other evaluation metrics and appears to be sufficiently technical in evaluating academic institutions and publication venues within the country. The next subsection discusses the citation index, followed by a section on India.

b. Indian Citation Index

In recent years, shifts in the research and higher education landscape in India have led to an increased focus on evaluating the quality of scholarly output. The University Grants Commission (UGC), a statutory body under the Government of India, plays a central role in overseeing and upholding the standards of teaching, examinations, and research across universities.

According to the 2016 UGC regulations regarding the minimum qualifications for appointing teachers and academic personnel in universities and colleges, the Commission introduced an approved journal list for career progression and faculty recruitment. This list comprises journals indexed in WoS (Web of Science Citation Index, Social Science Citation Index, and Arts and Humanities Citation Index) and those listed in Scopus. At the outset, the list also included journals indexed in the Indian Citation Index (ICI) and others recommended by university-level and subject-specific expert committees, subject to review and approval by the UGC standing committee.

More than 30,000 journals were included in the UGC-approved list of journals. Also, more than 13,000 journals that have ceased publication are recorded separately. In May 2018, the UGC responded to the numerous complaints it received from faculty, researchers, and other academic community members, as well as press and media representatives, by reevaluating and removing more than 4,000 journals from its list of approved journals.

Out of more than 6,000 journals published in India, about 1,800 are research-oriented and peer-reviewed. Out of these, about 20% are not indexable, either because they were not published regularly or because they were not reviewed [30]. The global visibility, even for the remaining indexable journals, is very low. The available citation databases have a limitation. They offer limited coverage due to the many journal titles in all disciplines and languages.

There is a highly underrepresented presence of journals from the developing world in international citation databases, so countries need to establish their citation databases [22]. The Knowledge Foundation, a civil society organisation, launched the Indian Citation Index (ICI) database in 2009. ICI is a multidisciplinary abstract and citation database for Indian research journals designed for literature searches and citation evaluation of Indian literature. ICI has covered data since 2004 and includes content from over 1,500 Indian journals in the sciences, social sciences, arts, and humanities [23].

The ICI website [24] (2017 snapshot) listed 43 journals under the category "Computer Science and Technology" (Table 2). Of these 43 journals, 22 were included in the initial UGC-approved list of journals. However, ICI does not expose its criteria for evaluating the journals. Not surprisingly, in 2018, during the scrutiny of the quality of the journals, several Computer Science journals were removed from the UGC list.

Table 2. Metrics of the Computer Science and Technology Journals Indexed on ICI (2017 snapshot)

Journal Name	No. of Articles	No. of Citations	Scholar Indexed	SJR Score (2017)	UGC Indexing
Advances In Computational Sciences and Technology	83	5	n	n	n
Bvicam's International Journal of Information Technology	172	126	n	n	9769
Global Journal of Enterprise Information Systems	96	13	n	n	n
Indian Journal of Computer Science and Engineering	540	81	n	n	ceased
International Journal of Advanced Computer Research	441	18	n	n	n
International Journal of Advanced Information Science and Technology	113	0	n	n	n
International Journal of Advanced Research in Computer Science	2999	78	n	n	ceased
International Journal of Advanced Trends in Computer Science and Engineering	257	1	n	n	n
International Journal of Applied Mathematics and Computation	124	15	n	n	ceased
International Journal of Applied Research on Information Technology and Computing	163	12	n	n	ceased
International Journal of Computational and Applied Mathematics	54	22	n	n	n
International Journal of Computational Intelligence Research	178	27	n	n	n
International Journal of Computer Networks & Communications	624	218	y	0.113	ceased
International Journal of Computer Science & Information Technology	659	157	n	n	ceased

Journal Name	**No. of Articles**	**No. of Citations**	**Scholar Indexed**	**SJR Score (2017)**	**UGC Indexing**
International Journal of Computer Science and Applications	261	42	n	n	2776
International Journal of Computer Sciences And Engineering	47	1	n	n	63193
International Journal of Computing Algorithm	176	0	n	n	n
International Journal of Computing and Applications	276	4	n	n	ceased
International Journal of Data Mining and Emerging Technologies	76	3	n	n	ceased
International Journal of Data Mining Techniques and Applications	113	0	n	n	n
International Journal of Distributed and Cloud Computing	44	0	n	n	n
International Journal of Information and Computing Science	103	14	n	n	22940
International Journal of Information Processing	372	13	n	n	22945
International Journal of Innovative Research in Computer Science & Technology	301	0	n	n	n
International Journal of Network Security & Its Applications	399	178	n	n	64541
International Journal of Research in Computer Application & Management	187	2	n	n	n
International Journal of Web Technology	80	0	n	n	n
International Journal on Computer Science and Engineering	1621	375	n	n	ceased
International Journal of Information, Communication and Computing Technology	38	0	n	n	n
Journal of Analysis and Applications	71	6	y	0.127	n
Journal of Analysis and Computation	212	8	n	n	26412
Journal Of Banking, Information Technology and Management	74	1	n	n	44343

Journal Name	No. of Articles	No. of Citations	Scholar Indexed	SJR Score (2017)	UGC Indexing
Journal Of Computational Intelligence in Bioinformatics	37	5	n	n	n
Journal Of Computational Mathematics and Optimisation	65	13	n	2013 score: 0.105	n
Journal Of Digital Information Management	204	13	y	0.135	n
Journal Of Information and Optimisation Sciences	794	79	n	n	ceased
Journal of the Institution of Engineers (India) Part CP: Computer Engineering Division Board	102	5	n	2014 score: 0.104	ceased
Journal of the Institution of Engineers (India): Series B - Electrical, Electronics, Telecommunication And Computer Engineering	289	16	y	0.148	11115
Journal On Embedded Systems	107	0	n	n	ceased
Journal On Information Technology	134	2	n	n	64575
Journal on Software Engineering	316	14	n	n	n
Journal on Wireless Communication Networks	114	2	n	n	n
Oriental Journal of Computer Science and Technology	479	38	n	n	n

It can be safely argued that the evaluation frameworks followed by Brazil and India aim to develop a coherent assessment system that reflects the country's context and needs for some standardisation, which is not a complete replica of those followed by the Global North. While attempting to be Indigenous and adopting a fairly basic standardisation framework, caution must be exercised to avoid becoming arbitrary in terms of guidelines and procedures, as a change in government can lead to drastic changes in operating guidelines and procedures. Therefore, while regular assessments and transparency of guidelines are appreciated, ensuring safeguards that restrain arbitrary and spontaneous changes without thorough review and consensus among stakeholders is necessary.

The following section briefly overviews an alternative method for evaluating the conference database, highlighting other evaluation methods that remain marginal.

3.1.4 LiveSHINE Ranking: An Alternative Method

LiveSHINE is a conference database that allows access to the citations accumulated by the papers of a given conference for a given year range. It queries Google Scholar to update citation numbers progressively. Its predecessor, Simple H-Index Estimator (SHINE), used Google Scholar data to calculate the h-index (an indicator for assessing both the research output and scholarly influence of an author or publication; more on this follows in the next section) of computer science conferences. In the latest version of SHINE, LiveSHINE, the acronym has been changed to mean "A Simple and Humble Impact Index Estimator" to reflect the inclusion of other metrics besides the h-index. LiveSHINE is available as an extension to the Chrome web browser [25].

While liveSHINE is a well-intentioned attempt at a more inclusive and holistic metrics framework, the lack of focus indicates the need for the academic community to pay attention to alternative, marginal ways of evaluation and experiment with them.

3.1.5 Author(S) or Publication(s) Centric Metrics: H-Index And Its Variants

The h-index serves as a widely recognised indicator for assessing the research output and scholarly influence of an author or publication. Specifically, it represents the highest number of h such that the researcher has authored h papers, each of which has received at least h citations. For instance, an h-index of 8 implies that the individual has published at least eight works, each of which has been cited at least eight times.

Many variations of the h-index have been proposed, including (i) m-quotient, (ii) Trend h-index, (iii) Normalised h-index, (iv) g-index, (v) e-index, (vi) Contemporary h-index, (vii) Individual h-index, (viii) h_I norm-index, (ix) Multi-authored h-index, (x) h_I annual-index, (xi) A-index and R-index, and (xii) AR-index.

a. m-quotient

   m-quotient [3] may be used to compare scientists of different seniority, as it takes care of the academic career length by dividing a scientist's h-index by the number of years since first publication. It is computed as

$$m - quotient = \frac{h - index}{\#\ years\ since\ first\ publication}$$

b. Trend h-index

   Trend h-index [26] is a measure of the current relevance of a paper. It weighs each citation by its weight.

$$\frac{1}{\#\ years\ since\ citation}$$

   Giving more weight to a recent citation.

c. Normalised h-index

   Normalised h-index (h_n) [26] is a measure of the overall importance of a researcher's research output and is computed as,

$$h_n = \frac{h - index}{\#\ published\ papers}$$

   Thus, a researcher with an h-index of h and several publications greater than h has a lower value of the normalised h-index compared to a researcher with the same h-index value but with the same number of publications. For example, if a researcher has 10 publications, each with 10 citations, the h-index is 10, and hn = 1. On the other hand, a

 https://doi.org/10.58421/misro.v4i3.409

researcher with 20 publications, 10 of which have 10 citations, the rest have < 10 citations, has an h-index of 10, hn = 10 = 0.5.

d. *g*-index

The g-index [27] is designed to emphasise the impact of highly cited publications. A collection of articles is assigned a g-index of g if the top g papers collectively have no fewer than g2 citations.

e. *e*-index

e-index [28] is the number of excess citations beyond those required to make up an h-index of h and can be used to compare researchers' citation patterns with the same h-index value. An author/venue having an h-index value h will have at least h2 citations, and therefore, the e-index is computed as,

$$e - index = Total\ citations - h^2$$

f. Contemporary *h*-index

Contemporary h-index (hc-index) [26] rewards authors who publish consistently, assigning more weight to recently published articles. The index ages the articles, reducing the article's contribution with age. It computes a score for each article i as follows,

$$score(i) = \frac{\gamma \times \#citations\ of\ article\ i}{(age\ of\ article\ i)^{\delta}}$$

In the formula for calculating the score, for δ = 1, since the number of citations received by an article *i* is divided by the article's age, the score's value becomes too small to create an h-index; hence, the coefficient γ is used. Larger coefficient (δ) values result in an older citation's contribution to the score quickly becoming negligible. Sidiropoulos, Katsaros, and Manolopoulos suggest $\gamma = 4$, $\delta = 1$ [26]. For an article published in the current year, its citation accounts for four times as many as an article published four years ago. Thus, the h_c-index for an author has the value h_c if the h_c of his/her articles has the score(i) $\geq h_c$ and the remaining articles have the score(i) $< h_c$.

Table 2 is A fictitious example of a model data set with six publications, listed in descending order of the number of citations received. *n* is the total number of authors in these *h* articles. The effective rank ($Rank_{eff}$) is computed as given in Equation 2. Individual *h*-index (h_I) is computed using Equation 1. h_m is the multi-authored *h*-index value, computed using Equation 3. *h*-index, h_I, and h_m values corresponding to an article number *i* are computed assuming that articles 1 to *i* are included in the computation.

Table 3. A fictitious example of a model data set with six publications

Article No.	Citations	*h*-index	Authors	*n*	h_I	rankeff	h_m
1	20	1	2	2	0.5	0.5	0.5
2	12	2	3	5	0.8	0.8	0.8
3	8	3	1	6	1.5	1.8	1.8
4	6	4	2	8	2	2.3	2.3
5	5	5	5	13	1.92	2.5	2.5
6	2	Paper not included	2	15	Paper not included	3	Paper not included

g. Individual *h*-index

Individual h-index (hI) [29] measures individual average productivity. That is, it is the potential h-index value for an author if he/she had worked alone. It reduces the effect of co-authorship by dividing the h-index value by the average number of authors in the articles that contribute to the h-index. Batista et al. (2006) argue that the hI-index has the advantage of being less sensitive to different research fields. For an author having h-index as h, n as the total number of authors in the h articles considered to compute the h-index, hI-index is computed as [29],

$$h_I = \frac{h}{\frac{n}{h}} = \frac{h^2}{n} \quad (1)$$

Table 3 presents a hypothetical illustration demonstrating how an author's Individual *h*-index (h_I) evolves as additional publications are considered in the *h*-index calculation. As shown in Table 3, the h_I value can decline when a multi-authored paper begins to influence the author's *h*-index [30].

h. h_I norm

The h_I norm, an alternate individual-level *h*-index introduced in Publish or Perish [31], adjusts for co-authorship by dividing each paper's citation count by the number of authors. The resulting normalised citation values are sorted in descending order to determine the corresponding h-index.

i. Multi-authored *h*-index

Multi-authored *h*-index (h_m) [32] uses a fractional paper count value as the effective paper count for a paper. The h_m value is the effective number of papers cited hm or more times. To compute h_m for an author, his/her publications are ordered in descending order of their citations. For each article *i*, an effective rank ($Rank_{eff}$ (*i*)) is computed as,

$$Rank_{eff}(i) = \sum_{j=1}^{i} \frac{1}{\#\ of\ authors\ in\ article\ j} \quad (2)$$

The value of h_m for the author is then computed as,

$$h_m = rank_{eff}\,(i) \quad (3)$$

$$i = max_{\,j}\left(rank_{eff}\,(j) \leq \#citations\ received\ by\ article\ j\right)$$

j. h_I annual

The annualised *h*-index, denoted as h_I, annual (h_{Ia}) [31], reflects a scholar's average yearly research impact, providing a time-normalised measure in contrast to the cumulative values reported by the *h*-index or h_I, norm. It is calculated as,

$$h_{Ia} = \frac{h_I\ norm}{\#\ years\ since\ first\ publication}$$

It reduces the effect of career length and provides a fairer comparison between junior and senior researchers.

k. *A*-index

A-index [33] is the average number of citations from the publications in the *h*-index. It is calculated as,

$$A - index = \frac{\#\ of\ citations\ in\ top\ h\ publications}{h}$$

Interestingly, if two researchers have the same number of citations but one has half the h-index compared to the other, the researcher with the higher h-index will have a lower A-index. The following example illustrates this. Consider a researcher, say RA, who has 10 published papers, of which two papers have five citations each, and the remaining papers have two citations each. Consider another researcher, say RB, who has 14 published papers, of which four papers have four citations each, and the remaining have one citation each. Both researchers have a citation count of 26, but their h-index values are 2 and 4, respectively. In this case, the A-index for researcher RA is five, while that of researcher RB is 4. To resolve this, one may consider the sum of citations received by the publications in the h-index or the square root of this sum instead of the average [33]. When the formula for the index uses the square root of the total citations received by the publications included in the h-index, it is called an R-index, that is,

$$R - index = \sqrt{\#\ of\ citations\ in\ top\ h\ publications}$$

l. Age-Dependent R-index

Age-Dependent R-index (AR-index) [33] weighs an article's citations by the article's age, resulting in less weight for older articles. It overcomes the drawback of the h-index, which does not indicate whether the researcher is still contributing in the present since the h-index never decreases. Suppose that the h-index for an author/publication venue is h. Then, considering the publications in the order of decreasing citations, the AR-index will be computed as,

$$AR = \sqrt{\sum_{j=1}^{h} \frac{\#\ of\ citations\ received\ by\ article\ j}{age\ of\ article\ j}}$$

3.2. Discussion

The paper offers a whistle-stop tour of the various metrics for evaluating academic journals, conferences, and author(s) publications. It begins with some key citation metrics grouped, as they all adhered to the time-based aspect of publications and were not particularly developed by specific institutions to serve a specific vested purpose; instead, their strength lay in their standardised procedure applicable to all. However, whether age, duration, or frequency can be the sole defining factor of a journal's quality and potential is concerning. The following section focuses on the evaluation mechanisms developed by institutions from the Global North, which is then followed by the ones adhered to by the two countries of the Global South (Brazil’s Qualis and India’s Indian Citation Index). The section on the framework developed by the Global North for assessing academic journals and conferences reveals a bias towards repute, prestige, and reinforcing elite hierarchies rather than encouraging budding academic forums.

On the other hand, those followed by the Global South can be appreciated for their attempts to respond to national or contextual needs. However, they can slide into arbitrariness when formulating guidelines, measures, and operations, indicating the need to establish sufficient safeguards against such arbitrariness. The brief note on LiveSHINE as a potential and inclusive alternative highlights the need to explore promising, marginal evaluation methods. The paper's final section addresses the h-index and its variations as a mechanism for assessing an author's publications. Therefore, the paper transitioned from technical journal evaluation frameworks to institutionally led ones for journals and academic conferences, ultimately adopting author-level frameworks, thereby following a level-based approach. While an attempt is made to make the metrics more accessible and comprehensible, the paper seeks to critique the existing mechanism in order to argue for exploring more ways of analysis and assessment to make the academic field more inclusive, holistic, and encouraging for emerging authors, journals, and conference planners.

4. CONCLUSION

Citation-based metrics play a crucial role in measuring the reach and significance of academic work. Several commonly used indicators include the impact factor, h-index, and SCImago Journal Rank (SJR). Although numerous citation metrics have been developed—each offering different advantages and perspectives—many remain unfamiliar to a large segment of the research community.

Therefore, many citation metrics are not used widely for evaluating scientific publications. Researchers should not rely solely on a few citation metrics when assessing the impact and influence of scientific publications; instead, they should consider multiple metrics in context, considering the specific characteristics of their field and their goals. In this study, we review several citation metrics to assess their usefulness in evaluating the impact and influence of scientific publications.

A RELATED TERMS

A.1 Popularity vs. Prestige

The significance of a publication venue, such as a journal or conference, can be assessed through two primary lenses: its popularity and prestige. While popularity reflects the frequency with which a venue is cited overall, prestige accounts for the quality of those citations by incorporating the reputational weight of the citing venues [34]. Typically, popularity is gauged by counting the number of times articles from a venue are cited without considering the source of those citations. In contrast, prestige-based evaluation considers whether those citations come from other well-regarded venues. For instance, if a paper from journal B cites that of A can influence one from journal A, the prestige of B. Pinski and Narin proposed the foundational recursive approach to quantifying such prestige relationships in 1976 [35], who introduced a model in which the value of a citation depends on the status of the citing source [34]. Later, Page, Brin, Motwani, and Winograd [36] extended similar ideas to the web environment through the PageRank algorithm, using weighted links to reflect collective user attention and engagement [36]. This principle has since been adopted in various scholarly evaluation frameworks [37], [38], [39], [40], [41], [42], [43], [44], [45] wherein a modestly cited article can achieve a high prestige score if it is referenced by highly ranked sources [39]. Such articles often align with expert opinion regarding their perceived value [39]. Among the various prestige-based indicators developed, the Eigenfactor (EF) [37] and SCImago Journal Rank (SJR) [41] have gained widespread acceptance as robust metrics for journal evaluation.

A.2 Bibliometrics and Scientometrics

The term "Bibliometrics" was first coined by Alan Pritchard in 1969, with the intention that it "be used explicitly in all studies which seek to quantify the processes of written communication" [46]. In his seminal work, Pritchard [46] described bibliometrics as using mathematical and statistical techniques to analyse books and various forms of recorded communication. Bibliometric indicators are generally categorised into three groups: quantity indicators reflect an author's output, quality indicators pertain to the impact or influence of those publications, and structural indicators highlight the interrelationships among publications, researchers, and research domains [47].

"Scientometrics," also known as naukometriya in Russian, was coined by Vasily V. Nalimov and Z. M. Mulchenko in 1969 [48]. It relates to the study of systematically measuring and analysing science, technology, and innovation [49].

A.3 Eigenvector Centrality

In graph theory, eigenvector centrality (often called eigencentrality) quantifies a node's relative importance within a network. It builds on the principle that a node's significance is determined by how many connections it has and by the quality or centrality of those it connects to. Being linked to influential nodes boosts a node's centrality score. Thus, nodes with high eigenvector values are typically embedded within clusters of other well-connected nodes [11].

REFERENCES

[1] S. Gupta, N. Kumar, and S. Bhalla, "Citation metrics and evaluation of journals and conferences," *Journal of Information Science*, Feb. 2023, doi: 10.1177/01655515231151411.

[2] E. Garfield, "Citation indexes for science," *science*, vol. 122, no. 3159, pp. 108–111, Jul. 1955, doi: 10.1126/science.122.3159.108.

[3] J. E. Hirsch, "An index to quantify an individual's scientific research output that takes into account the effect of multiple co-authorship," *Scientometrics*, vol. 85, no. 3, pp. 741–754, Mar. 2010, doi: 10.1007/s11192-010-0193-9.

[4] "Eigenfactor." EIGENFACTOR.org. http://www.eigenfactor.org/whyeigenfactor.php. (accessed: Apr. 17, 2016).

[5] "SJR Scimago Journal and country rank." scimago. https://www.scimagojr.com/ (accessed: Apr. 18, 2016).

[6] "Clarivates analytics: Incites help." Clarivates analytics: Incites help. http://help.incites.clarivate.com (accessed: Jun. 22, 2022).

[7] "Scopus journal metrics." Elsevier. https://www.elsevier.com/solutions/scopus/how-scopus-works/metrics (accessed: Sept. 13, 2019).

[8] L. Waltman, N. J. Van Eck, T. N. Van Leeuwen, and M. S. Visser, "Some modifications to the SNIP journal impact indicator," *Journal of Informetrics*, vol. 7, no. 2, pp. 272–285, Jan. 2013, doi: 10.1016/j.joi.2012.11.011.

[9] "Conference ranks." Conference Ranks. http://www.conferenceranks.com/ (accessed: Jul. 28, 2018).

[10] S. Effendy and R. H. C. Yap, "Investigations on Rating Computer Sciences Conferences," *Www - World Wide Web Consortium (W3c)*, Jan. 2016, doi: 10.1145/2872518.2890525.

[11] "Microsoft academic." Microsoft academic. https://academic.microsoft.com/home (accessed: Jul. 24, 2018).

[12] Wang, K., Shen, Z., Huang, C.-Y., Wu, C.-H., Eide, D., Dong, Y., . . . Rogahn, R. (2019). A review of microsoft academic services for science of science studies. *Frontiers in Big Data*, 2, 45.

[13] P. Küngas, S. Karus, S. Vakulenko, M. Dumas, C. Parra, and F. Casati, "Reverse-engineering conference rankings: what does it take to make a reputable conference?," *Scientometrics*, vol. 96, no. 2,

pp. 651–665, Jan. 2013, doi: 10.1007/s11192-012-0938-8.
[14] “News & Publications - Australian Business Deans Council,” Australian Business Deans Council. https://abdc.edu.au/research/abdc-journal-list/ (accessed Aug, 23, 2019).
[15] A. W. Harzing, “Journal Quality List.” Harzing.com https://harzing.com/resources/journal-quality-list (accessed: May 14, 2025). “News & Publications - Australian Business Deans Council,” Australian Business Deans Council. https://abdc.edu.au/research/abdc-journal-list/ (accessed Aug, 23, 2019).
[16] “Core Rankings Portal.” CORE. http://www.core.edu.au/conference-portal (accessed: Jul. 28, 2018).
[17] “The GII-GRIN-SCIE (GGS) Conference Rating.” http://valutazione.unibas.it/gii-grin-scie-rating/ (accessed: Aug. 17, 2018).
[18] https://www.mea.gov.in/Portal/ForeignRelation/Brief_on_India-Brazil_Relations__unclassified___22.1.24_.pdf
[19] I. C. De Souza Almeida, R. G. De Almeida, and L. R. De Carvalho, “Academic rankings and pluralism: The case of Brazil and the new version of Qualis,” *EconomiA*, vol. 19, no. 3, pp. 293–313, Mar. 2018, doi: 10.1016/j.econ.2018.03.003.
[20] Andriolo et al., “Classification of journals in the QUALIS System of CAPES URGENT need of changing the criteria!,” *Arquivos De Neuro-Psiquiatria*, vol. 68, no. 2, pp. 327–329, Apr. 2010, doi: 10.1590/s0004-282x2010000200037.
[21] M. R. Farias, B. H. Storb, S. Storpirtis, and S. N. Leite, “Impact Factor: an appropriate criterion for the Qualis journals classification in the Pharmacy area?,” *Brazilian Journal of Pharmaceutical Sciences*, vol. 53, no. 3, Nov. 2017, doi: 10.1590/s2175-97902017000301001.
[22] P. Chand, “Knowledge indexation and research productivity in India: Experience with Indian Citation Index,” in *Fourth CODESRIA Conference. on Electronic Publishing*, 2016.
[23] R. Giri and A. K. Das, “Indian Citation Index: a new web platform for measuring performance of Indian research periodicals,” Library Hi Tech News, vol. 28, no. 3, pp. 33–35, May 2011, doi: 10.1108/07419051111145154.
[24] “Indian citation index.” Indian Citation Index. http://www.indiancitationindex.com/ici.aspx (accessed: Sept, 09, 2019).
[25] “LiveSHINE.” LiveSHINE. https://chrome.google.com/webstore/detail/liveshinebeta/obohlnnfogkjeknnfgcfmacjbgekmana (accessed Sept. 13, 2019).
[26] A. Sidiropoulos, D. Katsaros, and Y. Manolopoulos, “Generalised Hirsch h-index for disclosing latent facts in citation networks,” *Scientometrics*, vol. 72, no. 2, pp. 253–280, Jun. 2007, doi: 10.1007/s11192-007-1722-z.
[27] Egghe, L. (2006). Theory and practise of the g-index. *Scientometrics*, 69(1), 131–152.
[28] C.-T. Zhang, “The e-Index, complementing the H-Index for excess citations,” *PLoS ONE*, vol. 4, no. 5, p. e5429, May 2009, doi: 10.1371/journal.pone.0005429.
[29] C.-T. Zhang, “The e-Index, complementing the H-Index for excess citations,” *PLoS ONE*, vol. 4, no. 5, p. e5429, May 2009, doi: 10.1371/journal.pone.0005429.
[30] M. Schreiber, “A modification of the h-index: The hmh_mhm-index accounts for multi-authored manuscripts,” *Journal of Informetrics*, vol. 2, no. 3, pp. 211–216, 2008, doi: 10.1016/j.joi.2008.05.001.
[31] A. W. Harzing, “Publish or perish.” Harzing.com. Feb. 06, 2016. Available: https://harzing.com/resources/publish-or-perish (accessed Feb. 06, 2016).
[32] M. Schreiber, “To share the fame in a fair way, hmh_mhm modifies hhh for multi-authored manuscripts,” *New Journal of Physics*, vol. 10, no. 4, p. 040201, 2008, doi: 10.1088/1367-2630/10/4/040201.
[33] B. Jin, L. Liang, R. Rousseau, and L. Egghe, “The R- and AR-indices: Complementing the h-index,” *Chinese Science Bulletin*, vol. 52, no. 6, pp. 855–863, Mar. 2007, doi: 10.1007/s11434-007-0145-9.
[34] M. Franceschet, “The difference between popularity and prestige in the sciences and in the social sciences: A bibliometric analysis,” Journal of Informetrics, vol. 4, no. 1, pp. 55–63, Sep. 2009, doi: 10.1016/j.joi.2009.08.001.
[35] G. Pinski and F. Narin, “Citation influence for journal aggregates of scientific publications: Theory, with application to the literature of physics,” *Information Processing & Management*, vol. 12, no. 5, pp. 297–312, Jan. 1976, doi: 10.1016/0306-4573(76)90048-0.
[36] L. Page, S. Brin, R. Motwani, and T. Winograd, “The PageRank citation ranking : Bringing order to the web,” *The Web Conference*, vol. 98, pp. 161–172, Nov. 1999, Available: http://dbpubs.stanford.edu:8090/pub/1999-66/.
[37] C. Bergstrom, “Eigenfactor: Measuring the value and prestige of scholarly journals,” College & Research Libraries News, vol. 68, no. 5, pp. 314–316, May 2007, doi: 10.5860/crln.68.5.7804.
[38] X. Liu, J. Bollen, M. L. Nelson, and H. Van De Sompel, “Co-authorship networks in the digital library research community,” *Information Processing & Management*, vol. 41, no. 6, pp. 1462–1480, Jun.

2005, doi: 10.1016/j.ipm.2005.03.012.
[39] P. Chen, H. Xie, S. Maslov, and S. Redner, “Finding scientific gems with Google’s PageRank algorithm,” *Journal of Informetrics*, vol. 1, no. 1, pp. 8–15, Dec. 2006, doi: 10.1016/j.joi.2006.06.001.
[40] D. Fiala, F. Rousselot, and K. Ježek, “PageRank for bibliographic networks,” *Scientometrics*, vol. 76, no. 1, pp. 135–158, May 2008, doi: 10.1007/s11192-007-1908-4.
[41] S. R. Group, *Description of Scimago Journal Rank Indicator*, 2008.
[42] X. Liu, J. Bollen, M. L. Nelson, and H. Van De Sompel, “Co-authorship networks in the digital library research community,” *Information Processing & Management*, vol. 41, no. 6, pp. 1462–1480, Jun. 2005, doi: 10.1016/j.ipm.2005.03.012.
[43] N. Ma, J. Guan, and Y. Zhao, “Bringing PageRank to the citation analysis,” *Information Processing & Management*, vol. 44, no. 2, pp. 800–810, Aug. 2007, doi: 10.1016/j.ipm.2007.06.006.
[44] S. Maslov and S. Redner, "Promise and pitfalls of extending Google’s PageRank algorithm to citation networks," *Journal of Neuroscience*, vol. 28, no. 44, pp. 11103–11105, 2008, doi: 10.1523/JNEUROSCI.0002-08.2008.
[45] A. Sidiropoulos and Y. Manolopoulos, “Generalised comparison of graph-based ranking algorithms for publications and authors,” Journal of Systems and Software, vol. 79, no. 12, pp. 1679–1700, Feb. 2006, doi: 10.1016/j.jss.2006.01.011.
[46] A. Pritchard, “Statistical bibliography or bibliometrics,” Journal of Documentation, vol. 25, p. 348, Jan. 1969.
[47] V. Durieux and P. A. Gevenois, “Bibliometric indicators: quality measurements of scientific publication,” *Radiology*, vol. 255, no. 2, pp. 342–351, Apr. 2010, doi: 10.1148/radiol.09090626.
[48] V. V. Nalimov and Z. M. Mul’chenko, *Naukometriya: Izuchenie razvitiya nauki kak informatsionnogo protsessa Naukometriya: The Study of the Development of Science as an Information Process*. Moscow: Nauka, 1969.
[49] Y. Manolopoulos and D. Katsaros, “Metrics and Rankings: Myths and Fallacies,” in *Communications in computer and information science*, 2017, pp. 265–280. doi: 10.1007/978-3-319-57135-5_19.