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Peer review as a science evaluation tool: main tensions and some alternative proposals

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Peer review as a science evaluation tool: main tensions and some alternative proposals

La revisión por pares como herramienta de evaluación de la ciencia: principales tensiones y algunas propuestas alternativas

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ABSTRACT

Peer review plays a crucial role in scientific and academic research. However, the different ways that have been implemented have been criticized by the international scientific community. This essay aims to identify the main questionings raised about peer review as a science assessment tool and propose alternative solutions to these discussions. The field of study from which the research was approached was science and technology evaluation studies, a qualitative methodology of exploratory and descriptive scope was applied that included the search, compilation and analysis of various sources of scientific information in English, Spanish and Portuguese languages that addressed the proposed categories. A brief overview of peer review as a science assessment tool is presented, along with a summary of the main types of peer review, as well as their advantages and disadvantages. The text addresses the questionings and biases present in the peer review system that can perpetuate existing scientific paradigms, discourage novel ideas, and reinforce systemic inequalities within academia. Although measures to address these biases have been put in place, peer review remains a human-driven process and is not entirely free of bias or limitations. A series of alternatives are proposed to improve the peer review process with the purpose of strengthening the quality and reliability of peer review, through transparency, diversity and collaboration in scientific research.

Keywords: *Scientific and academic research, Peer review, Science evaluation.*

RESUMEN

La revisión por pares desempeña un papel crucial en la investigación científica y académica. No obstante, las diferentes formas que se han implementado han sido objeto de críticas por parte de la comunidad científica internacional. Este ensayo tiene como objetivo identificar los principales cuestionamientos desarrollados a la revisión por pares como herramienta de evaluación de la ciencia y proponer soluciones alternativas frente a estas discusiones. El campo de estudio desde el cual se abordó la investigación fue los estudios de evaluación de la ciencia y la tecnología, se aplicó una metodología cualitativa de alcance exploratorio y descriptivo que incluyó la búsqueda, recopilación y análisis de diversas fuentes de información científica en idiomas inglés, español y portugués que abordaran las categorías propuestas. Se presenta un breve recorrido por la revisión por pares como herramienta de evaluación de ciencia y una síntesis de los principales tipos de revisión por pares, así como, sus ventajas y desventajas. El texto aborda el cuestionamiento y sesgos presentes en el sistema de revisión por pares que

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pueden perpetuar paradigmas científicos existentes, desalentar ideas novedosas y reforzar desigualdades sistémicas dentro de la academia. Aunque se han implementado medidas para abordar estos sesgos, la revisión por pares sigue siendo un proceso impulsado por humanos y no está completamente libre de sesgos o limitaciones. Se propone una serie de alternativas para mejorar el proceso de revisión por pares con el propósito de fortalecer la calidad y confiabilidad de la revisión por pares, mediante la transparencia, la diversidad y la colaboración en la investigación científica.

Palabras Clave: *Investigación científica y académica, Revisión por pares, Evaluación de la ciencia.*

Video presentation: https://youtu.be/xKeJTeugI1w?si=qEh5YWJBePPTqKMM

1. INTRODUCTION

Peer review is a fundamental process in the scientific and academic research field. It represents an essential tool to assess the quality, validity and originality of scientific papers before their publication in specialized journals or after their publication in preprint repositories. This process, also known as scientific arbitration, involves the critical evaluation of a research article or project by experts in the relevant field.

The main objective of peer review is to ensure that the scientific and academic advances presented in the articles are rigorous, reliable, and relevant to the scientific community (Castellanos & González, 2019; Köhler et al., 2020). When submitting a work for review, the authors seek to obtain comments and suggestions from experts in the field, who evaluate the quality of the research, the design, the methodology used, the results obtained, and the proposed conclusions.

This science assessment tool has several benefits. First of all, it guarantees the quality and reliability of published scientific results, since peer review helps to detect errors, methodological flaws or misinterpretations. In addition, it allows authors to improve the quality of their work through the comments and suggestions provided by reviewers. Likewise, peer review helps to filter and select the best works for publication, which contributes to the advancement and development of science.

However, there are also criticisms and limitations associated with peer review as a tool for evaluating scientific research. This system can be slow and biased, as reviewers may have biases or vested interests, depending on the type of peer review being conducted. In addition, this process can miss errors or not detect scientific fraud.

A recent peer review report states that key issues with peer review include the next aspects:

> It can be burdensome and time-consuming for researchers, reviewers and funders; It tends to produce conservative decisions, avoiding risk and novelty; It struggles to suitably assess and reward interdisciplinary research; It can be biased in favour of established names and institutions, and there is some evidence of gender bias; Fine-grained rankings of proposals can be influenced by reviewer choice; It is underused as a developmental tool (e.g., investing sufficiently in feedback that has sufficient depth and quality to improve applicants' future work (Kolarz et al., 2023, p. 3).

This report, together with other research carried out internationally (Amaral, 2022; Bhaumik, 2021; el-Guebaly et al., 2023; Gonzalez et al., 2022; Heesen & Bright, 2021; Rodríguez-Venegas & Fontaine-Ortiz, 2021; Tennant & Ross-Hellauer, 2020), sustain an intense debate around the revision by peers as a tool for evaluating science and the criticisms, limitations and deficiencies that arise in said process. In this order of ideas, it is pertinent to ask: What are the main questionings raised about peer review as a tool for evaluating science? And, what proposals for alternative solutions or improvements could be formulated?

In this order of ideas, the present research aims to identify the main questionings developed to peer review as a tool for evaluating science and propose alternative solutions to these questionings.

2. THEORETICAL FRAMEWORK

2.1. Brief tour of peer review as a science assessment tool

Peer review of research results has a history of approximately three centuries. The origins of this procedure are associated with the founding of National Academies in the 17th century in Europe, although there are some precedents in the previous century. With the creation of the journals Philosophical Transactions and Journal des Scavans by the Royal Society of London and the Académie Royal des Sciences in Paris respectively, the process of independent review of scientific manuscripts gradually began.

In 1731 the Royal Society of Edinburgh published Medical Essays and Observations, considered the first peer-reviewed collection of medical articles, from which peer review evolved as it is now known; but it was after the Second World War when this procedure became relevant due to the increase in global scientific production, which was increasingly specialized (Benos et al., 2007).

Throughout the science history, the peer review process has been fundamental in the selection of manuscripts, projects and research to ensure that they meet a set of quality criteria. The practice of peer review is mainly used to evaluate research papers. It is a tool used in the critical assessment of the quality of academic research (journal articles, books, applications for funding funds, scholarships, research projects, and communications to conferences, etc.) carried out by peers, whose feedback and judgment are used to improve the work and decision-making regarding its acceptance (for publication, award of funding funds or its presentation).

Therefore, peer review is the most important aspect during the process of communicating research results in highly reputable scientific journals. It guarantees that the published materials are valid and reliable, as much as possible (Dadkhah et al., 2018).
In this order of ideas, peer review is a fundamental tool in the science evaluation and is a process in which experts in a specific academic field critically review and evaluate the content and quality of a scientific article, research proposals and projects, doctoral theses, academic presentations at conferences and academic books, before their acceptance or publication.

There are different forms of peer review, each with its own characteristics and approaches. Table 1 summarizes the main types of peer review, their possible advantages and disadvantages.

TABLE 1. OVERVIEW OF DIFFERENT PEER REVIEW MODELS

TYPES OF PEER REVIEW	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Single-blind	Reviewers remain anonymous, but know the identity of the authors, which means that only the authors do not know the identity of the reviewers.	The reviewer can be completely honest with his evaluation about the manuscript, since he will remain anonymous throughout the process. In addition, it provides the possibility for the reviewer to access previous works of the authors to confirm the novelty or not of the manuscript under evaluation.	Providing author details risks distracting the reviewer from objective evaluation of the paper itself. It enables conscious bias, as reviewers can offer a more critical review to an article written by a perceived rival. Likewise, the evaluation can be favored in front of a friend or colleague.
Double-blind	Reviewers and authors remain anonymous, which means that the authors do not know the identity of the reviewers and vice versa.	Promotes impartiality and objectivity in the evaluation of academic and scientific work. By maintaining the anonymity of authors and reviewers, potential biases and prejudices are minimized, ensuring that papers are assessed solely for their quality and scientific merit.	As in the other blind reviews, not knowing the identity of the reviewers may make it difficult for authors to fully understand the comments and suggestions received. Anonymity may allow some reviewers to behave irresponsibly or biasedly, as they do not face accountability for their evaluation.
Triple-blind	The identity of the authors, reviewers and editors involved is concealed.	Potential biases, conflicts of interest, and biases in the review process are reduced. It contributes to the fact that the works are evaluated solely for their quality and scientific merit.	Achieving complete anonymity represents a logistical challenge, as current editing software cannot always ensure complete anonymity for all participants in the process. Authors may find it difficult to fully understand the comments and suggestions received.

TYPES OF PEER REVIEW	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Open review	Both authors and reviewers know each other's identities during the review process.	Transparency and accountability. Encourages more direct and open communication. It allows a constructive dialogue between both parties, facilitating the understanding of the comments and suggestions received. Promotes reviewer visibility and recognition, which can incentivize their participation and engagement in the review process.	It may create conflicts of interest and bias based on the personal relationships or reputation of the authors or reviewers. When the identities are known, there is the possibility that influences or favoritism will be seen in the works evaluation. Some reviewers may feel self-conscious about issuing criticism or negative comments towards well-known authors, which could affect the objectivity and quality of the review. In general, the lack of anonymity in open peer review can compromise the fairness and integrity of the evaluation process.
Post-publication	The critical evaluation of an academic or scientific work is carried out after the article has been published.	It allows the scientific community and readers to review and comment on the work once it is publicly available. It makes it possible to improve the quality and accuracy of the papers, as well as encourage debate and collaboration in research. Faster in the publishing process.	It can lead to the spread of misinformation or low-quality information before potential errors are corrected. The lack of a formalized review process can lead to unconstructive discussions or the spread of unsubstantiated opinions. A critical analysis is required by the readers to discern the quality and reliability of the works.
Collaborative	Authors and reviewers engage in direct interaction throughout the evaluation process, but the reviewers identity remains hidden from the authors.	Promotes active participation and interaction between reviewers and authors during the evaluation process. It allows a more dynamic exchange of ideas, improving the work quality through constructive feedback and joint identification of improvements.	It can involve a considerable investment of time and resources. Establishing an adequate system, such as a technology platform, and having trained personnel to monitor and correct possible errors or failures is necessary to facilitate and support these collaborations.

Source: Own elaboration, 2023.

One of the most widely used methods in peer review is the single-blind peer review method (Besançon et al., 2020; Riding, 2023). In this method, the reviewers know the identity of the author, but the author does not know the identity of the reviewers. This is done to ensure impartiality and objectivity

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in the evaluation process (King et al., 2018). Once reviewers have completed their evaluation, they provide comments, suggestions, and recommendations to the author and editor. These comments may include constructive criticism, corrections, questions, or requests for clarification or additional evidence. Reviewers can also recommend whether the article, project, or research proposal should be accepted, rejected, or reviewed and resubmitted.

Another method is double-blind peer review, where both authors and reviewers remain anonymous (Ali & Watson, 2016; Camacho Rodríguez, 2022; Morales-Castillo et al., 2020). Neither the authors know the identity of the reviewers, nor do the reviewers know the identity of the authors. This approach helps to minimize biases based on the reputation or institutional affiliation of the authors. Therefore, there is a general consensus that this procedure significantly reduces the probability that reviewers issue biased reports (Fox et al., 2023; Sun et al., 2022; Tomkins et al., 2017).

The blind peer review process often takes time (Tennant & Ross-Hellauer, 2020) and may involve multiple rounds of review and revising of reviews. Once the article, project or research proposal has been accepted, the author has the opportunity to incorporate comments and make any necessary modifications before the work is approved or published. Regarding double and triple blind systems, it could be noted that maintaining the anonymity of the authors is not always easy. There is usually data from projects and previous works that an experienced reviewer will not miss and allow them to identify the origin of the article.

Another way is open peer review, in this approach both authors and reviewers are known to each other (Ali & Watson, 2016). The identities of the authors and reviewers are revealed, and comments and evaluations are made in a transparent manner. This allows for greater accountability and promotes openness and scholarly discussion. As Riding (2023) puts it: "Arguments in favour of open peer review are that the intellectual property of the authors is safeguarded, and the full transparency of this procedure" (p. 3).

There is also post-publication peer review, a relatively new innovation that emerged in the early 2000s. Unlike previous methods, in this approach the review is carried out after the article has been published (Abdin et al., 2021; O'Sullivan et al., 2021; Tang & Yeo-Teh, 2023). The scientific community as a whole can review, evaluate and comment about the work. This form of peer review promotes open participation and ongoing discussion of scientific findings.

As shown in Table 1, different peer review approaches have their advantages and disadvantages, and their applicability may depend on the study field, the scientific community, and the research nature. Some journals, review agencies, and conferences may prefer a particular approach, while others may use methods combinations or experiment with new review models.

The truth is that peer review is a fundamental process in the academic and scientific field. The process is developed with the purpose of guaranteeing the quality and validity of research papers or other academic works before they are published. It involves independent experts, or peers, who evaluate the work and provide feedback to publication authors and editors. As stated by Neupane et al. "is the main mechanism for evaluating science, a fundamental component of academic communications and research evaluation" (2022, p. 4).

The peer review process helps identify errors, improve clarity and consistency of the work, and provides rigorous evaluation of the research before it is publicly available. However, it is important to note that peer review is not a foolproof process and has limitations. It is based on the experience and availability of reviewers, and may be susceptible to bias and error. Reasons why it is not exempt from criticism and discussion. These limitations and criticisms will be explored in depth in the following section.

3. METODOLOGY

The field of study from which the research was approached was science and technology evaluation studies, a qualitative methodology of exploratory and descriptive scope was applied that included the search, compilation and analysis of various sources of scientific information in English, Spanish and Portuguese languages that addressed the proposed categories.

In the process, open sources, websites of professional associations, e-libraries, gray literature, preprint servers were consulted; and as fundamental sources of scientific information, the databases: Web of Science and Scopus, with wide international coverage (Guerrero-Bote et al., 2021; Singh et al., 2021; Visser et al., 2021); the Scielo database with the largest regional scope; the Google Scholar database was also consulted with a wide thematic, language, and geographic coverage (Andrade Pereira & Mugnaini, 2023; Canto et al., 2022; Harzing & Alakangas, 2016), and which indexes research products of various types such as theses, conferences, preprints, among others.

The query to the information search and retrieval systems was based on the following search equation:

> (((("peer review" OR "peer review process" OR "reviewers" OR "peer assessment" OR "peer evaluat*" OR "single-blind review" OR "single anonymized review" OR "double-blind review" OR "double anonymized review" OR "triple-blind review" OR "collaborative review" OR "open peer review" OR "open review" OR "transparent peer review" OR "peer review quality" OR "post publication peer review" NEAR (publication* OR research OR R&D results)) AND (alternative OR critic* OR limitation* OR deficienc* OR questioning))

It is important to clarify that this equation was fragmented and combined with information search and retrieval systems, and their particularities (own query operators, advanced search systems, faceted search, own query languages).

As a result, book chapters, original research articles, review articles, letters to the editor, opinion articles, conferences and theses were analyzed. For the content analysis, the following criteria were taken into consideration: informative summary, research type, data collection methods, main contributions, value, originality and most relevant aspects, comments and evaluative synthesis, keywords, criticisms, questionings, limitations and deficiencies of the peer review process.

4. PEER REVIEW AS A SCIENCE EVALUATION TOOL: CRITICS AND ALTERNATIVES

4.1. Main questionings to peer review

Several of the publications consulted address the questionings of peer review in the academic science evaluation (Amaral, 2022; Bhaumik, 2021; el-Guebaly et al., 2023; Gonzalez et al., 2022; Heesen & Bright, 2021; Invernizzi & Davyt, 2019; Kuo, 2022; Mavrogenis & Scarlat, 2023; Neupane et al., 2022; Peterson Lu et al., 2022; Rodríguez-Venegas & Fontaine-Ortiz, 2021; Teixeira da Silva, 2019; Tennant & Ross-Hellauer, 2020). Some of the main questionings are related to biases and subjectivity, reviewer biases and professionalism lack, representativeness lack, delays, difficulty in detecting fraud or errors, pressures and conflicts of interest, integrity problems with reviewers suggested by the author, incentives for reviewers lack, reviewer training lack, and peer review retractions (Retraction Watch, 2023).

Traditional peer review (such as single or double blind peer review) has been the mainstay of peer review of scholarly publications, however the commercialization of science and scientific information has exploited the scientific findings publication, making the process more competitive, leading some nations to financially reward publications; thus biasing purely intellectual objectives with non-academic ones (Teixeira da Silva, 2019). This led to the statement that the traditional peer review system is in crisis (Bhaumik, 2021; Henriques et al., 2021; Martínez-Saucedo et al., 2020; Mavrogenis & Scarlat, 2023; Neupane et al., 2022; Peterson Lu et al., 2022; Tennant & Ross-Hellauer, 2020).

Tight (2022) expresses concern about the current peer review process and the possibility of it not being fit for purpose, stating that it "doesn't work well, not only in terms of the time and effort required to conduct a review, but also in terms of the emotional distress it causes among the authors whose work is being judged" (p. 229).

As stated by Peterson Lu et al. (2022):

> Peer review is limited by bias. Even with the best of intentions, reviewers carry biases including, but not limited to, prestige bias, affiliation bias, nationality bias, language bias, gender bias, content bias, confirmation bias, bias against interdisciplinary research, publication bias, conservatism, and conflict of interest bias (p. e412).

As part of the system criticism, Gérvas & Pérez Fernández (2001) states that this practice promotes arbitrariness, dogmatism, the brake on the results publication, the innovation rejection, the ideas theft, and the methods and biases in favor of established authors and prestigious institutions.

Among the biases and subjectivities criticized in peer review processes is the confirmation bias, which refers to the tendency of reviewers to favor information or research findings that confirm their pre-existing beliefs or hypotheses while ignoring or minimizing evidence that contradicts them (Castellanos & González, 2019; Cubero, 2020; Gisbert & Chaparro, 2023; Martínez, 2019; Ramasamy, 2021; Travis & Steven, 2021). Thus, the presence of confirmation bias can undermine the objectivity and impartiality of the peer review process.

Confirmation bias can manifest itself in a number of ways during peer review, from a selection standpoint, reviewers may unconsciously select articles that align with their own perspectives or research interests, leading to a biased sample of articles being reviewed; from the point of view of interpretation, reviewers may interpret research findings or methodologies in a way that supports their existing beliefs, ignoring alternative explanations or conflicting evidence (Castellanos & González, 2019; Gonzalez et al., 2022; Mavrogenis & Scarlat, 2023; Rodríguez-Venegas & Fontaine-Ortiz, 2021; Teixeira da Silva, 2019; Zhao, 2021). In this regard, reviewers may have preferences for specific research methodologies or paradigms. This bias can lead to the rejection or acceptance of studies based solely on alignment with the methodological preferences of the reviewers, rather than scientific rigor or research relevance.

These biases have an impact on the evaluation processes, since reviewers can assess the quality and rigor of a study differently based on their preconceived notions, which generates inconsistencies in the evaluation process. Furthermore, it constitutes a publication bias, as investigators and reviewers tend to prefer positive or significant results, leading to bias against studies with negative or inconclusive results. This bias may result in an incomplete representation of the available evidence (Arroyo-Hernández et al., 2021; Bhaumik, 2021; Invernizzi & Davyt, 2019; Peterson Lu et al., 2022; Rodríguez-Venegas & Fontaine-Ortiz, 2021). From this perspective, journals are more likely to accept articles reporting positive or significant results, while studies with null or negative results may have difficulty being published.

This bias can influence the selection of reviewers and the publication overall outlook.
Confirmation bias in peer review can have significant implications. It can perpetuate existing scientific paradigms, discourage novel or dissenting ideas, and hinder the knowledge progress. Additionally, it can reinforce systemic biases and inequities within academia, as marginalized researchers and unconventional perspectives may face increased scrutiny or rejection.

One of the most radical criticisms of peer review is presented by Sarewitz (2016), stating that peer review is incapable of guiding science while ensuring its quality. The author argues that there are more and more bodies of scientific knowledge published in peer reviewed journals that are not reproducible, present low quality and low reliability. He adds that, in many cases, they are directly useless, in addition to having gone through processes with conflicts of interest. The author links this whole situation with the current academic promotion systems, which include many pressures to produce publications quickly.

Another of the biases that can manifest itself in various ways during peer review is cultural. Reviewers from different cultural backgrounds may have different perspectives and assumptions, which may affect their evaluation of the work. This can lead to a bias towards research that aligns with dominant

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cultural norms or paradigms within a particular field. Certain methodologies, theories, or research questions that challenge or deviate from the dominant culture may be underappreciated or misinterpreted (Gonzalez et al., 2022; Mavrogenis & Scarlat, 2023; Neupane et al., 2022; Peterson Lu et al., 2022; Tennant & Ross-Hellauer, 2020).

On the other hand, gender biases can arise in peer review due to stereotypes and social expectations. Research has shown that gender disparities exist in various academic and scientific disciplines, and that women often face additional challenges in their careers. These biases can influence the peer review process, where reviewers may consciously or unconsciously assess research differently depending on the author gender. For example, studies have found evidence of gender-based differences in assessing the quality and competence of scientific work, with female authors sometimes receiving harsher criticism or less favorable evaluations compared to their male counterparts (Bhaumik, 2021; Costa, 2022; el-Guebaly et al., 2023; García Mavrogenis & Scarlat, 2023; Neupane et al., 2022; Peterson Lu et al., 2022; Tennant & Ross-Hellauer, 2020).

Peer review competing interest bias refers to a situation where the impartiality and objectivity of the peer review process is compromised due to conflicts of interest between the individuals involved. When reviewers have competing interests, they can introduce bias into the evaluation process, which could undermine its impartiality and reliability. Conflicting interests can arise from various sources, such as financial relationships, personal or professional relationships, or intellectual biases (Gonzalez et al., 2022; Hall, 2021; Invernizzi & Davyt, 2019; Kuo, 2022; Mavrogenis & Scarlat, 2023; Neupane et al., 2022; Rodríguez-Venegas & Fontaine-Ortiz, 2021; Teixeira da Silva, 2019; Tennant & Ross-Hellauer, 2020).

Addressing the competing interests bias in peer review is essential to maintaining the integrity of the process. Journals often have policies to identify and manage conflicts of interest. Reviewers are often required to disclose any potential conflicts of interest before conducting their evaluations. Journal editors then consider these disclosures and make decisions regarding the appropriateness of reviewers based on the nature and extent of their competing interests. In some cases, reviewers with conflicts of interest may be excluded from the review process to ensure impartiality (Gonzalez et al., 2022; Invernizzi & Davyt, 2019; Kuo, 2022; Mavrogenis & Scarlat, 2023; Neupane et al., 2022; Rodríguez-Venegas & Fontaine-Ortiz, 2021; Teixeira da Silva, 2019; Tennant & Ross-Hellauer, 2020).

However, despite these measures, it is a challenge to completely eliminate the bias of competing interests. Reviewers may not always disclose conflicts of interest, either intentionally or unknowingly. Furthermore, the identification and interpretation of competing interests can be subjective, leaving room for potential biases to influence the review process.

In addition to the biases exposed above, criticism is reflected towards specific biases in the peer review process, such as the language bias. This bias refers to the preference for articles written in certain languages, typically english, which can result in a disproportionate representation of research from anglo-saxon countries. English has become the dominant language of scientific communication, and researchers who publish in English are more likely to have their work accepted and cited. This creates a language barrier for non-native english speakers, who may face challenges getting their research

recognized and published (Araiza Díaz et al., 2019; Bhaumik, 2021; Faraldo Cabana, 2019; Invernizzi & Davyt, 2019; Mavrogenis & Scarlat, 2023; Peterson Lu et al., 2022; Sandoval Romero, 2020; Tennant & Ross-Hellauer, 2020). Linguistic bias can limit the diversity of perspectives and impede the diffusion of knowledge from non-english speaking regions.

Geographic bias is closely related to linguistic bias and refers to a preference for research conducted in certain geographic regions, often those with well-established research infrastructures and strong academic traditions. Researchers in these regions may have better access to resources, funding, and opportunities for collaboration, which can lead to higher-quality research. As a result, research from these regions may receive more attention and recognition during the peer review process, while work from underrepresented regions may face increased scrutiny or be discarded due to bias about the research origin (Arroyo-Hernández et al., 2021; García Costa, 2022; Gonzalez et al., 2022; Invernizzi & Davyt, 2019; Neupane et al., 2022; Peterson Lu et al., 2022).

These biases can have significant implications for the inclusion and global representation of scientific research. They can hinder the knowledge advancement by limiting diverse perspectives and preventing the inclusion of valuable research conducted in languages other than English or from non-Western countries. Additionally, peer review biases can perpetuate existing power imbalances in academia, as researchers from certain regions or languages are disadvantaged.

These biases can have significant implications for the inclusion and global representation of scientific research. They can hinder the advancement of knowledge by limiting diverse perspectives and preventing the inclusion of valuable research conducted in languages other than english or from non-western countries. Additionally, peer review biases can perpetuate existing power imbalances in academia, as researchers from certain regions or languages are disadvantaged.

In general, subjectivity in peer review exposes the process to the possibility that reviewers' biases, opinions, or personal preferences influence the evaluation and judgment of scientific research manuscripts, projects, or proposals. Despite efforts to address subjectivity in peer review, by publishers, review agencies, and the scientific community, it is important to note that while subjectivity can be minimized, peer review is still a human-driven process and is not completely free of bias or limitations. It remains a topic of ongoing discussion and exploration within the academic community. Addressing bias and subjectivity in peer review is challenging, but steps can be taken to mitigate its impact. Additionally, encouraging diversity among reviewers can bring in a broader range of perspectives, reducing the influence of individual biases.

Also, the lack of peer reviewers is part of the limitations of this process, due to the shortage of experts willing or able to carry out a critical and constructive review of academic, scientific or research works. The lack of peer reviewers can have several negative effects. First, it can slow down the publication process, which in turn can delay the dissemination of important new knowledge and discoveries. Furthermore, it can lead to a lack of rigorous review leading to the publication of low-quality research or even erroneous or biased information, which can undermine credibility and trust in the scientific community as a whole.

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The above is related to the problem of the reviewers selection, since the lack of adequacy of the reviewers is criticized, which means that they cannot contribute ideas for the improvement of the articles and that, sometimes, their comments lack any sense. Good selection is related not only to the diversity of the reviewers and their training for this task, but also to their knowledge of the topic to be reviewed. The poor selection of reviewers has a lot to do with the fact that the best reviewers, experienced reviewers, do not take on all the requests they receive, which are undoubtedly too many. This means that journals have to resort to reviewers who are less related to the subject of the manuscript or without sufficient knowledge about arbitration.

What solutions would be relevant to these criticisms? From a propositional approach, the following section presents some reflections and possible solutions to the limitations and criticisms formulated by the scientific community regarding the peer review process.

4.2. Alternatives for a more balanced, fair and transparent peer review

As has been discussed during the development of this study, the different forms of peer review have their own limitations and, consequently, have been criticized by the scientific community. Based on the main questionings, alternative improvements that can be applied to the corresponding type of peer review are proposed below. Especially, an articulation between the peer review typologies developed can shed light on complementing solutions to this evaluation process.

In the first instance, and in the face of criticism related to bias and subjectivity, a possible solution is to implement a double-blind peer review system, where both the reviewer and the author maintain their identity in anonymity during the review process. But with greater control by those responsible for the process in general, and where the content of the research is the main focus, rather than the reputation or affiliation of the authors. For greater transparency in the process, greater control by editors is suggested and the disclosure of the identity of the reviewers together with the manuscript publication (in the event that it is approved), or in the evaluation platforms, once the process is finished (in the case of those that are rejected), so that it also contributes to protecting the authors ideas.

In relation to the representativeness lack in the reviews, it is suggested to establish clear policies and guidelines for editors and academic journals, as well as for the research projects evaluation, researchers selection and accreditations, in order to ensure greater diversity and representativeness in the selected reviewers. This includes the reviewers insertion of different genders, ethnicities, institutions and countries.

A very important aspect in this process is mediation and conflict management by editors. Editors should act as impartial mediators in situations where reviewers may offer conflicting suggestions. This involves making informed and balanced decisions to address any discrepancies between reviewers and providing clear guidance to authors on how to address conflicting comments effectively.

To improve the problems associated with delays in the review processes, a possible solution is to establish clear and realistic deadlines for the review process and ensure constant follow-up by the editors. In addition, workflow management systems can be implemented and technologies such as time tracking and automated reminders can be used to streamline the review process.

Given the difficulty in detecting fraud or errors, one way to address this problem is to promote the transparency and replicability of the research. The data and methods used in the study must be clearly described and accessible so that reviewers and other researchers can verify and replicate the results. In addition, more rigorous guidelines and protocols can be established for the detection of fraud and errors, including the use of plagiarism detection tools and statistical analysis software.

To minimize the influences of pressures and conflicts of interest, strict policies can be implemented to disclose and manage conflicts of interest. Reviewers must provide information about any personal, financial, or professional relationships that may influence their objectivity. For their part, editors must carefully assess these conflicts and make impartial decisions about accepting or rejecting papers.

Regarding the integrity problems that arise with author-suggested reviewers, one solution is to promote transparency in the reviewer selection process. Authors may provide a list of potential reviewers, but editors should be free to select independent and objective reviewers. In addition, internal review and complaint mechanisms can be established to address any integrity issues related to reviewers.

One of the persistent criticisms is the incentives lack for reviewers. The scientific community recognizes that it is important to recognize and reward the reviewers work, however, this irregularity remains unresolved. Possible solutions may include the attribution of academic credit, recognition certificates, free journal memberships, or discounted publication fees. In addition, some journals have adopted open peer review systems, where the reviewers names and review reports are published along with the articles, which contributes to increasing the visibility and reputation of the reviewers.

On the other hand, the lack of reviewers training can be solved with the development of training and orientation programs for reviewers, especially those who are new to the process. For exmple, Publons (https://publons.com/home/), a platform focusing on peer review, has developed the Publons Academy, which organizes training courses on peer review practice for young researchers. These practices can multiply, even among the reviewers schools that promote publishing houses. It is good practice for editors to provide clear guidelines on review criteria, the structure of review reports, even best practices. In addition, mentoring programs can be established where experienced reviewers provide support, coaching, and feedback to novice reviewers.

Confirmation bias in peer review has also been strongly questioned, in this sense, providing clear and objective guidelines to reviewers can help minimize this bias. These guidelines should emphasize the need to assess the methodological quality, originality, and the study relevance, rather than relying solely on confirmation of expected results or in agreement with one's own beliefs. In addition, in the face of this phenomenon it is essential to

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encourage reviewer diversity, provide ongoing training to reviewers on the identification and management of confirmation bias, and require reviewers to submit clear and transparent review reports that explain their reasoning and justification for the decisions made.

In the context of open science, the promotion of transparency, accessibility and collaboration in scientific research, can contribute considerably to ameliorate the criticisms and limitations of peer review in several ways. A favorable element is the transparency and openness of data. Open science encourages open access to research data and results, allowing reviewers to access the underlying data used in a study and assess the robustness of the results more effectively. By having access to the data and being able to replicate the study, reviewers can more accurately identify potential errors or limitations.

On the other hand, there are the open reviews that open science raises, where the review reports and comments of the reviewers are made public. This allows for greater transparency in the peer review process and allows other researchers to assess the quality of the reviews performed. The open review can also help reduce bias and improve objectivity in the review process. To this is added the collaboration and comments of the scientific community and society. Through online platforms and academic and social networks, researchers can share their results, ask questions, and receive feedback from other experts in the field. This broadens the scope of criticism and feedback received, enriching the peer review process.

Finally, several tools, some based on neural networks, are used by scientific journals to control plagiarism, identify reviewers, detect statistical errors, review structure, or report contributions. It is recommended to take advantage of artificial intelligence (AI)-based approaches that are being developed to detect bias and improve peer review in scientific research. Along with the accelerated development of AI, these tools are constantly updated, including: plagiarism and duplication detection tools, language and style analysis software that helps identify biases or errors, AI-based peer review platforms, data bias detection tools, among others. In this sense, it is important to suggest action strategies, such as greater training in AI tools, promotion of research-based education, and the need to open a debate about the use of AI in peer review processes.

5. CONCLUSIONS

Peer review as a tool for evaluating scientific research presents deficiencies in the different ways that it has been implemented, as reflected in the dissimilar scientific publications that have been developed around this issue and that were consulted in this study. The main criticisms of the peer review process suggest that it can be affected by biases and limitations, such as conflicts of interest, language and geographic bias. These biases can hinder the inclusion and global representation of scientific research, perpetuating systemic inequalities and limiting the diversity of perspectives. Although measures have been put in place to address these limitations, peer review is still a human process and is not without subjectivity. To mitigate these limitations, it is necessary to develop alternative proposals that encourage diversity among reviewers, promote the inclusion of research in different languages and regions, and ensure transparency in the disclosure of conflicts of interest.

In response, this study proposes a series of alternatives to improve the peer review process as a tool for evaluating scientific research. These alternatives constitute possible solutions that range from the implementation of double-blind peer review systems that integrate aspects of open peer review, at the end of the decision about a job, to promoting the research transparency and replicability. In addition, it is suggested to establish policies to ensure diversity and representativeness in the selected reviewers, as well as to attribute academic credits and rewards to the reviewers. The importance of developing training and orientation programs for reviewers, providing clear and objective guidelines, and encouraging collaboration and feedback from the scientific community and society is also highlighted. Together, these proposals seek to strengthen the quality and reliability of peer review, promoting transparency, diversity, and collaboration in scientific research.

Finally, open science can ameliorate the criticisms and limitations of peer review by fostering transparency, collaboration, and participation from the scientific community. By making research data and results accessible, promoting open review and early feedback, it can strengthen the review process and ensure more rigorous and reliable science.

It is important to note that these solutions are general proposals and may vary according to the policies and practices of different scientific journals, evaluation agencies and scientific disciplines. Continuous improvement of the peer review process requires the collaboration of researchers, editors, and the academic community at large.

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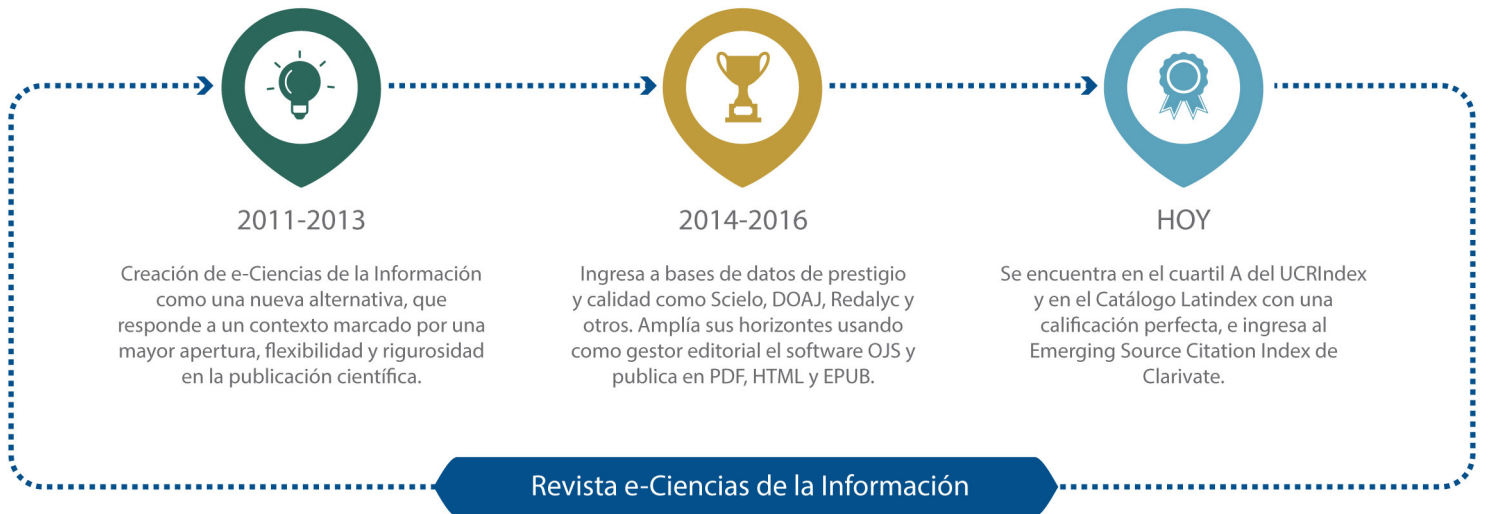
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