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Transforming Researcher Evaluation: A New Global Platform to Measure Impact Across Disciplines

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Abstract

Ranking researchers based solely on raw metrics such as citation counts or the H-index can introduce significant biases. These measures often disadvantage early-career scientists and those working in disciplines with distinct publication norms. To address this inequity, we aimed to create a global, field-adjusted reference for evaluating scientific productivity.

We developed a comprehensive worldwide reference database encompassing 19 scientific disciplines. Using data from Scopus, we analyzed the most recent 5,000 researchers across 174 sub-fields. To account for disciplinary differences, we incorporated diverse publication types into the analysis tailored to each domain.

Our reference dataset includes 507,233 researchers from across the globe and facilitates the calculation of expected values for H-index, annual citations, and recent publications (within the past five years) for each percentile in every discipline. These benchmarks were stratified by career stage, assessed at each year after a researcher's first publication. A composite score was developed to rank publication performance into deciles (D1–D10), where D1 represents the highest level of achievement. Importantly, only data from researchers within the same career stage and scientific domain are used for comparison, ensuring fair and context-sensitive evaluations. To enhance accessibility, we established a web portal (www.scientometrics.org) to facilitate researcher benchmarking.

This age- and discipline-normalized international database promotes the application of responsible metrics, offering a robust framework for global scientometric rankings. By providing an online analysis platform, we enable researchers, institutions, and policymakers to determine expected levels of scholarly output at the individual level while fostering fairness and equity in academic evaluation.

Introduction

Researchers' performance is often evaluated using quantitative metrics such as publication counts, citations, and the H-index, which provide an initial overview of achievements. These metrics are widely used, driven by the "Publish or Perish" culture that prioritizes publication volume. Tools like Web of Science, Scopus, and Google Scholar supply these indicators, serving grant agencies, academic committees, and university rankings (Szluka et al., 2023; Győrffy et al., 2023). However, exclusive reliance on these metrics introduces three key limitations.

First, they embed systemic biases. Researchers with longer careers naturally accumulate higher values, disadvantaging early-career scientists. For instance, peak productivity in fields like economics is often reached eleven years post-PhD (Lan et al., 2023). Metrics also vary across disciplines; an exceptional H-index in one field may be average in another (Győrffy, Csuka et al., 2020).

Second, academic productivity often plateaus and declines after a researcher's "Golden Age" (Győrffy, Csuka et al., 2020; Alchokr et al., 2022), and traditional metrics fail to account for those non-active "giants" whose past influential work inflates their indicators, skewing evaluations of their current relevance.

Third, authorship conventions complicate contributions. In many fields, first authorship signifies significant involvement, while the last author often represents the supervising researcher. Middle authorship contributions vary widely. Though these conventions are less established in the arts and humanities, they are gaining acceptance.

Evaluating scientific impact using single metrics like citation counts or H-index provides an oversimplified view of scholarly contributions. A study of over 84,000 scientists revealed that traditional metrics fail to capture the complexities of modern research, especially in fields with extensive multi-authorship (Ioannidis et al., 2016). Notably, only 322 of the top 1,000 scientists ranked by comprehensive metrics appear in the top 1,000 based on total citations, and some highly-cited researchers have never been first, last, or sole authors. These discrepancies, along with significant disciplinary differences in publication patterns, highlight the need for a multi-parameter approach to measuring productivity.

Our prior analyses have identified robust predictors of future scientific output. A large-scale evaluation of grant allocation in Hungary, analyzing 42,905 review reports for 13,303 proposals, found that H-index, yearly independent citation counts, and publications in top-tier journals (Q1) were the strongest predictors of future success, dramatically outperforming reviewer-assigned scores (Győrffy, Herman et al., 2020). Similarly, an analysis of Hungarian Momentum grant recipients showed that total citations, H-index, and publication impact factors strongly correlated with future productivity, while factors like gender, degree, or international grants showed no significant effect (Győrffy et al., 2018, Tóth et al. 2024).

Building on these findings, we developed a novel evaluation system that incorporates validated metrics while normalizing for age, discipline, and authorship position. Initially piloted for Hungarian researchers, where it achieved high national engagement (Győrffy et al., 2022), we redesigned the system for global application using Scopus data. The updated framework addresses data source differences and categorization standards, enabling accurate and equitable global assessment. Overall, here we introduce a fairer framework for researcher evaluation, mitigating biases inherent in traditional methods. Our online platform now provides a user-friendly tool for assessing and comparing approximately 20 million researchers across diverse scientific disciplines.

Methods

Data source

We used Elsevier's Science-Metrix database to classify fields, grouping 174 subfields into 19 broader fields across applied sciences, arts, humanities, health sciences, economics, and natural sciences. One field, visual and performing arts, was excluded due to insufficient data.

Publication and citation data were obtained from Scopus using its Search and Citation Overview APIs. Authors with at least five publications were included, prioritizing the most recent 5,000 per subfield for manageability. Independent citations were extracted for all articles.

Scientometric parameters

We computed H-index, yearly independent citation counts, and the number of publications in the past five years (Q1 journals preferred). Age was defined as years since the first publication. High-impact publications were identified using citation thresholds based on Web of Science's top 1% thresholds (**Table 1**).

Table 1. The research subfields were grouped into broader research fields, representing the five major domains of science. The "Scopus author n" column refers to the number of researchers from Scopus who were included in the reference database. The "Citation/year" column indicates the annual independent citation count required to classify a publication as high-impact within the specified scientific field.

Domain	Field	Scopus author n	Citation / Year	Source
Applied Sciences	Agriculture, Fisheries & Forestry	25487	14.3	WoS
	Built Environment & Design	6558	16.2	Computed
	Enabling & Strategic Technologies	18997	16.2	Computed
	Engineering	38551	16.7	WoS
	Information & Communication Technologies	24924	17.6	WoS
Arts & Humanities	Communication & Textual Studies	5824	11.5	= Social sciences
	Historical Studies	16447	11.5	= Social sciences
	Philosophy & Theology	10083	11.5	= Social sciences
Economic & Social Sciences	Economics & Business	32987	16.6	WoS
	Social Sciences	38186	11.5	WoS
Health Sciences	Biomedical Research	40078	32.6	WoS
	Clinical Medicine	101402	18.1	WoS
	Psychology & Cognitive Sciences	18823	16.0	WoS
	Public Health & Health Services	20315	22.2	Computed
Natural Sciences	Biology	19246	21.0	WoS
	Chemistry	21563	21.2	WoS
	Earth & Environmental Sciences	20612	16.3	WoS
	Mathematics & Statistics	13743	7.2	WoS
	Physics & Astronomy	33397	16.2	WoS

Discipline-specific adjustments

Fields were grouped into three categories to account for differences in publication practices. For most sciences, only first- or last-authored Q1 publications were considered, while arts, humanities, and social sciences included all Scopus-indexed outputs (**Figure 1**).

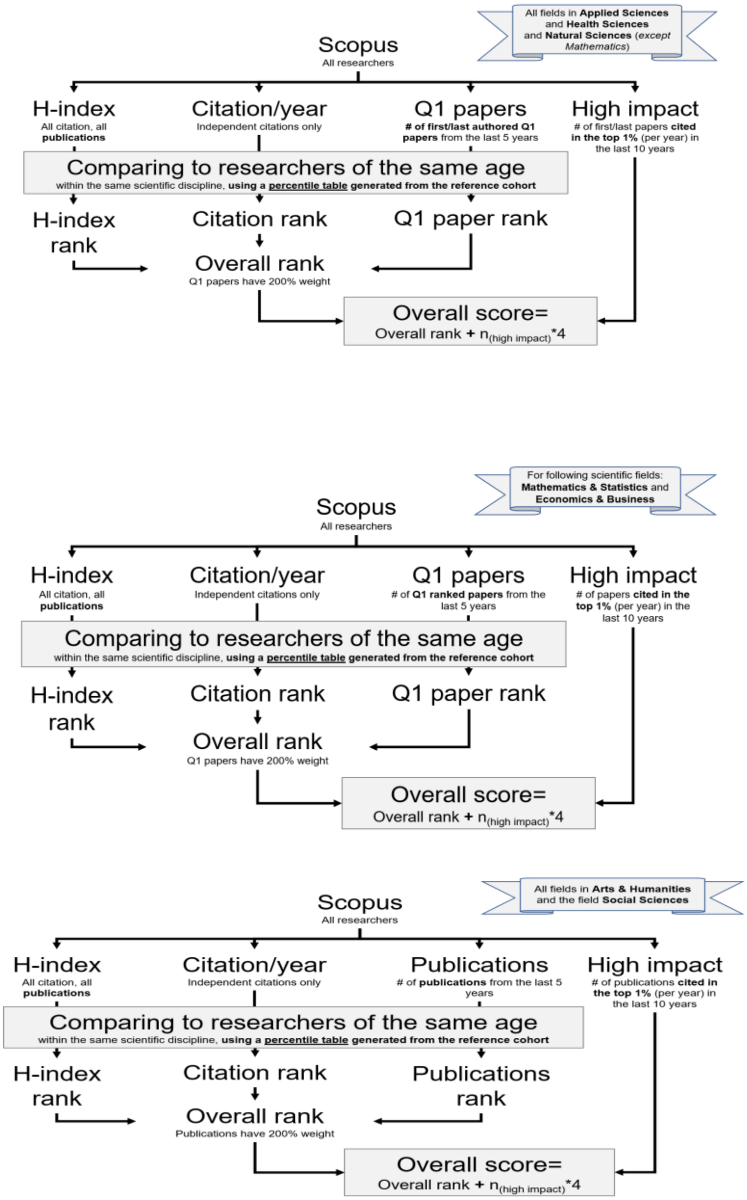

Figure 1. The overall score is calculated using distinct pipelines tailored to each major scientific discipline in order to account for the unique publication patterns specific to each field. One key aspect of this analysis involves the normalization of publication age relative to the first scientific publication. For example, the H-index of a researcher who has been active for 10 years is compared to the H-index at the same career stage for all researchers who have been active for more than 10 years.

Percentile tables and ranking

We generated percentile tables for H-index, citations, and publications by career age and field. Scores were averaged, with publication output weighted double. High-impact publications increased scores by a fixed value. Researchers were ranked into deciles (D1–D10) based on their total score.

An online portal, built using R Shiny, computes rankings for Scopus-indexed researchers. Users can input a name or Scopus ID to retrieve and rank data instantly. The platform is accessible at www.scientometrics.org/scopus.

Results

Database overview

For establishing the reference cohort, we analyzed 507,223 researchers across 174 subfields using Scopus data, excluding fields with insufficient publications (e.g., Education, Music, Law). China and the U.S. were the top contributors, each exceeding 86,000 researchers. Publication years peaked between 2015–2019, with fewer recent authors meeting the five-publication threshold. Researchers in natural sciences dominated publication counts, while arts & humanities had the least.

Scientometric analysis

We calculated the H-index, annual independent citations, and publication counts for each researcher at each career age with yearly bins. Independent citations were used for yearly citation metrics, while H-index calculations included all citations, aligning with Hirsch's original definition. Discipline-specific publication patterns were considered, ensuring accurate cross-field comparisons (**Figure 1**).

To speed up analysis, percentile thresholds for H-index, yearly citations, and publication counts at each years post-first publication were established across 19 disciplines. These thresholds allow rapid researcher assessment and are available for download on the scientometrics.org website.

Online analysis portal

We developed an online platform for researcher evaluation. Users can input a researcher’s name and discipline to retrieve Scopus data and generate rankings based on H-index, citations, and publication counts. Visualizations include percentile-based distributions across disciplines, offering detailed insights into a researcher's relative performance (**Figure 2**).

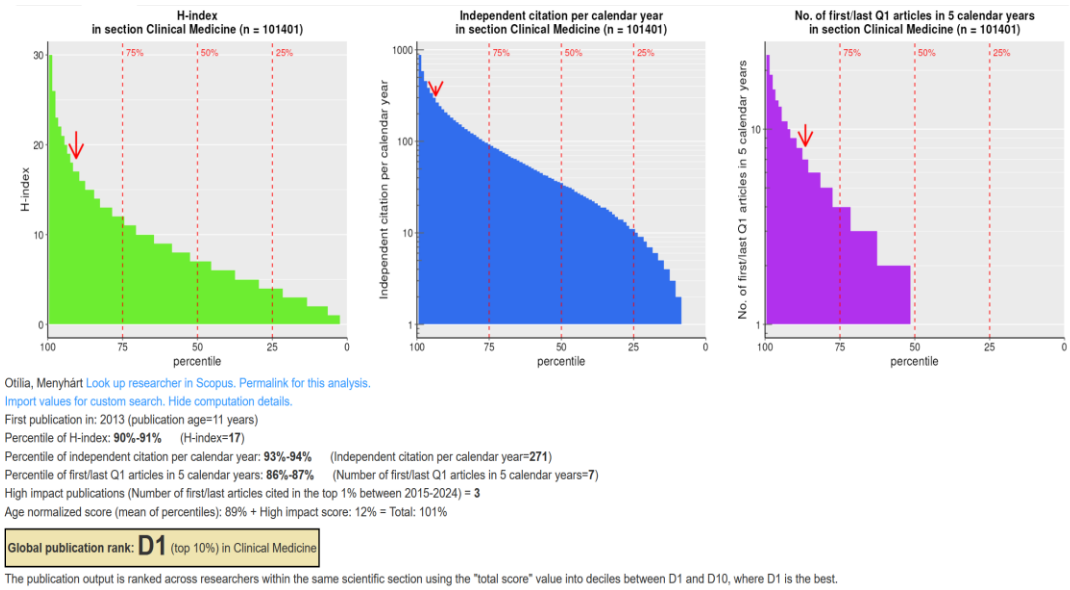

Figure 2. The ranks plot illustrates the evaluation of a randomly selected medical researcher's standing across three computed metrics: The H-index (left panel), the annual count of independent citations (central panel), and the quantity of first/last authored Q1-ranked articles in the most recent five years (right panel). Dashed red lines indicate the quartile thresholds, with red arrows pointing to the researcher's current position within these rankings.

Discussion

Evaluation of researcher output

A quantitative evaluation of researchers across disciplines is essential for uncovering hidden talents. Past performance is often a reliable indicator of future success, as demonstrated in the comparison of publication output before and after earning a PhD (Munkácsy et al. 2022). Several global platforms assess scholarly output, such as Scopus, which provides the H-index, total publications, citations, and authorship distribution; Google Scholar, which includes the H-index, total publications, and i10 index; Web of Science, which offers the H-index and citation percentiles; Semantic Scholar, which lists influential citations; and Open Alex, which reports the H-index, i10 index, and aggregate publications and citations.
However, the reliability of these metrics varies by researcher age and discipline, with younger researchers and fields like humanities seeing less accuracy.

Pilot and global application of analysis pipeline

Our pilot project, based on the Hungarian Academy of Sciences' classification system and data from the Hungarian Scientific Work Archive (HSWA) (Győrffy et al. 2022), highlighted some challenges due to the limited scope and differing categorization of HSWA data. Notably, HSWA includes shared first/last authorships and non-Scopus-indexed publications.

To address these issues, we redesigned our analysis pipeline for global applicability, using Scopus data. This redesign involved omitting corresponding authorships and adjusted filtering to include only Scopus-listed publications, avoid double-counting citations for first/last authored works, and ensure compatibility with global standards. The newly established platform now allows users to evaluate and compare the output of around 20 million researchers across various scientific fields, providing an accessible and accurate tool for global scholarly assessment.

Limitations of the approach

There are some limitations to our analysis that need to be addressed. First, Van Leeuwen et al. (2001) highlighted the language bias in citation metrics, particularly for non-English publications. Since our data source primarily includes English-language publications, researchers in non-English-speaking countries may be underrepresented. We emphasize the importance of considering these language biases when evaluating research performance at national or institutional levels.

Second, researchers often publish across multiple disciplines, which complicates bibliometric analysis. A more nuanced evaluation, incorporating contextual data, is required to accurately assess cross-disciplinary researchers. Developing methodologies to address this challenge can be a future research objective.

Third, our analysis is based on a snapshot of the database, and any changes to researchers' profiles or IDs since that snapshot—such as name similarity issues or ID cancellations due to mergers—may affect individual assessments. However, given the large number of researchers in the reference cohort, these fluctuations are unlikely to undermine the broader reliability of our approach.

Conclusions

We have introduced a new global platform for evaluating individual researchers' scientific output. Our study presents a new way of scientometric analysis, offering global coverage of 507,223 researchers across 19 disciplines and a unique methodology that accounts for publication age and disciplinary differences. The user-friendly online portal (www.scientometrics.org/scopus) democratizes complex bibliometric analysis. By integrating multiple parameters with a weighted scoring system and including a high-impact publication component, we provide a more equitable framework for assessing scientific productivity. Our method offers additional insights to complement existing evaluation practices, with our goal to ensure fair and transparent assessments within the scientific community.

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