



# From Integrity to Inflation: Ethical and Unethical Citation Practices in Academic Publishing

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## Abstract

Citation counts are a key metric in academic success, influencing career advancement and funding. However, the pressure to increase these counts has led to unethical practices such as citation inflation through manipulation. This paper examines strategies such as excessive self-citation, coercive citation demands by reviewers, and overuse of unpublished works, which distort the academic record and undermine scholarly integrity. The paper also explores ethical approaches to increasing citation counts, emphasizing high-quality research, appropriate journal selection, and active dissemination through reputable channels. A quantitative analysis of self-citation practices across different countries and fields revealed significant disparities, with some nations exhibiting high levels of self-citation among top scientists, while others showed more restrained behaviors. These findings suggest that citation practices may be influenced by various factors, including national research policies, cultural norms and others. The study highlights the potential long-term consequences of these behaviors for academic careers and the scientific community. Practical solutions to curb citation manipulation, such as stricter editorial oversight and improved journal collaboration, are proposed. The study aims to raise awareness of ethical challenges in academic publishing and offers strategies to maintain integrity in citation practices, ensuring that metrics reliably measure scholarly impact.

**Keywords** Citation ethics · Academic misconduct · Self-citation · Research integrity · Citation manipulation

## Introduction

The ethical landscape of academic publishing is foundational to the integrity, credibility, and advancement of scientific research (Maral, 2024). In an era where the dissemination of knowledge is critical for societal progress, maintaining rigorous ethical standards is essen-

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tial to ensure that the scientific record accurately reflects true advancements in understanding (Glendinning et al., 2024). Citations play a pivotal role in this process, as they recognize the contributions of previous work and also help establish the relevance, impact, and influence of current research within the broader scientific community (Aksnes et al., 2019).

For many researchers, increasing the citation count of their work is a legitimate and desirable goal. Citations often serve as a proxy for the influence of a study, indicating how much it has contributed to the ongoing scholarly dialogue (Teplitskiy et al., 2022). They are frequently used as metrics in evaluating academic success, influencing decisions related to hiring, promotion, grant funding, and institutional rankings. However, while striving for a high citation count can motivate researchers to produce high-quality work that resonates with their peers, it is crucial that this goal is pursued through ethical and academically sound methods that contribute positively to the field.

The current academic climate, characterized by the “publish or perish” (Vasconez-Gonzalez et al., 2024) mentality, places immense pressure on researchers to continuously publish and achieve high citation counts. This pressure is particularly pronounced for novice researchers, who often face unique challenges in navigating the complex expectations of academic publishing. Habibie and Hyland (2019) explore these struggles, highlighting the difficulties novice writers encounter when aiming to achieve publication and meaningful citation counts in a competitive academic environment. This pressure is exacerbated by the increasing reliance on quantitative citation metrics, such as the h-index (Hirsch, 2005) and impact factor, as key indicators of academic performance and success. In this context, some individuals resort to unethical practices to artificially inflate their citation counts. These practices, which range from excessive self-citation to coercive citation demands in peer review, undermine the integrity of the scientific process by distorting the academic record. The consequences are far-reaching, as they lead to skewed perceptions of a researcher’s influence and the actual significance of their work within the scientific community.

The distortion of citation metrics affects individual careers and also impacts the entire academic ecosystem. It can mislead other researchers, funders, and policymakers, who may rely on these metrics to make informed decisions. Furthermore, it perpetuates a cycle where unethical behavior is rewarded, potentially encouraging others to engage in similar practices. Over time, this can erode trust in the scientific enterprise and hinder the true progress of knowledge. The recent study by Bruton et al. (2024) explored the issue of citation ethics, revealing that researchers possess nuanced views on various citation norms, despite these norms often being vaguely defined or insufficiently detailed. The study suggests that more effort is needed to strengthen the principles and guidance surrounding good citation practices.

Goodhart’s Law states, “When a measure becomes a target, it ceases to be a good measure” (Goodhart, 1984). This concept is used to explain the unintended consequences that arise when a specific metric is overemphasized as a performance target. In the context of citation metrics, Goodhart’s Law is particularly relevant. Metrics such as the h-index, impact factor, and total citation counts, originally designed as objective measures of a researcher’s influence, the quality of academic journals, and the overall impact of scholarly work, have increasingly become explicit targets for researchers and institutions. This shift is particularly evident in their role in decisions related to hiring (Aksnes & Langfeldt, 2025), promotion and tenure (Marsicano et al., 2022), and research funding (Roshani et al., 2021).

When citation metrics become targets, the focus can shift from producing high-quality, impactful research to strategies aimed at inflating these metrics. This can lead to a range of unethical behaviors, such as excessive self-citation, citation cartels, and coercive citation practices, where reviewers or editors pressure authors to cite their work or the journals they represent, regardless of relevance. These practices distort the original purpose of citation metrics, turning them into poor reflections of actual scholarly impact and leading to a misrepresentation of the true value of research.

In essence, Goodhart's Law highlights the danger of over-relying on quantitative metrics in academia. When citation metrics are treated as direct targets rather than as indicators, they can be manipulated in ways that undermine the integrity of scientific research. This creates a cycle where the measure loses its value as a true indicator of academic quality, ultimately compromising the very goals it was intended to support.

Given the centrality of ethical citation practices to the credibility of academic research, this paper explores both the unethical practices that some researchers use to inflate their citation counts and the ethical strategies that can be employed to conduct research responsibly (Hite et al., 2022) and achieve genuine and meaningful citation growth. By exploring these issues from the perspectives of authors, reviewers, and editors, the paper underscores the importance of maintaining high ethical standards across all facets of academic publishing. The ultimate objective is to cultivate a research environment where citation metrics accurately reflect the true impact of scholarly work and where the integrity of the scientific process is safeguarded. In addition to the qualitative analysis and discussion, this paper also presents quantitative findings. Specifically, it examines the percentage of self-citations among the world's top scientists, as reported in the works of Ioannidis et al. (Ioannidis, 2023, 2024; Ioannidis et al., 2019, 2020). The quantitative analysis uncovers intriguing insights, not only about individual researchers but also about citation practices in different countries.

## Literature Review

Citation is a fundamental practice in scientific publishing, crucial for acknowledging sources and supporting the integrity of academic work (Gasparyan et al., 2015). However, it is imperative that citations are used properly and ethically (Reedijk, 2012). Mammola et al. (2022) conducted a meta-analysis to quantitatively assess the influence of non-scientific factors on the citation impact of scientific articles. Their findings suggest that certain patterns emerge in the data, indicating that non-scientific features can significantly affect how often a paper is cited.

Manipulating citations in research articles represents a form of academic misconduct that breaches publication ethics. This type of manipulation is typically aimed at artificially increasing the citation counts of a researcher or a journal. Unfortunately, although this unethical behavior has been on the rise in recent years, it has not garnered significant attention from the scientific community (Mehregan, 2022). A major factor contributing to this trend is the heavy emphasis that universities and research institutions, particularly in developing countries, place on author-level metrics for decisions related to hiring, promotion, and research funding. This focus on metrics may inadvertently encourage researchers

to engage in fraudulent practices to boost the citation numbers of their own publications (Biagioli, 2016).

The h-index (Hirsch, 2005), a widely used metric designed to measure both the productivity and citation impact of a researcher's publications, was introduced to address the limitations of traditional impact metrics, such as simply counting the number of authored papers or citations. Hirsch highlighted the h-index's robustness against self-citations, suggesting that it is difficult to manipulate (Hirsch, 2005). While the h-index is more robust than traditional metrics, it remains vulnerable to manipulation, such as through excessive self-citations or similar practices (van Bevern et al., 2016). Additionally, it has the inherent limitation of not accounting for the number of authors contributing to each publication (Bi, 2023).

In an effort to establish fair and unbiased metrics for assessing a scientist's "level of excellence", researchers have introduced various alternative measures, including the f index (Katsaros et al., 2009), b-index (Brown, 2009), Fi-index (Fiorillo, 2022), g-index (Alonso et al., 2010), hg-index (Alonso et al., 2010),  $h_u$ -index (Li et al., 2021),  $h_t$ -index (Bi, 2023), among others. However, none of these metrics has achieved widespread popularity, and the h-index remains the most popular and widely used metric today.

COPE, the Committee on Publication Ethics, dedicated to educating and supporting editors, publishers, universities, and research institutions, has published a report addressing the issue of citation manipulation (COPE Council, 2019a). The report recommends that journals develop clear policies and standards to define self-citation thresholds, provide educational resources to promote best practices, and establish procedures for responding to potential instances of misconduct.

The Dutch publisher Elsevier conducted an investigation into hundreds of researchers suspected of deliberately manipulating the peer-review process to inflate their own citation counts (Singh Chawla, 2019). The investigation focused on the possibility that some peer reviewers were pressuring authors to cite the reviewers' own research in exchange for favorable reviews—a widely criticized practice known as coercive citation.

A study published in *Nature* (Van Noorden & Singh Chawla, 2019) found that some highly cited academics appear to engage in significant self-promotion. In the most extreme case, a researcher had received 94% of his citations from either himself or his co-authors up to 2017. This individual is not the only example; the study revealed that, out of a database of approximately 200,000 researchers, at least 250 scientists had accumulated more than 50% of their citations from themselves or their co-authors. By comparison, the median self-citation rate across the database was 12.7%. A study by Baccini and Petrovich (2023) examined the trends in country self-citations across 50 countries between 1996 and 2019, using data from Scopus. The analysis reveals that when bibliometric indicators are tied to incentive systems, they can swiftly and significantly influence the citation behavior of entire nations.

The editor of the journal *Results in Physics* authored an article (Markel, 2024) to offer guidance on identifying and avoiding inappropriate requests for citations (IRCs) and to prevent the inclusion of scientifically unmotivated citations in published papers. The article aims to raise awareness and equip reviewers, authors, and editors with the knowledge needed to understand IRCs and develop best practices to avoid potential issues. The key strategies emphasized include recognizing IRCs, exercising diligence, and maintaining transparency. The author notes that it is challenging to provide definitions and recommendations applicable to all real-world situations. Markel (2024) suggests that IRCs and other

forms of citation manipulation are likely to persist in the scientific publishing landscape, and stakeholders are encouraged to approach this challenge with flexibility and creativity.

According to another study (Van Noorden, 2012), one in five academics across various social science and business disciplines reported being asked by journal editors to add superfluous references to their papers as a condition for publication. Wilhite and Fong (2012) explored the issue of coercive citation in academic publishing, specifically examining the behavior of editors who pressure authors to add citations to their journal.

Fong and Wilhite (2017) conducted a study examining how intense competition for limited journal space and research funding can drive manipulation in academic research. Analyzing data from over 12,000 survey responses sent to more than 110,000 scholars across various disciplines, including science, engineering, social science, business, and health care, they found that, despite widespread disapproval of such tactics, many scholars feel pressured to engage in them, while others view them as a necessary part of the academic process. The study suggests that certain changes in the review process could help curb this ethical decline, although progress may be slow.

At the end of this literature review, it is evident that while considerable research has been conducted on the ethical and unethical practices surrounding citation behaviors, gaps remain in understanding the nuanced impact of these practices on academic integrity and scholarly communication. Specifically, there is a lack of comprehensive frameworks that connect individual behaviors, systemic pressures, and policy-level interventions to their consequences for citation metrics. This study aims to address these gaps by examining citation practices through the perspectives of authors, reviewers, and editors, while also presenting a quantitative analysis of global self-citation trends. By doing so, it seeks to contribute to the broader discourse on maintaining ethical standards in academic publishing and propose actionable strategies to curb manipulative citation behaviors.

## **Unethical Pathways of Citation Practices in Academia**

### **From an Author's Perspective**

This section examines the issue from an author's standpoint, analyzing the unethical practices some authors use to artificially boost their citation counts.

#### **Overuse of Self-Citations**

One of the most prevalent unethical practices in academic publishing is the overuse of self-citations (Hussein et al., 2025). While it is entirely legitimate and often necessary to cite one's previous work in certain contexts—such as when building on earlier research, providing background information, or establishing continuity within a body of work—excessive self-citation goes beyond these reasonable boundaries (Szomszor et al., 2020). It becomes a tactic not just for referencing relevant past work but for artificially inflating citation metrics, such as an author's h-index or other indicators of scholarly impact.

When an author frequently cites their own previous publications, especially in cases where these citations are not directly relevant or necessary, it can lead to an inflated perception of the importance and influence of their work. This not only distorts the true impact of

the research but also misleads readers, reviewers, and academic institutions into believing that the author's contributions are more significant within the field than they actually are.

Excessive self-citation can also create a false narrative within the academic community, where certain ideas or findings appear to have gained more traction and validation than they have in reality. This practice can skew the scholarly record, as the repeated referencing of one's own work may overshadow other relevant studies that deserve attention. Over time, this can lead to a narrowing of the academic discourse, where a limited range of perspectives and findings are repeatedly cited and discussed, while other valuable contributions are overlooked.

Moreover, the overuse of self-citations can have broader implications for the field of research. It can contribute to an environment where citation metrics are prioritized over the quality and relevance of scholarly contributions. In such an environment, researchers—particularly those publishing regularly—may feel pressured to engage in similar practices to remain competitive, leading to a cycle where self-citation becomes increasingly normalized, despite its ethical implications. This, in turn, undermines the integrity of the academic publishing process, where citations are meant to serve as a genuine measure of the influence and relevance of research within a given field.

In extreme cases, the overuse of self-citations can even influence the direction of future research. As papers with high citation counts are often viewed as more authoritative and are more likely to be used as the basis for further studies, self-citation can artificially steer the research agenda towards favoring the author's work, regardless of its actual merit. This can hinder the development of a more diverse and robust body of knowledge, as researchers may be less likely to explore alternative ideas or challenge the prevailing narrative if it is dominated by self-cited work.

## Excessive Citation of Unpublished Work

Citing unpublished work, such as preprints or personal communications, more than is necessary, particularly when the work is unlikely to be published in the future, can inappropriately inflate citation counts. This practice is especially problematic when these citations are used to support arguments that have not yet been substantiated by peer-reviewed evidence.

This issue is particularly evident in online databases like Google Scholar, which not only includes citations from reputable journals but also counts citations from a wide array of sources, including pdf files found on the internet and other non-peer-reviewed content (Ibrahim et al., 2024). Because Google Scholar aggregates citations from such a broad range of sources, including unpublished or non-peer-reviewed materials, it is more susceptible to being manipulated through the excessive citation of such works (Loan et al., 2022; Torres-Salinas, 2013).

In contrast, other research databases such as Scopus or Web of Science (WoS) are more selective in the sources they index and the metrics they present. These databases place a strong emphasis on the credibility of the sources they include, with journals and conferences undergoing meticulous examination before being indexed. As a result, citation counts in Scopus and WoS are generally more reflective of peer-reviewed, published research, reducing the likelihood of inflated citation metrics due to the inclusion of unpublished work.

The issue with Google Scholar, however, is that it is widely used as a quick and convenient tool for checking an academic profile and its citation counts or h-index. Due to its

broad inclusion criteria, it has become an easy target for manipulation, allowing researchers to artificially boost their citation metrics by citing unpublished work extensively. This highlights the importance of relying on more rigorous databases, for evaluating scholarly impact, particularly in the context of hiring and promotion decisions.

### Citation Bias

Citation bias refers to the preferential referencing of studies with positive or significant findings over those with negative or non-significant results. This selective citation practice can distort the scientific literature, leading to an overestimation of the efficacy or validity of certain interventions or theories. For instance, studies have shown that articles reporting positive outcomes are more frequently cited, while those with null results are often overlooked, contributing to a skewed representation of research findings (Gøtzsche, 2022).

The implications of citation bias are profound, as it can influence meta-analyses, systematic reviews, and the development of clinical guidelines (Urlings et al., 2021). When negative or inconclusive studies are underrepresented in citations, the cumulative evidence may suggest a more favorable outcome than what is accurate. This bias affects the perceived effectiveness of interventions and impacts funding decisions, policy-making, and future research directions. Addressing citation bias requires a concerted effort from authors, reviewers, and editors to ensure a balanced and comprehensive representation of all relevant studies, regardless of their outcomes.

### Other Unethical Strategies

**Citation Cartels** Some researchers participate in forming “citation cartels”, where groups of authors agree to excessively cite each other’s work (Kojaku et al., 2021). This mutual citation practice artificially inflates the citation counts of the involved authors and skews the academic literature by disproportionately elevating certain works. Furthermore, because these citations originate from third parties rather than the individuals themselves, they do not count as self-citations. This makes the manipulation of citation metrics through citation cartels even more difficult to detect and address. The concept is revisited in Sect. 3.2, where the role of reviewers is discussed.

**Salami slicing/publishing** This practice involves splitting research findings into multiple, minimally publishable units, often resulting in unnecessary and redundant citations of closely related papers by the same authors (Adams, 2022; COPE Council, 2024). While not inherently unethical, it becomes problematic when used to inflate citation counts rather than to genuinely contribute to the body of knowledge. This manipulative strategy offers a double advantage to the bad actor: it increases the number of published papers and, when combined with self-citation, further boosts the number of citations, amplifying the apparent impact of the research. This concept is revisited in the context of editors’ involvement in Sect. 3.3, highlighting how it may be used to manipulate journal metrics.

**Misleading Citations** Authors may also engage in the practice of citing papers that are only tangentially related to their work, or even irrelevant, simply because those papers are highly cited or belong to influential researchers. This can give a false impression of the paper’s

connection to established research and can mislead readers about the true context of the study.

### From a Reviewer's Perspective

Building on the discussion of authors' practices, reviewers, too, can influence citation metrics, both positively and negatively, through their recommendations. Reviewers play a critical role in the academic publishing process, serving as gatekeepers who assess the quality and relevance of research submitted for publication. However, this position of power can be misused, particularly when reviewers engage in unethical practices to increase their own citation counts. One of the most concerning practices is **citation coercion**, where reviewers demand that authors cite the reviewer's own work as a condition for accepting the manuscript (McLeod, 2021). This can be particularly problematic when reviewers suggest citing their own work in contexts where it is not directly relevant, thereby artificially boosting their citation counts (Baas & Fennell, 2019). This practice exploits the inherent power dynamics in the peer-review process, putting authors in a difficult position where they may feel compelled to add unnecessary citations to secure publication. These coerced citations often do not contribute meaningfully to the content of the manuscript but serve primarily to inflate the reviewer's citation metrics, such as the h-index.

Reviewers may also recommend citing works from their close colleagues or research group, effectively contributing to a form of citation cartel—a concept previously discussed from an author's perspective—where a small group of researchers mutually inflates their citation metrics through coordinated self-citation and cross-citation (Kojaku et al., 2021). Such practices distort the academic record and compromise the integrity of the peer-review process by introducing bias into what should be an impartial evaluation of the manuscript.

Additionally, some reviewers engage in **delaying tactics**, where they slow down the review process for competing papers while pushing for the citation of their own work. This can unfairly disadvantage other authors and manipulate the academic timeline to the reviewer's advantage, giving their own publications more time to gain citations before similar work is published.

These unethical practices have a corrosive effect on the academic community. They can mislead other researchers, skew the literature, and ultimately degrade the quality and trustworthiness of published research. Furthermore, they create an environment where unethical behavior is rewarded, perpetuating a cycle of misconduct.

To address these issues, stricter editorial oversight and enhanced collaboration between journals are essential in identifying and addressing unethical practices by reviewers. Currently, reviewers remain anonymous, and their identities are protected. While this anonymity is generally beneficial, it also allows some reviewers to act unethically with little fear of repercussions. Even if a reviewer is caught engaging in unethical behavior, the consequences are often limited to the journal in question, enabling them to repeat the misconduct in other journals. This lack of cross-journal accountability allows unethical reviewers to continue their behavior unchecked, highlighting the need for improved mechanisms to track and address such patterns across the academic publishing landscape.

## From an Editor's Perspective

Similar to the roles of authors and reviewers, editors also wield significant influence over citation practices, with their responsibilities encompassing the broader ethical management of academic publishing. Editors hold considerable power in the academic publishing process, with the authority to influence which articles are published and how they are presented. Unfortunately, this position of authority can be misused to manipulate citation metrics, either to boost the editors' own citations or to increase the citation counts of the journal they oversee. One of the most concerning unethical practices is **coercive citation**, where editors pressure authors to add citations to the editors' own work or, most commonly, to articles published in the editors' journal. While it is natural and expected that some relevant citations to the journal may arise due to its theme and scope, coercive citation crosses ethical boundaries when it forces authors to include citations that are not directly relevant to their work. This practice, sometimes subtle and framed as a suggestion, can create undue pressure on authors who may feel obliged to comply in order to secure publication. Coercive citation artificially inflates citation counts and also undermines the objectivity and integrity of the peer-review process, eroding trust in academic publishing.

Coercive self-citation differs from the typical citation recommendations made during the peer-review process, which are intended to enhance the quality of a manuscript. Instead, coercive self-citation involves requests that (Wilhite & Fong, 2012): (i) do not indicate any deficiencies in the manuscript's citations; (ii) fail to suggest specific articles, authors, or relevant bodies of work that need to be reviewed; and (iii) focus solely on adding citations from a single source, i.e. the editor's own journal. While the language used may be more subtle, the underlying message is clear: add these citations or face the possibility of rejection.

Another unethical practice is **editorial bias in article selection**. Editors may favor submissions that are likely to cite articles from their own journal, thereby inflating the journal's impact factor (Ophhof, 2013). This bias can manifest in the preferential treatment of articles from certain authors, institutions, or research groups that have a history of citing the journal extensively. Such practices distort academic literature by prioritizing citation potential over the quality and relevance of the research, leading to a skewed representation of the field. The phenomenon of journal self-citation has been studied in the literature (Campanario, 2018; Gazni & Didegah, 2021). According to studies, the impact factor rankings of most journals, with the exception of a few high-impact ones, undergo significant changes when self-citations are excluded from the calculation (Taşkin et al., 2021).

This behavior can also influence authors, even without direct intervention from the editor. In many cases, authors are aware of the tendencies of certain journal editors who prefer manuscripts that include numerous citations to the journal or who have a reputation for requesting additional citations to boost the journal's metrics. As a result, authors may proactively include unnecessary citations to the journal in their submissions, even if the editor has not explicitly asked for them. This tactic, from the author's perspective, increases the likelihood of their manuscript being accepted. Although this behavior is unethical on the part of the authors, it is discussed in this section on editorial practices because it originates from the editorial environment. It is the editors who implicitly or explicitly allow this to occur or encourage it, and authors simply respond to the unspoken expectations that have been established.

Additionally, some editors engage in **salami publishing** (COPE Council, 2024), encouraging authors to split their research findings into multiple, minimally publishable units that cite one another, all within the same journal. As noted previously, this strategy artificially inflates the journal's citation metrics but may fragment the literature and reduce the overall impact of the research.

In the past, before the advent of online submission and review systems, the peer review process was conducted through mail or, later, via email. During this time, editors had total control over the review process, including the ability to alter or **manipulate reviews** before passing them on to authors. In some cases, editors would impersonate the reviewer by adding their own comments to the review, such as suggesting unnecessary citations to the journal or to their own work. By doing this, the editor could conceal their unethical behavior, making it appear as though the suggestions were coming directly from the reviewer. This allowed the editor to exploit the system for personal gain without raising suspicion, as there were no established control mechanisms to monitor such actions. However, with the rise of online submission and review systems, this kind of manipulation has become much more difficult. The review process is now more transparent, with all communication conducted through the online platform, making it easier for journal management to monitor and detect any misconduct. Today, unethical actions by editors are more likely to be noticed and addressed, as the systems in place provide greater accountability and oversight throughout the review process.

### **Summary of Unethical Practices Used in Academia to Boost Citation Counts**

The preceding sections have provided a detailed examination of various unethical practices employed by different stakeholders—authors, reviewers, and editors—to artificially boost citation counts. These practices range from subtle manipulations to overtly unethical strategies, each contributing to the distortion of citation metrics and undermining the integrity of academic publishing. To provide a concise overview and facilitate a better understanding of these practices, we summarize the key unethical behaviors in Table 1. The table categorizes these practices by stakeholder, highlighting the specific actions and their impact on the academic community.

### **Ethical Pathways of Citation Practices in Academia**

The ethical practices described in this section are grounded in the analysis of unethical behaviors presented in earlier sections. These recommendations are designed to address and counteract the specific unethical practices previously discussed, offering practical solutions to promote integrity in citation practices. In some instances, these recommendations are informed by documented guidelines and best practices from academic organizations such as the Committee on Publication Ethics (COPE) (COPE, 2017; COPE Council, 2019a, 2019b, 2024). By implementing these ethical practices, stakeholders can contribute to maintaining transparency, fairness, and trust in academic publishing. To ensure a comprehensive approach, the discussion in this section is organized into three perspectives: ethical principles for authors, reviewers, and editors.

**Table 1** Summary of key unethical citation practices categorized by stakeholders in academia

Stakeholder	Unethical Practice	Description
Authors	Overuse of self-citations	Excessively citing their own work to inflate personal citation metrics, often without relevance to the current study.
	Excessive citation of unpublished work	Over-citing unreviewed preprints or communications, potentially misrepresenting research validity.
	Citation bias	Preferentially citing studies with positive outcomes, neglecting studies with negative or null results, which skews the literature and misrepresents actual findings.
	Citation cartels	Collaborating with groups of researchers to excessively cite each other's work, creating a distorted view of influence.
	Salami publishing	Splitting a single study into multiple publications to generate redundant citations among related papers.
Reviewers	Coercive citation	Requiring authors to cite the reviewer's own work or specific papers to secure publication, regardless of relevance.
	Citation cartels	Recommending citations from close collaborators or group members to mutually inflate citation metrics.
	Delaying tactics	Slowing down the review process for competing works while promoting their own research, thus manipulating publication timing.
Editors	Coercive citation	Pressuring authors to add citations to the editor's own work or the journal's articles to artificially inflate citation metrics.
	Editorial bias in article selection	Favoring submissions that are likely to cite the editor's journal, prioritizing citation metrics over the quality of the research.
	Salami publishing	Encouraging authors to divide studies into smaller, minimally publishable units that excessively cross-reference within the same journal, leading to unnecessary fragmentation of research.
	Manipulation of reviews	Altering or inserting reviewer suggestions to include citations to the editor's journal or their own work.

## From an Author's Perspective

In an academic environment where citation counts are often used as a measure of a researcher's impact and influence, it is important to pursue strategies that not only enhance visibility but also uphold the integrity of scholarly work. Below are some ethical strategies that authors can use to increase citation counts, ensuring that they reflect genuine academic contribution rather than manipulative practices.

**Publish High-Quality, Original Research** The most ethical and effective way to increase citations is by producing high-quality research that tackles important challenges, introduces innovative ideas, or makes meaningful contributions to the advancement of the field (Lindgreen & Di Benedetto, 2024). Well-executed, original studies naturally attract citations from other researchers who recognize their value and relevance. Of course, this is the more challenging path—it is evident that higher-quality research yields greater impact, but achieving this level of work typically requires extra time, effort, and dedication from the researcher.

**Choose the Right Journal** Publishing in reputable, high-impact journals that are widely read by the target audience can significantly increase the visibility of one's work. Submitting to journals that are relevant to the field and have a broad readership ensures that the research reaches the right audience.

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**Engage in Active Dissemination** Actively promoting research through conferences, seminars, and workshops is vital for increasing visibility and citation potential. Sharing findings with peers fosters collaboration and integrates the research into ongoing academic discussions. Ross-Hellauer et al. (2020) highlight that effective dissemination, particularly through open science practices, enhances the accessibility and impact of research by engaging broader audiences and fostering transparency.

**Utilize Open Access Options** Publishing in open-access journals or making articles available through institutional repositories ensures that the work is accessible to anyone and can be cited more widely. A systematic review by Langham-Putrow et al. (2021) analyzed studies comparing citations of open-access and subscription-based articles, providing insights into the open-access citation advantage. Additional studies have provided evidence that open access can serve as a mechanism for widening the use of research and increasing the diversity of the communities that benefit from it (Huang et al., 2024).

**Network and Collaborate** Building and maintaining professional relationships within the research community can lead to more citations. Engaging in academic discussions, attending conferences, and participating in collaborative projects help establish a presence in the field, making others more likely to cite one's work. Collaborative research, especially with colleagues from different institutions or countries, often leads to wider dissemination and can result in higher citation counts due to the expanded network of co-authors and their respective audiences. For instance, a study by Uddin et al. (2013) found that certain network properties, such as degree centrality, closeness centrality, and betweenness centrality, are associated with higher citation counts, indicating that well-connected researchers tend to receive more citations.

**Cite Relevant Literature** When writing papers, it is important to cite relevant and current literature in the field. This practice not only supports the arguments but also encourages reciprocity, where authors cited may, in turn, cite the work in their future research.

**Promote Work Online** Using social media platforms like Twitter, LinkedIn, and ResearchGate to share research can help reach a wider audience. Engaging with the online academic community can lead to increased visibility and potentially more citations.

**Create and Share Data and Methodological Resources** Providing open access to datasets, software, or methodologies associated with research can significantly enhance its visibility and increase citation frequency. (Colavizza et al., 2020) analyzed over 500,000 articles and found that those including a link to data in a repository experienced up to a 25% increase in citations compared to those without such links. This demonstrates that sharing research resources openly not only promotes transparency and reproducibility but also encourages other researchers to reference the work when utilizing these resources.

**Maintain an Updated Research Profile** Keeping research profiles on platforms like Google Scholar, ORCID, Scopus, WoS, and ResearchGate updated ensures that the work is easily discoverable. These platforms allow other researchers to find and cite papers, and they often provide tools to track citations and metrics.

**Write Review Articles or Book Chapters** Review articles and book chapters that summarize and synthesize existing research are often cited more frequently than original research papers. A study showed that review articles consistently received higher numbers of citations than did original research articles, while also accounting for 3–10% of the impact factors of top journals (Lei & Sun, 2020). Writing comprehensive reviews can establish one as an expert in the field and attract citations from researchers looking for authoritative sources.

### From a Reviewer's Perspective

After examining the ethical practices and responsibilities of authors in the citation process, we now turn our attention to the role of reviewers. While the potential for abuse exists, reviewers also have a responsibility to uphold the integrity of the peer-review process by adhering to ethical practices. Ethical reviewers approach the citation process with fairness and objectivity, ensuring that any suggestions for additional citations are made solely based on the relevance and quality of the cited work.

A key ethical practice is **transparency and clarity in citation recommendations**. When suggesting citations, an ethical reviewer should focus on works that genuinely contribute to the enhancement of the manuscript, such as those that provide critical background information, support the manuscript's claims, or offer contrasting perspectives that enrich the discussion (COPE, 2017). Reviewers should clearly justify any suggested citations, explaining how they will improve the manuscript. For instance, if suggesting the addition of a citation, the reviewer should specify how the cited work complements the current research, fills a gap in the argument, or provides essential context. This ensures that citations are added based on merit and relevance rather than the reviewer's personal interests.

Ethical reviewers should avoid unnecessary self-citation. While suggesting one's own work is acceptable if directly relevant, overemphasis can be manipulative. The goal is to enhance the manuscript, not inflate personal citation metrics. Unfortunately, even in cases where such misconduct is identified, consequences are typically limited; for instance, a reviewer may be banned from reviewing for that specific journal, which is a relatively minor repercussion. As noted in a case reported by the journal *Bioinformatics*, a reviewer who repeatedly engaged in coercive citation practices was eventually simply prohibited from reviewing for the journal (Wren et al., 2019).

Furthermore, ethical reviewers should also be aware of the broader ethical guidelines and standards established by the journal and the academic community, such as those provided by COPE (2017). Most journals and publishers simply refer to these general guidelines, which cover topics like self-citation and citation recommendations in a broad and overarching manner. However, some journals provide more specific and guidelines for their reviewers. For instance, the *Mathematical Methods in the Applied Sciences* journal by Wiley explicitly states in its reviewer guidelines: "reviewers should never ask authors to cite the reviewers' own articles" (Wiley, 2025), among other instructions. Some journals, such as the *Engineering Failure Analysis* journal from Elsevier, add a special note in their review invitation stating that "We strongly discourage reviewers from recommending citations of their work. If you strongly believe citing your work is necessary, kindly explain the reasoning for this recommendation in your comments to the editor."

Reviewers should also be open to **declining to review** manuscripts where they feel they cannot provide an impartial assessment, for example, due to conflicts of interest. In addition

to providing fair and constructive feedback, ethical reviewers can contribute to the academic community by encouraging authors to **engage with a broad range of relevant literature**. This includes suggesting citations from diverse sources, such as works from underrepresented groups, emerging scholars, and lesser-known yet pertinent studies. By promoting inclusive and representative citation practices, reviewers help ensure that academic dialogue is rich, diverse, and equitable. Dewidar et al. (2022) emphasize that equity, diversity, and inclusion (EDI) are essential in publication processes, noting that editors, reviewers, researchers, funders, and academic institutions collectively act as gatekeepers of our disciplines, enabling ethical publication practices and setting rigorous research standards.

While the role of a reviewer carries the potential for misuse, it also provides an opportunity to uphold and promote ethical practices in academic publishing. By focusing on relevance, fairness, and transparency in citation recommendations, reviewers can contribute positively to the integrity of scholarly communication and the advancement of knowledge.

### From an Editor's Perspective

Building on the discussion of ethical responsibilities for reviewers, we now examine the critical role of editors in safeguarding the integrity of the academic publishing process. The ethical responsibilities and challenges faced by scholarly journal editors have been a topic of discussion for decades (Stryker, 1990). Unlike the unethical practices highlighted in Sect. 3, ethical editors serve as guardians of ethics, upholding high ethical standards in managing publications and conducting their own research (Teixeira da Silva & Al-Khatib, 2017). To support this effort, COPE has published a concise guide to ethical editing for new editors (COPE Council, 2019b), outlining minimum standards that all COPE members are expected to follow.

One of the primary ethical responsibilities of an editor is to **promote transparency and fairness** in the selection and review of manuscripts. Editors should base their decisions on the quality, originality, and relevance of the research, rather than on the potential for increasing citation counts (Wilhite & Fong, 2012). By ensuring that all submissions are evaluated on their merit, editors help to maintain the integrity of the academic record and foster trust in the publication process.

Editors can also contribute positively to citation practices by **encouraging the citation of relevant literature** without exerting undue pressure on authors. When suggesting additional citations during the review process, editors should ensure that these recommendations are grounded in the relevance of the work to the manuscript at hand, rather than in a desire to boost the journal's citation metrics. Clear communication and justification for suggested citations help authors understand their value and maintain the ethical standards of the review process.

Another important ethical practice is **supporting the dissemination of high-quality research**. Editors should actively seek out and promote articles that have the potential to make significant contributions to their fields, regardless of their likely citation impact. This includes encouraging the publication of interdisciplinary research (Van Noorden, 2015), negative results (O'Hara, 2011), and replication studies (Nature, 2017), all of which are essential for the advancement of science but may not always attract high citation counts.

Editors are responsible for maintaining rigorous standards when selecting articles for publication in their journals (Wager & Kleinert, 2014). This requires avoiding the tempta-

tion to accept lower-quality or less relevant papers solely for their potential to generate citations for the journal. Instead, editors should prioritize fostering a reputation for publishing high-quality, impactful research that meaningfully contributes to the advancement of the field.

Finally, editors can help to promote ethical citation practices by **educating authors, reviewers, and editorial board members** about the importance of maintaining high ethical standards in citation practices. This can be achieved through editorial policies (Min, 2021), guidelines (COPE, 2017), and training programs that emphasize the significance of fair and transparent citation practices. By fostering a culture of integrity within the journal, editors can contribute to the overall health and credibility of academic publishing.

Although editors have the ability to misuse their influence to manipulate citation metrics, they hold a crucial responsibility in fostering ethical practices and ensuring that citation counts accurately represent the true impact and quality of research. By upholding ethical standards and prioritizing the long-term integrity, editors contribute to sustaining the credibility of their journals and strengthening trust within the broader academic community.

### Summary of Ethical Practices

The preceding sections have outlined various ethical practices that authors, reviewers, and editors can adopt to uphold the integrity of citation practices and academic publishing. These practices are grounded in both documented guidelines and the analysis of unethical behaviors discussed earlier, offering actionable strategies to promote transparency, fairness, and trust in scholarly communication. To provide an overview and facilitate a clearer understanding of these practices, we summarize the key ethical behaviors in Table 2, categorized by stakeholder, emphasizing their role in fostering responsible and impactful citation practices.

### Quantitative Analysis & Discussion

This section presents a quantitative analysis of self-citation trends among the world's top scientists, using publicly accessible datasets developed by Ioannidis (2024); Ioannidis et al. (2019); Ioannidis et al. (2020). These datasets provide comprehensive citation metrics, including the h-index, coauthorship-adjusted hm-index, and citations based on authorship positions, offering a robust foundation for examining long-term and recent citation behaviors.

The datasets are updated annually, with the most recent release in August 2024 (Ioannidis, 2024). This release includes data covering publications up to 2023 and is divided into two subsets: (a) **Career-long dataset (Dataset 23C)**: Includes cumulative citation data up to the end of 2023; (b) **Single-year dataset (Dataset 23s)**: Focuses exclusively on citations received during the 2023 calendar year.

These datasets are substantial, containing thousands of entries, and are provided as Microsoft Excel (.xlsx) files, each approximately 80 MB in size. Table 3 outlines the number of entries in the 2023 datasets, with a comparison to the corresponding datasets from the previous year (2022).

**Table 2** Summary of key ethical citation practices categorized by stakeholders in academia

Stakeholder	Ethical practice	Description
Authors	Publish high-quality research	Focus on producing original, impactful work that addresses significant challenges and advances the field.
	Choose the right journal	Submit work to reputable, relevant journals to reach the appropriate audience and increase visibility.
	Engage in active dissemination	Share research through conferences, seminars, and workshops to integrate it into ongoing academic discussions.
	Utilize open access	Make research accessible through open-access journals or repositories to broaden its reach and citation potential.
	Network and collaborate	Build professional relationships and collaborate with researchers across institutions to enhance visibility and impact.
	Cite relevant literature	Reference current, relevant works to support arguments and encourage reciprocity in citations.
	Promote work online	Use social media and academic platforms to share research and increase visibility.
	Share data and resources	Provide open access to datasets, methodologies, and software to encourage use and citation of research.
	Write reviews or book chapters	Create review articles or book chapters summarizing existing research to attract frequent citations.
Reviewers	Make transparent citation suggestions	Recommend citations based on relevance and merit, with clear justifications for their inclusion.
	Avoid unnecessary self-citation	Suggest self-citations only when directly relevant, avoiding manipulative practices to inflate personal metrics.
	Follow journal guidelines	Adhere to ethical guidelines set by journals and organizations like COPE in citation practices.
	Promote diverse literature	Encourage authors to cite underrepresented groups, emerging scholars, and lesser-known but relevant studies.
	Decline if impartiality is compromised	Avoid reviewing manuscripts if unable to provide an unbiased assessment due to conflicts of interest.
Editors	Promote fair manuscript evaluation	Ensure submissions are judged based on quality, originality, and relevance, not citation potential.
	Encourage ethical citation practices	Suggest relevant citations without pressuring authors to inflate metrics for the journal.
	Support dissemination of high-quality work	Prioritize impactful research, including interdisciplinary studies, negative results, and replication studies.
	Uphold rigorous publication standards	Reject lower-quality papers, even if they might generate more citations, to maintain journal integrity.
	Educate stakeholders	Provide training and guidelines to authors, reviewers, and editorial boards on fair and transparent citation practices.

**Table 3** Number of entries (scientists) for each of the datasets

	2023 (Ioannidis, 2024)	2022 (Ioannidis, 2023)
Career Dataset (C)	217,097 entries	204,643 entries
Single-year Dataset (s)	223,152 entries	210,198 entries

Combining the career-long dataset with the single-year dataset provides a comprehensive view of both enduring trends and recent developments in self-citation practices. The following subsections present detailed findings, including statistical summaries, box plots, and histograms, to illustrate self-citation patterns at both individual, country and field levels. The analysis also examines the behavior of the top self-citers, whose practices have a pro-

**Table 4** Variables extracted from the career dataset 23C

Original name	Variable name	Description
np6023	np6023C	Number of papers published between 1960 and 2023
nc9623 (ns)	nc9623nsC	Total citations received between 1996 and 2023, excluding self-citations
nc9623	nc9623C	Total citations received between 1996 and 2023, including all citations
h23 (ns)	h23nsC	h-index as of the end of 2023, excluding self-citations
h23	h23C	h-index as of the end of 2023, including all citations
self%	self23C	Percentage of self-citations (1996–2023)

**Table 5** Statistical properties of the examined variables for career dataset 23C

	np6023C	nc9623nsC	nc9623C	h23nsC	h23C	self23C
min	2	29	144	2	3	0.0%
max	4084	566,794	582,575	306	320	96.0%
mean	207.3	9349.5	10730.5	40.5	44.2	13.1%
std	170.6	12955.9	14550.1	19.9	21.6	8.3%
CV	82.3%	138.6%	135.6%	49.2%	48.8%	63.5%
median	162	5637	6533	37	40	11.7%
p25	101	3027	3518.8	27	29	7.6%
p75	259	10715.0	12337.0	50	54	16.9%
p95	513	29072.0	33066.7	78	84	28.5%
p97.5	647	41246.7	46955.2	90	98	34.1%

nounced impact on scholarly metrics. By connecting these findings to the broader discourse on ethical and unethical citation behaviors, this section underscores the critical importance of transparency and accountability in academic publishing.

## Descriptive Statistics

### Dataset 23C (Career dataset)

The analysis focuses on six key variables from Dataset 23C, as outlined in Table 4. The “Original Name” column corresponds to the variable names in the provided Excel file, while the “Variable Name” column lists the unique identifiers used in our analysis and MATLAB code for clarity and consistency.

Table 5 provides the statistical characteristics of the parameters from the career-long dataset 23C. These include metrics such as the minimum (min), maximum (max), mean, standard deviation (std), coefficient of variation (CV), median, and various percentiles (p25, p75, p95, p97.5), representing the 25th, 75th, 95th, and 97.5th percentiles, respectively. It is important to note that Dataset 23C is cumulative, encompassing data collected over a 28-year period from 1996 to 2023, rather than reflecting a single year.

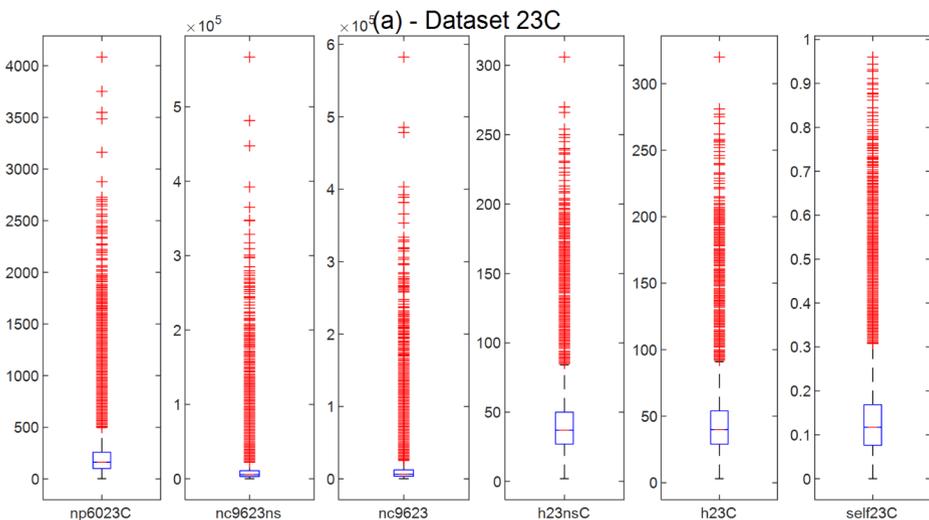
One of the most notable findings from dataset 23C (Table 5) is the significant variation in self-citation practices among top scientists over the years. Among this elite group, representing the top 2% globally according to the study’s methodology, there is a scientist with a

self-citation percentage as high as 96.0%, indicating that only 4.0% of their citations come from other researchers. The average self-citation percentage across the dataset is 13.1%, with a median of 11.7%. Furthermore, the 97.5th percentile (p97.5) value is 34.1%, meaning that approximately 5,427 scientists have a self-citation rate of 34.1% or higher.

The distribution of the six analyzed variables for the career-long dataset 23C is illustrated through box plots in Fig. 1. Box plots visually represent data distributions using a five-number summary: the minimum, first quartile (Q1 or p25), median, third quartile (Q3 or p75), and maximum. They also identify outliers, which are values that deviate significantly from the central data range. The central box in the plot represents the interquartile range (IQR), encompassing the middle 50% of the data, with a line inside the box indicating the median. The whiskers extend to the smallest and largest values within 1.5 times the IQR from Q1 and Q3, respectively, while outliers are shown as individual points beyond the whiskers (with red crosses).

The box plots reveal that all six variables exhibit a significant number of outliers, evidenced by the numerous red crosses extending beyond the whiskers. This indicates that the distributions of these variables are highly skewed or exhibit considerable variability. The relatively small central boxes suggest that most data points are concentrated within a narrow range, while the extreme outliers highlight instances of significantly higher values compared to the majority.

Variables such as total citations excluding self-citations (nc9623ns) and total citations including all citations (nc9623C) show the greatest spread, with higher maximum values and more dispersed outliers compared to other variables. This variability is further supported by the high coefficient of variation (CV) for these parameters, as shown in Table 5. These findings highlight the complex and diverse nature of citation behaviors among the world's top scientists.



**Fig. 1** Box plots of the six variables for the Career-long dataset 23C

**Table 6** Variables extracted from the single-year dataset 23s

Original name	Variable name	Description
np6023	np6023s	Number of papers published between 1960 and 2023
nc2323 (ns)	nc2323nss	Total citations received in 2023, excluding self-citations
nc2323	nc2323s	Total citations received in 2023, including all citations
h23 (ns)	h23nss	h-index as of the end of 2023, excluding self-citations
h23	h23s	h-index as of the end of 2023, including all citations
self%	self23s	Percentage of self-citations (2023)

**Table 7** Statistical properties of the examined variables for single-year dataset 23s

	np6023s	nc2323nss	nc2323s	h23nss	h23s	self23s
min	2	1	13	1	1	0.0%
max	4084	79,132	79,203	93	97	99.0%
mean	188.6	958.1	1074.3	12.2	13.0	10.7%
std	171.2	1539.326	1684.1	5.8	6.1	8.9%
CV	90.8%	160.7%	156.8%	47.5%	47.1%	83.2%
median	141	567	640	11	12	8.8%
p25	81	325	367.0	8	9	4.8%
p75	239	1032.0	1160.0	15	15	14.2%
p95	496	2872.0	3205.0	23	24	26.9%
p97.5	634	4292.0	4805.0	27	29	33.9%

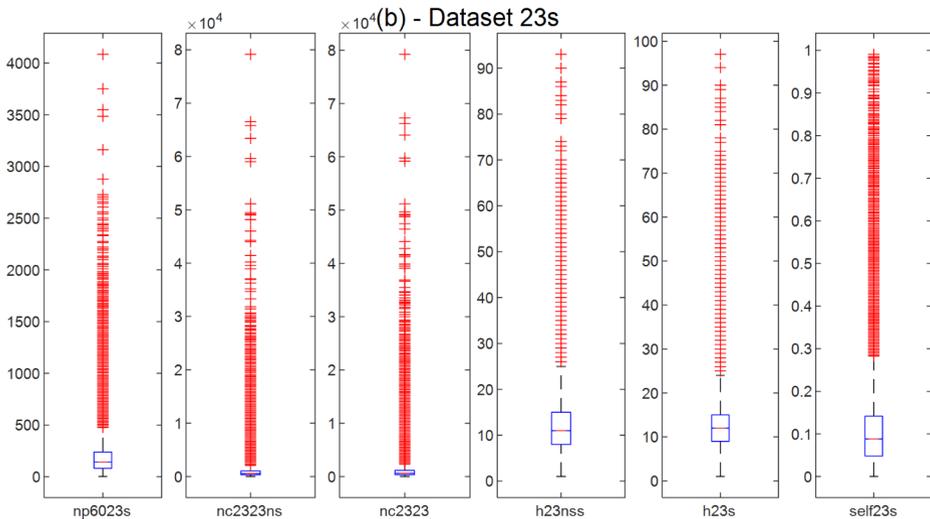
### Dataset 23s (Single-Year Dataset)

Again, we use six variables (columns), as shown in Table 6. The original names correspond to the labels from the Excel file, while the variable names are the ones used in our analysis and coding in MATLAB, ensuring unique identification for each parameter.

Table 7 presents the statistical properties of these parameters, which are associated with the single-year dataset 23s. Notably, this dataset also includes variables that relate to career-long data, such as the h-index of a scientist.

An especially noteworthy finding from the single-year dataset 23s (Table 7) is the presence of a scientist with a self-citation percentage of 99.0%. On average, the self-citation percentage across the entire dataset is 10.7%, with a median value of 8.8%. Furthermore, the 97.5th percentile (p97.5) value of 33.9% indicates that the top 2.5% of self-citers—approximately 5,579 scientists—have a self-citation rate of 33.9% or higher. The distribution of the six variables for the single-year dataset is visualized in Fig. 2 using box plots.

The distributions in Fig. 2 closely resemble those observed in Fig. 1 for the career-long dataset 23C. Similar patterns are evident, where variables such as total citations excluding self-citations (nc2323nss) and total citations including all citations (nc2323s) exhibit a broader spread, higher maximum values, and more dispersed outliers than the other variables. These findings provide further evidence of the variability and complexity of citation practices among scientists.



**Fig. 2** Box plots of the six variables for the single-year dataset 23s

## Analysis of the Self-Citation Ratio Across both Datasets

This section focuses on the variable representing the self-citation ratio, labeled as “self” in the original dataset. For our analysis, it is represented by self23C for the career-long dataset (23C) and self23s for the single-year dataset (23s). This variable, which reflects the proportion of self-citations relative to total citations, is the sixth variable detailed in the previous tables and Fig. 1. The histogram for this variable, using 200 bins, is presented in Fig. 3 for both datasets.

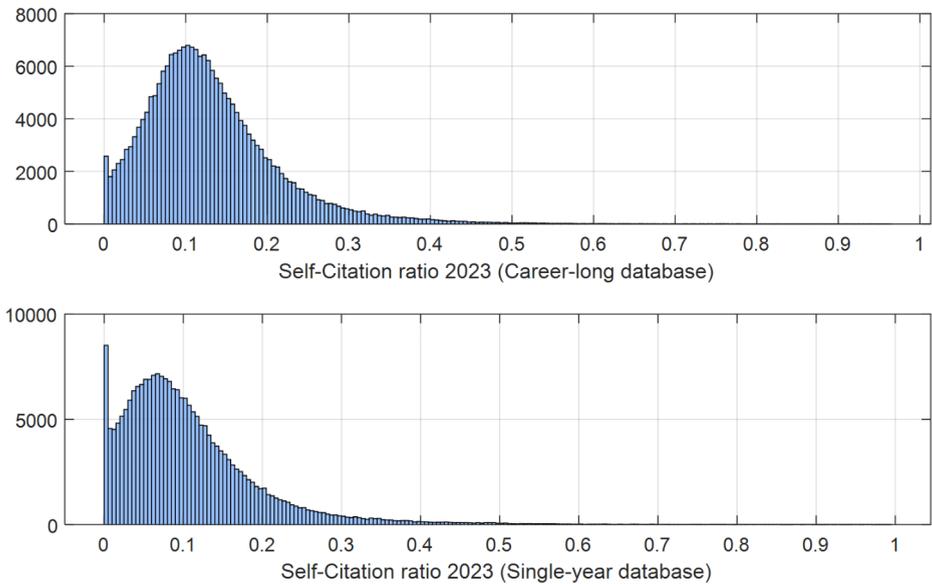
As noted earlier, the mean self-citation percentage for the career-long dataset 23C is 13.1%, while for the single-year dataset 23s, it is slightly lower at 10.7%. The mean provides an average that includes all values, even outliers, whereas the histogram peak represents the mode, indicating the most frequently occurring range of values.

### Career-Long Dataset (23C)

A detailed analysis of the self23C variable from the career-long dataset reveals striking patterns. Among the top 10 self-citers, the self-citation ratio exceeds 87.8%. Expanding this to the top 20, the ratio surpasses 81.8%, indicating that these scientists receive 18.2% or less of their total citations from others, with the remainder resulting from self-citations. For the top 50 self-citers, the ratio is above 75.2%. These findings emphasize the significant role self-citation can play in elevating citation metrics, even among the most prominent scientists.

### Single-Year Dataset (23s)

The single-year dataset provides an even more pronounced view of self-citation behaviors. For the self23s variable, the top 10 self-citers exhibit ratios exceeding 96.3%, the top 20 exceed 94.2%, and the top 50 surpass 87.5%. These percentages are notably higher than



**Fig. 3** Histogram of self-citation ratio: (a) Career-long dataset 23C, (b) Single-year dataset 23s

those observed in the career-long dataset. This suggests that self-citation practices within a single year can be both more intense and potentially more manipulative compared to those observed over an extended period. Additionally, this pattern may reflect a growing trend of increased self-citation in recent years. The findings underscore the variability and potential misuse of self-citation practices, highlighting the importance of transparency and accountability in maintaining the integrity of citation metrics in academic publishing.

### Country Analysis Using the Single-Year Dataset 23s

This section focuses on country-specific self-citation practices using the most recent data from the single-year dataset (23s).

#### Average Self-Citation Behavior by Country

Exploring self-citation practices at the country level provides valuable insights into global research behaviors and the variability in academic norms. The single-year dataset (23s), which includes 223,152 records, contains country-specific information that allows for a detailed analysis of self-citation trends across nations.

**World View** Table 8 lists the top 15 countries with the highest average self-citation percentages. The table also presents the average h-index for each country, calculated both with and without self-citations, as well as the difference between these two values.

The table demonstrates significant variability in average self-citation percentages across countries. French Guiana leads with an average self-citation rate of 40.1%, followed by

**Table 8** Top 15 countries in terms of average self-citation percentage, based on single-year dataset 23s

Rank	Code	Country	Avg. self%	Avg. h22 (ns)	Avg. h22	Diff.
1	GUF	French Guiana	40.1%	7.0	9.0	2.0
2	UZB	Uzbekistan	38.6%	7.5	10.1	2.6
3	FLK	Falkland Island	35.1%	7.0	9.0	2.0
4	ARM	Armenia	34.6%	9.8	13.7	3.9
5	UKR	Ukraine	33.5%	6.7	8.8	2.1
6	GRL	Greenland	31.3%	9.0	11.0	2.0
7	IRQ	Iraq	28.7%	10.0	12.5	2.5
8	LVA	Latvia	28.4%	8.3	9.5	1.2
9	YEM	Yemen	27.4%	9.7	12.1	2.4
10	MNE	Montenegro	27.1%	7.4	8.6	1.2
11	SDN	Sudan	26.9%	6.4	7.9	1.4
12	PRK	North Korea	25.7%	6.0	7.0	1.0
13	RUS	Russia	25.6%	8.6	9.9	1.4
14	NCL	New Caledonia	23.5%	8.5	10.0	1.5
15	EGY	Egypt	23.0%	9.6	11.4	1.8

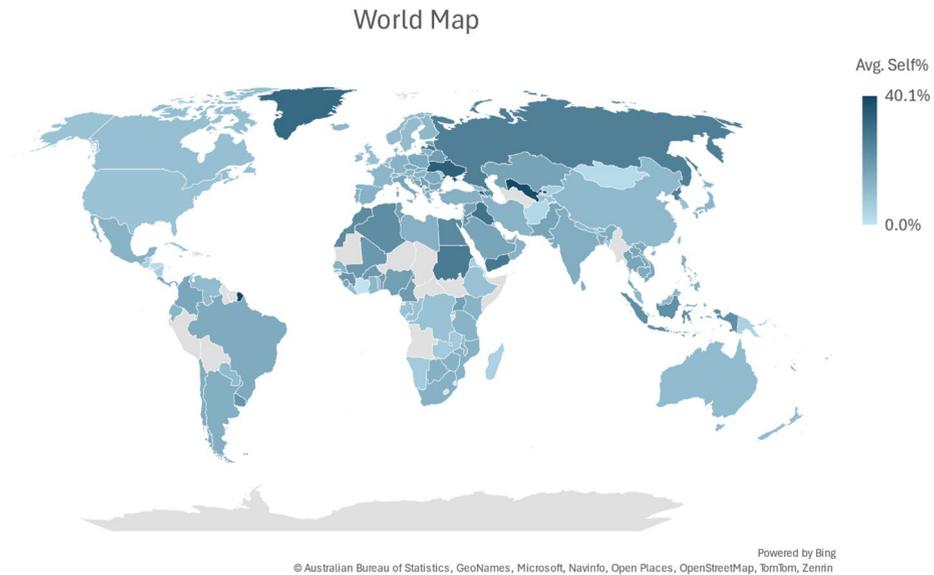
Uzbekistan (38.6%) and Falkland Island (35.1%). These high self-citation rates significantly inflate the h-index. For instance, Uzbekistan's average h-index increases from 7.5 (excluding self-citations) to 10.1 (including self-citations), reflecting a difference of 2.6 points. Similarly, Armenia's h-index rises from 9.8 to 13.7 due to a self-citation rate of 34.6%, resulting in a substantial 3.9-point difference.

Countries such as Iraq and Yemen also display notable differences in their average h-index values when self-citations are included, with increases of 2.5 and 2.4 points, respectively. This underscores how self-citation practices can significantly influence the perceived scholarly impact in specific regions.

Figure 4 provides a visual summary of these findings, presenting a world map with the average percentage of self-citations for each country based on the single-year dataset (23s). The map highlights the geographical distribution of self-citation practices, emphasizing notable differences between countries. By focusing on the most recent single-year data, this analysis captures current trends in self-citation behavior, reflecting the dynamic nature of the academic landscape.

An interesting observation is that in the Top 15 countries of Table 8, none has English as its first language, with the exception of the tiny Falkland Islands (population 3,662 as of 2021). It is even more impressive that the same trend holds for the Top-30 countries of the list. The only additional country where English is the main language is Gibraltar (position 24), another small territory. These findings resonate with the insights of Curry and Lillis (2013), who explored the pressures faced by non-English-speaking scholars in global academic publishing. The dominance of English as the lingua franca of scholarly communication presents challenges, and it underscores the strategies—such as self-citation—employed by researchers in these regions to navigate a system that inherently favors English-medium outputs. The overrepresentation of non-English-speaking countries in Table 8 may highlight the unintended consequences of such systemic pressures.

While a similar analysis could be conducted using career-long statistics, the rapidly changing academic environment in recent years makes single-year data particularly valu-



**Fig. 4** World map showing the average percentage of self-citations, per country. Data taken from the single-year dataset 23s

able for understanding contemporary self-citation practices. The findings emphasize the importance of accounting for national research policies and cultural norms when evaluating citation metrics, as these factors can greatly influence scholarly behaviors globally.

**OECD Countries** Table 9 provides an in-depth analysis of self-citation practices among the 38 OECD countries, highlighting their average self-citation percentages and the corresponding impact on their h-index, both with and without self-citations.

The data reveals a range of self-citation behaviors among OECD countries, with Latvia exhibiting the highest self-citation percentage at 28.4%. This self-citation rate results in a modest increase in Latvia's average h-index from 8.3 (excluding self-citations) to 9.5 (including self-citations), reflecting a difference of 1.2 points. Countries such as Costa Rica, Estonia, Colombia, Italy, Poland, and the Czech Republic follow closely with self-citation percentages ranging from 15 to 18%. These nations display comparable impacts on their h-indices, with increases of approximately 0.8 to 1.3 points.

The average self-citation percentage for all OECD countries is 12.6% (calculated as an average across countries, not individual researchers, i.e. without taking into account the population). Among the top 20 countries listed, significant variations are observed, underscoring the diverse citation behaviors within this group.

Countries with more established research infrastructures, such as Canada (ranked 34th with 9.5%), the United Kingdom (ranked 35th with 9.2%), and the USA (ranked 38th with 8.6%), maintain relatively low self-citation percentages. Their h-index increases minimally by around 0.6 points, indicating a stronger reliance on broader academic recognition rather than self-citation practices.

**Table 9** Top-20 of OECD countries in terms of self-citation percentage, for the single-year dataset 23s

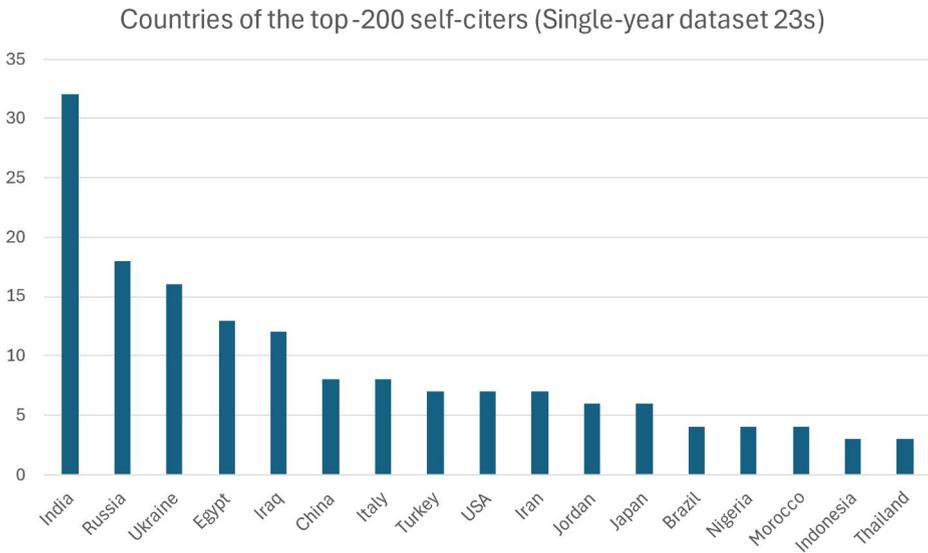
Rank	Code	Country	Avg. self%	Avg. h22 (ns)	Avg. h22	Diff.
1	LVA	Latvia	28.4%	8.3	9.5	1.2
2	CRI	Costa Rica	17.6%	10.6	11.4	0.8
3	EST	Estonia	16.3%	13.4	14.7	1.3
4	COL	Colombia	15.6%	11.3	12.4	1.1
5	ITA	Italy	15.6%	11.8	12.9	1.1
6	POL	Poland	15.1%	9.5	10.4	0.9
7	CZE	Czech Republic	15.1%	10.9	11.8	0.9
8	SVK	Slovak Republic	14.8%	9.4	10.3	0.9
9	CHL	Chile	13.9%	10.6	11.5	0.9
10	LTU	Lithuania	13.3%	11.9	12.8	0.9
11	PRT	Portugal	13.2%	12	12.8	0.8
12	TUR	Türkiye	13.0%	9.5	10.4	0.9
13	HUN	Hungary	12.9%	9.6	10.4	0.8
14	ESP	Spain	12.8%	12.2	13.2	1
15	DEU	Germany	12.8%	12.3	13.3	1
16	MEX	Mexico	12.6%	11	11.8	0.8
17	SVN	Slovenia	12.5%	10	10.8	0.8
18	GRC	Greece	12.5%	11	11.8	0.8
19	AUT	Austria	12.2%	11.8	12.6	0.8
20	FRA	France	12.0%	12.2	13.2	1

Overall, this analysis underscores the variability in self-citation practices across OECD countries. Focusing on the OECD countries, while self-citation can boost scholarly metrics to a moderate extent, it remains within a range that does not excessively skew academic impact in most cases. These findings partially support Hirsch's (2005) hypothesis about the robustness of the h-index against self-citations. However, as subsequent sections will explore, this robustness diminishes when examining individual researchers who engage in excessive self-citation practices.

### Country Analysis – Top Self-Citers

In this section, the focus shifts from the average self-citation behavior within countries to individual scientists, specifically the top 200 self-citers identified in the single-year dataset 23s. These individuals exhibit exceptionally high self-citation rates, ranging from 73.8 to 99.0%, with an average of 82.5% and a median of 80.9%. The top 200 self-citers represent scientists from 49 different countries. Figure 5 highlights the countries with the highest representation, including only those with three or more scientists in the top 200 (17 countries in total).

The chart reveals that India leads the list with 32 individuals among the top 200 self-citers. This is particularly notable, as India's average self-citation percentage is 14.1%, placing it outside the top 15 countries (presented before) by this metric. The significant representation of Indian scientists in the top 200 may be partly attributed to the country's large population, increasing the likelihood of individuals engaging heavily in self-citation. Comparatively, China, with a similarly large population and an average self-citation percentage of 11.1%, ranks 6th on the list, with 8 scientists featured.



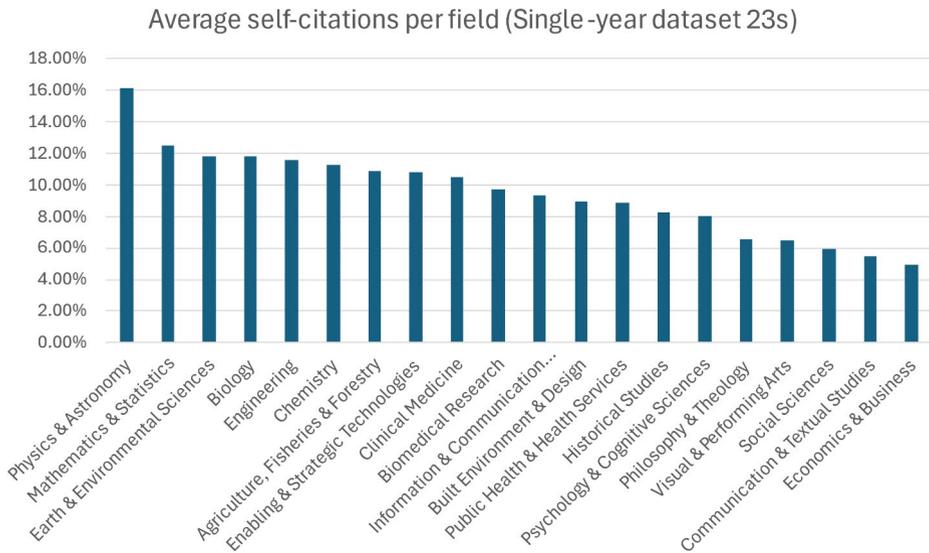
**Fig. 5** Countries of the top-200 self-citers in the single-year dataset 23s (with 3 or more appearances)

Russia follows India as 2nd with 18 individuals, which aligns with its substantial average self-citation percentage of 25.6%. Ukraine ranks third with 16 individuals and an average self-citation rate of 33.5%, while Egypt has 13 scientists in the top 200. Both Ukraine and Egypt were also highlighted in earlier analyses, confirming a consistent pattern of pronounced self-citation practices in these nations.

These heavy self-citers significantly influence their h-index scores through self-citations. Among the 200 scientists, the difference between the h-index calculated with and without self-citations varies widely, with a maximum difference of 25, a minimum of 1, a median of 6, and an average of 7.4. This partially challenges Hirsch's hypothesis about the robustness of the h-index against self-citations, particularly for individuals engaging in excessive self-citation.

The variability observed in these country-specific patterns suggests that self-citation practices may be influenced by national research policies and cultural norms. For instance, a study on Italy found that introducing metrics-based thresholds for academic promotions led to a significant increase in self-citations among Italian researchers (Van Noorden, 2019). Such policies incentivize self-citation as a strategy to meet citation requirements for career advancement. Notably, Italy is ranked 7th in Fig. 5, with 8 scientists among the top 200 self-citers.

These findings emphasize the importance of considering national and institutional policies when assessing self-citation practices. Effective policy design is critical to avoid unintended consequences, such as inflated self-citation rates, that can distort scholarly metrics and compromise academic integrity.



**Fig. 6** Average self-citation percentage per field for the single-year dataset 23s

## Field Analysis

This section examines self-citation behavior across various academic fields using the single-year dataset 23s. Significant differences in average self-citation percentages are evident among the fields, revealing distinct disciplinary trends. The full results are illustrated in Fig. 6, which provides a comparative overview of self-citation percentages across academic fields.

At the top of the list is the field of “Physics & Astronomy”, with an average self-citation rate of 16.1%, followed by “Mathematics & Statistics” at 12.5% and “Earth & Environmental Sciences” at 11.8%. These fields typically involve large-scale collaborations and cumulative research, which may partially explain the elevated self-citation rates. Researchers in these areas often build upon their previous work or that of their collaborators, leading to higher self-citation ratios.

At the lower end of the spectrum, “Economics & Business” ranks last, with an average self-citation rate of 4.9%. This difference may reflect the unique research practices and citation norms in fields like social sciences and business, where citations tend to be more distributed and interdisciplinary compared to the natural sciences.

## Conclusions

This manuscript has explored the unethical citation strategies employed by researchers, reviewers, and editors, shedding light on the complex dynamics of citation practices within academic publishing. These unethical practices, such as excessive self-citation, citation cartels, coercive citation demands, and salami slicing, distort the academic record and under-

mine trust in scientific research. While these tactics may yield short-term gains in citation metrics, they ultimately erode the quality and credibility of scholarly work.

In response to these challenges, this study provides actionable recommendations for fostering ethical citation practices. Although the manuscript does not present primary evidence of ethical strategies, the recommendations offered—such as producing high-quality, original research, actively disseminating findings, selecting appropriate journals, and fostering collaboration—are grounded in existing guidelines (e.g., COPE) and designed as countermeasures to the unethical behaviors analyzed earlier. These recommendations aim to ensure that citation metrics fulfill their intended purpose: to measure the genuine influence of research on the advancement of knowledge.

The manuscript also includes a comprehensive quantitative analysis of self-citation practices, which complements this discussion by illustrating their extent and variability, showing the broader implications of these behaviors on the academic ecosystem. The findings highlight significant variations in self-citation behaviors, influenced by geographical, cultural, and policy contexts. For example, country-specific policies, such as metrics-based thresholds for academic promotion in Italy, have been shown to drive higher rates of self-citation. These observations emphasize the need for national research policies and cultural norms to be carefully considered when developing strategies to detect and mitigate unethical behaviors. Several new findings are presented:

- The analysis highlights significant variability in self-citation rates across nations, influenced by geographical, cultural, and policy contexts. For example, countries such as French Guiana and Uzbekistan exhibit high self-citation rates, while OECD countries, including the USA, Canada, and the UK, maintain relatively lower rates.
- The study examines the behaviors of the top 200 self-citers, revealing extremely high self-citation rates among individuals, ranging from 73.8 to 99.0%, with significant implications for their h-index metrics.
- For the first time, self-citation practices have been analyzed across academic fields, revealing disciplinary variations. Fields like Physics & Astronomy and Mathematics & Statistics exhibit the highest average self-citation rates, while Economics & Business ranks the lowest.

Ultimately, fostering a research environment that prioritizes ethical citation practices is essential for preserving the integrity of academic publishing. By promoting transparency, fairness, and accountability, the academic community can ensure that citation metrics remain a reliable measure of scholarly impact. These efforts are critical to maintaining the credibility of the scientific record and the trust that underpins scholarly communication.

**Funding** Open Access funding provided by the Qatar National Library.

## Declarations

**Conflict of interest** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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