

by Maria Dolores Pereira

Gender diversity in editorial boards of scientific journals. Some earth science case studies for a geoethical reflection

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Any scientific area can benefit from the contributions of a diverse society. Upon reflection, many notable achievements have been made by women to the advancement of science, but they were not highlighted enough. Such was the case of Hedy Lamarr, who co-authored the development of a radio guidance system (the start of the present Wi-Fi) or Rosalind Franklin, who contributed enormously to the discovery of the structure of DNA. But they were shadowed by their male counterparts. The same happens today. The ratio male/female in most important scientific recognitions, like the Nobel prize, is very illustrative. This situation also applies to the inclusion of female researchers in journal editorial boards, where the main process of manuscripts management takes place. Steps have been done to correct the disparity, but actions need to be reviewed. This paper aims to compare the evolution of gender diversity within the editorial boards of six quality scholarly journals dealing with Earth Sciences to see how gender diversity has been considered in the update of board panels along the years. The conclusions are that there is a long way to go to reach gender diversity, but also that the implementation of constructive changes may trigger a definitive alteration in these trends through good practices.

Introduction

The number of women choosing to pursue careers in STEM-related fields (Science, Technology, Engineering and Mathematics) is variable and depends on the country and specific area. Some reports have shown that the number of female scientists is proportionally comparable in North America and Western Europe (Gonzales, 2010; Pereira and Díaz, 2016; European Commission, 2019). However, it has always been concluded that the number of female researchers is lower than that of their male peers in all the cases. Still, women represent less than 30 percent of the enrolments in STEM-related higher degrees, including geosciences, with this gender gap appearing in early education (<https://www.bbva.com/en/female-role-models-for-the-scientists-of-the-future/>).

Many historical barriers have existed that have hampered women from pursuing not only STEM career paths but other types of higher education that may prove beneficial or lead to a better job, despite evidence that indicates that men and women have similar, if not equal, capacities in these fields (Spelke, 2005; Hyde and Linn, 2006; Topaz and Sen, 2016). Consequently, if no innate biological differences exist, we must look for other factors that contribute to this gender imbalance. Cultural and religious issues can also impede the promotion of women in science in some male-oriented societies such as those with a Taliban government (e.g., Afghanistan) (Rahman and Lifang, 2020; Mallapaty, 2021) or ultra-orthodox societies, among others. The strict religious practices of the latter, including the Torah's commandments and the belief that serving God is linked to human reproduction (Hakak, 2004; Cohen, 2005; Cahaner, 2011; Odenheimer and Ackerman, 2012), go before any other life goals, especially those linked to gender equality and advancements in scientific knowledge that improve quality of life. And thus, women are shut out of the world of science, including leading research groups, the authorship of scientific publications and, ultimately, their inclusion within a network of academic influence and prestige. This situation can be compared to a dog chasing its tail, as women in leadership positions can better mentor other women, supporting more balanced policies and practices (Stainback et al., 2016). Although these aspects are beyond the scope of this paper, it is essential to bear them in mind, because they form part of the exclusion of an essential part of the world's scientific intellectual potential. Clearly cultural, structural, and interactional influences are capital in the analyses of gender discrimination in all contexts (Bobbit-Zeher, 2011).

The lack of female role models in STEM fields is the most plausible reason for fewer girls pursuing scientific careers, with girls becoming discouraged from imagining themselves carrying out STEM-related professions. But history has clearly documented the important role of women in the development of many scientific lines of research, from Hedy Lamarr, who co-authored the development of a radio guidance system (the start of the present Wi-Fi) and received a patent in 1942, to Rosalind Franklin, who contributed enormously to the discovery of the structure of the DNA in the 1950s. Hedy Lamar was also a movie star, and during years that was her main recognition, while society long ignored her inventive genius (Cheslak, 2018). These two relevant female researchers are only examples among many other women that achieved significant works that have helped in the advancement of

society but were shadowed by their male counterparts. Drawing attention to these very interesting, and unfair, cases will encourage female students to consider STEM areas as possible study options and enroll in degree programs such in the applied sciences, such as Biology, Medicine and Geosciences, to be leaders in the STEM areas. Humanity fields have not been much better in recognition of female authors. The French writer S.G. Colette, whose work was stolen by her first husband by signing her books under his nickname and keeping the copyright of her first writings, is one of the many cases (Thurman, 1999). Neglecting female intellectual capacity has always been a common place.

It must be noted that success in research is currently, and increasingly, measured through the number of quality articles that a scientist publishes. Those numbers are still discouraging in STEM areas, including Geosciences. To address this, gender issues associated with different STEM areas, should be explored to understand the importance of diversity in the different aspects, including publication of research in Geosciences. However, between 2013 and 2017, only 0.15 percent of all publications coming from the European Union addressed this issue (European Commission, 2019). Also, it has been shown that gender equality and diversity in editorial boards improve, at all levels, fairness in the peer review process (Murray et al., 2018) which in turn helps to build equality in terms of research outcomes. However, even in fields where many female researchers are leading in many specialties, like the health sciences, the editorial board of scholarly journals also lacks a balanced representation of women and men (e.g., Fox et al., 2019; Lobl et al., 2020; Pinho-Gomes et al., 2021). This also happens in review panels, although, in general, to a lesser degree. Alkhawtani et al., (2021) describe how women have been underrepresented within the editorial boards of major medical journals for many years. And even though today an increase in the number of women has been detected, this imbalance is still significant (Alkhawtani et al., 2021). Furthermore, it must be considered that only a few years ago, in the twentieth century, almost all members of all scholarly journal editorial boards were made up almost entirely by male researchers (see below the evolution of the studied journals' editorial board). The evolution of the boards has not change much in many cases.

Authors Pereira and Díaz, who analyzed data on researchers in Spain, concluded that great gender inequality was installed in many different aspects of science. It has been detected that women lead fewer major research projects and there is a relatively lower number of women who are authors of major publications, and even fewer as the first or last author. Many studies have been published on this issue and have concluded that only around 30 percent of authors in science are women (Pereira and Diaz, 2016, and references therein). Although continuous research on this subject is carried on, it is clear that the pipeline from junior to senior positions leaks female scientists in the context of journal editorial boards. Furthermore, most decision positions at these editorial boards (e.g., editors-in-chief, senior editors) are comprised exclusively of men. Thus, there is the need to examine whether this situation affects the results of any decisions made regarding the peer-review process. López and Pereira have broadened this context by revealing poorer results when evaluating the transfer of knowledge through female researchers compared to their male peers. Upon analyzing the different disproportionate situations, it seems that female researchers are not properly validating their efforts in science,

including Geology. Female researchers fair worse when assessing knowledge transfer because a good part of what is transferred is dedicated to social advances (López and Pereira, 2021). These same authors have identified that many women participate in disseminating the importance of science by giving seminars and special sessions for girls and female students, which is of capital importance when working on girls' mentorship. The value given to these social actions is by far less than the value given to the transfer of knowledge involving high economic impact such as contracts with pharmaceutical companies. Both types of knowledge transfer are vital for the progress of society, but there is no evidence that male researchers work on knowledge transfer related to encouraging girls to study STEM-related subjects, including the publication of reports pointing out to this subject.

Observations reflect the presence of women, but the numbers do not reflect their full capacity and their full contribution to science. Published data on the composition of many scientific journals clearly point out that male scientists comprise most editorial boards. Although most journals publish encouraging policies that promote equality and diversity, these policies are rarely implemented and very few admit their failure in the implementation. It must be noted there are some exceptional and encouraging cases. For example, the journal *Episodes*, the International Union of Geological Sciences (IUGS) flagship publication, recently published its success in achieving full gender diversity on its editorial board and the improvement in terms of the geographical range. At present, the journal *Episodes* has over twice the percentage of female editorial members compared to other geoscience journals (Kim et al., 2021). This picture was not always the same. This positive result was recently made possible by filtering the applications of those researchers expressing interest in becoming a member of the editorial board. The selection was not done based on gender but on individual skills, as well as the editorial and publication experience of the applicants. When two candidates had similar curriculum vitae, the woman was chosen over the man, which led to positive discrimination of the female candidate. Unfortunately, the level of diversity in the review panel of *Episodes* and the other studied journals is not optimistic, as it can be seen from their web sites. It must be taken into account that Earth Science is still mainly a male-dominated scientific area, but even in those areas where women are normally represented in higher numbers, the disparity in board panels is disconcerting. For decades, studies have confirmed gender inequality in the composition of journal editorial boards across a large number of specialties. Despite an upward trend in the number of women present on editorial boards, the rate of increase has been slow, and the numbers generally do not reflect the representation of women in their respective specialties. This is particularly true in the case of several health study areas where women outnumber men, but this high representation is not reflected in the editorial boards (Jagsi et al., 2006; Capdeville, 2019).

Diversity is the key to build a healthy world. It should be maintained in nature, but also in the society. The Geosciences have an ethical obligation to broaden their diversity in all their working areas as part of Geoethics, and this includes gender diversity in the research publications and editorial boards of Geosciences journals. To advance on the implementation of diversity rules, this article examines gender diversity in six Earth Sciences journals that can be models for the many journals that are being published these days. Gender inequality in the composition of the editorial boards of most of the studied scientific

journals dealing with the applied sciences in general and Earth Sciences in particular, can have a negative impact on research productivity and therefore the promotion of women in the Earth Sciences. While it could be thought that using only few journals to reach a conclusion is very limited, the characteristics of these journals may open the possibility of using the results for comparative purposes. The intent of this paper is not to offer an exhaustive analysis of the composition of editorial boards, as this kind of analysis has been done in previous works focusing on different specialties, including Earth Sciences as part of STEM areas. As a recent example, Henriques and Garcia (2022) analyzed 53 journals in Geoscience and they found out that 85% of the researchers with the position of editor-in-chief, the highest at the editorial level, is occupied by male researchers. Moreover, 80% of the members that make up the editorial board of those journals are men, leaving the other 20% to their female pairs (Henriques and Garcia, 2022). The present work does not refer to the statistics of the editorial boards but is focused on the evolution of the situation of gender diversity in the editorial boards in the available years of the study on the selected journals and the reflection on how to apply good practices and positive actions have been proved to change positively the trend on gender diversity, focused on Earth Sciences journals. The same positive actions should be implemented to gain balance in the reviewers' panels as well.

Also, this paper will discuss the relationship between the so-called "predatory" journals and the lack of gender diversity, as it has been already pointed out by other authors (Beall, 2012), although this very interesting subject is not the main scope of this paper.

Materials and Methods

Any data on individuals, broken down according to gender, allows to see the differences between women and men on various social, scientific, and economic grounds to be measured and are one of the requirements for obtaining gender statistics (European Institute for Gender Equality. <https://eige.europa.eu/gender-statistics/dgs>). Visualizing gender information at all levels can promote changes toward gender balance. This visualization includes information given by journals regarding their editorial structure. And it must be taken into account that the editorial structure differs from journal to journal, although the highest positions almost always remain in the change to editor-in-chief. Some editorials have recently gone one step forward and report data on the sex of their editors as a means to promote openness and increase inclusivity and diversity within this space. Due to the difficulty in monitoring gender diversity in the editorial boards of journals, and to simplify the work, this paper is restricted to six scientific journals with similar characteristics: *Episodes*, *Journal of Building Engineering*, *China Geology*, *Applied Sciences*, *Geology* and *Construction and Building Materials*. All are dedicated to the experimental sciences, and form part of the Journal Citation Report, with published impact factors. The author tried to include other journals that could be a model due to the high quality and impact, but the difficulties in comparing structures at the editorial level made it difficult. For example, the journal *Elements*, very well rated and with very high impact factor, has three principal editors at present, two of which are women, and the executive committee at present is perfectly diverse: 50%

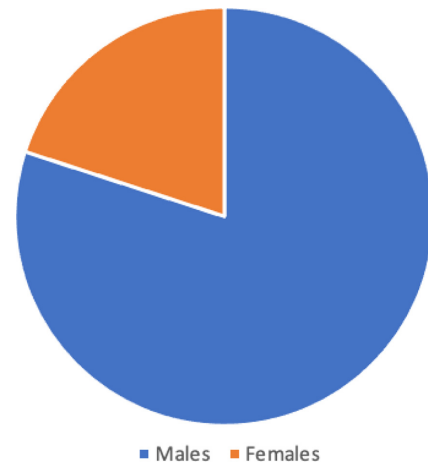


Figure 1. Comparison of male against female principal editors in the journal *Elements* since 2005 until present.

female, 50% male (11 female and 11 male researchers). This means that since the first publication in 2005 to today, the improvement at the principal editor level has been notorious, but it has been slow. The past principal editors were mainly male researchers, and therefore the final picture shows as Fig. 1. The evolution at the executive committee level was not possible to check from the data at the journal website.

Episodes

Episodes is the flagship publication of the IUGS. It is a specialized journal in geosciences that publishes four issues per year, including one special issue when there is a promising thematic proposal. Each issue is made up of about eight to ten scientific articles, besides news on IUGS activities, editorials, and reports, including UNESCO-IGCP reports. *Episodes* was first published online in 2016. Previously, it was published only as hard copies. To prepare this paper, the author had the great assistance of Fareeduddin Fareeduddin, former editor-in-chief of *Episodes*, who searched libraries in Bangalore (India) to find first issues and provided photos of the inner covers of issues from 1997, when the journal first started, to the years when *Episodes* started to be published online. From those photos the author was able to retrieve the names of the editorial board members at the time. This information was used to analyze the evolution on gender diversity for this journal. From 2016, data are also available from the web site of the journal, updated annually.

The first data on the Journal Citation Report was published in 1997. Its latest published impact factor is 2.439 (2021). The history of IUGS has been linked to the history of *Episodes*. Based in South Korea since 2018, besides of publishing quality scientific articles, one of its main targets has been to achieve wide geographical and gender diversity, not only as readers and authors, but also in the editorial board and the team of reviewers. Its geographical diversity has improved in recent years, as it now includes members from all continents. The gender diversity of the editorial board reached its peak in 2021 when the editorial comprised the maximum number of females (15 out of 29 members).

Applied Sciences

Applied Sciences is a Multidisciplinary Digital Publishing Institute (MDPI) journal, relatively new (first data on the Journal Citation Report is 2014) that provides an advanced forum on all aspects of applied natural sciences. Applied Sciences publishes experimental and theoretical results in physics, chemistry, engineering, and material sciences. Its latest published impact factor is 2.834 (2021) (Science Citation Index Expanded).

Applied Sciences publishes, and updates, the composition of the editorial board and reviewers online only, and therefore the author was not able to track the trend on gender diversity along the years the journal has been active.

Applied Sciences has been increasing the number of publications, and its present production level consists of one volume per year; each volume made up of 24 issues and each issue comprising hundreds of articles. This journal, and other journals published by the same editorial house, is facing strong criticism derived from this very large number of publications that may induce to think of a not very selective reviewing process (Oviedo-García, 2021). Although this issue is out of the scope of this paper, it will be interesting to see if the so-called “predatory” journals (Beall, 2012, Laine and Winker, 2017) are working to improve gender diversity in their editorial and reviewing panels. This paper will discuss the author’s observations compared to the published conclusions by other authors.

Journal of Building Engineering

This is a very recent journal, published online by Elsevier since 2015, with open-access option under payment. It started publishing four volumes per year, but it has increased the number of volumes up to twelve. At present, each volume is made up of more than one hundred research articles, with authorships from all over the world. It is ranked in Q1 (First decile in Civil Engineering category) and the last Journal Impact Factor is 7.144 (Science Citation Index Expanded). The journal publishes the composition of its editorial board in each issue, so the author was able to follow the evolution of the gender diversity for this journal. Geographic information for the editorial board members is also included in the web site. At the same site it is possible to find statements and advises on gender diversity that will be commented below.

China Geology

This is a very recent open-access journal, published since 2018 both online and as paper copy. It publishes four issues per year, with a wide number of contributions, from editorials to research articles to reviews, most from Chinese authors. The first citation report comes from 2020 and it is ranked in Q2. 2021 Journal Impact Factor is 0.72 (Science Citation Index Expanded). The journal informs on the editorial board composition in its website, but it was not possible to follow the evolution in the years that has been active.

Geology

This journal is published by the Geological Society of America

since 1973. Its contents are only available, on-line, upon subscription. It publishes twelve issues per year, and it has been the first ranked geosciences journal in the Web of Science’s for 15 years in a row, in position Q1 from the beginning, therefore it is a reference journal that could serve as model for other Geoscience journals.

Construction and Building Materials

This journal is published by Elsevier. It publishes articles related to construction materials, from natural stones to products such as cement. The contents are on-line, available upon subscription, although some articles have open access, subject to payment from authors. Articles are dated from 1971, starting with 3 to 4 issues per volume/year during the first years, but at present the journal publishes over 40 issues per year. The last measured impact factor is 7.693 and it is a Q1 journal. It must be taken into account that the first issues uploaded to the website and accessible online are scanned from original paper volumes and some errors might have been introduced. In fact, only after 2006 was possible to access a full view of the editorial board composition, except for the 1971 first issue and the scanned page for 1989.

All the selected journals publish the names of the board members and some of them also the reviewers, accessible through their web pages. The lists are not disaggregated by gender, and to identify female researchers from the lists, the first approach was to consider the names of researchers and, when included or available on the Internet, the pictures. However, some names are ambiguous in the different languages. For example, several names of English origin (e.g., Angel, Ashley, Blair, Carol), French origin (e.g., Cezanne, Kari, Noe), Asian origin (e.g., Heng, Hinata, Hirome, Zhe), and other origins are unisex. In addition, a name in any language (e.g., Rosario) can be male (in Italian) or female (Spanish from Spain, because in South America it can be masculine). Asian names are always more difficult to ascribe to any gender for a non-Asiatic person. Liou et al. (2021) developed a method to predict gender (and age) based on a given name, considering local cultural and social contexts when working with Asian names. For these reasons, methodologies based on algorithms and other disaggregation tools provide somewhat less accurate results (Altman and Cohen, 2021). In this paper, the author has followed the same simple but time-consuming method as in Pereira and Díaz (2016), a paper discussing the minor number of female scientific citations against their male peers. But other investigations were needed to make sure that our assignments were correct, respecting the information given by researchers, either in their institutional web sites or even using their public social media data (e.g., FaceBook, ResearchGate, LinkedIn, Google Scholar).

Although anecdotal, the lists published by journals (mainly when lists are extensive, as is the case for the journal *Applied Sciences*) sometimes contain duplications of names (for this paper the author ensured that two equal names belonged to the same person to eliminate one of them; common names (e.g., José, Kristof) were also checked by institution) to avoid large deviations in the results. When in doubt, the author used the Internet to determine gender through the institutional web pages, personal web pages, personal social media, or searches using Google search engines (Altman and Cohen, 2021). Platforms such as Google Scholar or ResearchGate, where many researchers post their pictures, were also helpful in some cases. In some cases, when no pictures were available and first names of the members of editorial boards were

missing, except for initials (i.e., Journal of Building Engineering, some years for Construction and Building Materials), deep research using combinations of surnames, institutions and research and teaching profiles were used to determine gender through their biographies. It must be noted that some of the journals uploaded the information to the websites using scanned documents (e.g., CBM) and some mistakes could have been introduced, as there is such a large amount of data. In any case, it was possible to determine confidently whether a person was male or female in almost all cases. In this study, non-binary and other genders were not considered for the complexity of the task, but the author is of the opinion that this is not an obstacle to achieving the main goal, and other concerns were not in the scope of this paper.

It must be noted that Journal of Building Engineering kept the name of a female researcher for several years after she passed away. The author assumed this was unintentional and considered this anomaly when obtaining the ratio of male/female for the statistics for this journal.

Results

From the observations made for the six journals, the composition of editorial boards at present is as follows (Table 1, Fig. 2):

Episodes: the editorial board at present consists of one editor-in-chief and a panel of twenty-nine editorial board members. Out of the twenty-nine members, 15 are female researchers and 14 are male, which is close to full parity. The journal publishes the names of reviewers in the last issue (December) since 2018, and it should be noted that from a list of almost 200 names, only around 15% are female researchers. Although the goal of the paper is not focused on reviewers, the appalling number calls upon reflection also.

Applied Sciences: The structure of higher places at the editorial board consists of: one editor in chief, 17 section editors in chief, 6 section associate editors and 1 member of the advisory board. All the 23 members are male researchers. There were 2270 editorial board members at the time of checking the data. This journal also publishes the names of reviewers, and from a list of more than 1100 researchers (data from 30th of March 2022) only 16% are female researchers.

Journal of Building Engineering has an editorial board made up of 44 editors and editorial board members. Of the four editors-in-chief, two are male and two females. Of the seven associate editors, two are female and five are male. Of the 33 editorial board members, 3 are female researchers, that is less than 14% of the full composition. The author could not find appropriate information on the reviewers for this journal.

China Geology has 49 members in its editorial structure, divided into one director (male), four deputy directors (all males), five editors-in-chief (all males) and 39 members of the editorial board, where 4 are female researchers, that is, about 10% of the list, but the 7.5% of

the full editorial structure. No information of reviewers was found for this journal.

Geology has six Science Editors, of which only one is a female. The Editorial Board seems to be updated every two years, including new members. From the data on the website, there is a set of 18 members selected for the period 2020-22, of which 6 are female. For the period 2021-2023, six new members were included, although none of them were female members. For the period 2022-2024, ten new members were added, of which 4 were females. This makes a total of 10 females out of 34 members, which is less than one third of the composition of the full board. *Geology* is the first journal ranked by impact factor. This means that is a very useful source for Earth Science contents and should be a model for other journals, not only regarding quality, but also diversity in its editorial board (https://www.geosociety.org/GSA/Publications/Journals/geology/gsa/pubs/geology/edBoard_Geology.aspx).

Construction and Building Materials has an editor in chief (male), six Senior Editors (one female), two managing editors (one male, one female), 22 Editors (eight females) and 23 Advisory Editors, with zero female members. That makes a total of 54 members in the full Editorial Board and are only 10 female members, that is, a bit above 20% of the composition.

The person responsible in all the studied cases is a male researcher.

The results are plotted in Table 1 and Fig. 2 for better illustration of the striking numbers.

Geography diversity should be another very important issue that should be taken into account if trying to cover the maximum number of scientists in journals. The author has found that in three journals, the most represented region in the editorial board composition is Europe, followed by Asia, America, and Oceania. Only in *Episodes* there is representation of Africa, although with only one female member. *China Geology* is made up only by Chinese members (Fig. 3). This issue should be further explored.

If going backwards in time, a slight improvement has been achieved since the first years of publications of the studied journals (when data are available to follow the track) (Figs. 4). Some of the studied journals did not get even 10% of female researchers when they started to publish Science.

Discussion

Geoscientists face with the challenges of communication important scientific results to those who might benefit from them. But Geoscience should include the gender perspective in all the different study areas that are published. This is part of the geoethical reflection that should be analyzed when discussing gender diversity in editorial boards of journals of Geoscience.

It is not an easy task to study the evolution of gender diversity in the editorial boards of journals. Some of them do not publish the histori-

Table 1. Composition of the full editorial boards of the studied journals in 2021-2022

Gender	Episodes	Applied Sciences	China Geology	Journal of Building Engineering	Geology	Construction and Building Materials
Male	14	1819	49	42	29	44
Female	15	345	4	7	11	10
% Female	52	16	7.5	14	27.5	18.5

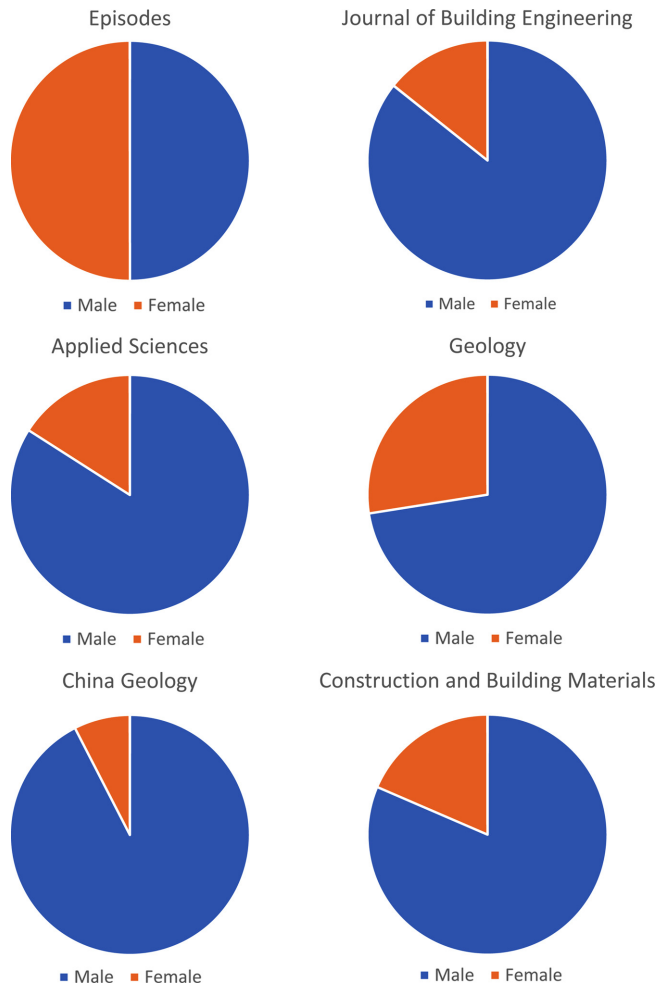


Figure 2. Gender ratio in the editorial board of the studied journals at present.

cal data. For this reason, the author of this paper filtered six of the journals that could be used as examples, either because they are very well recognized among the geoscientists or because they have become popular for the high rate of acceptance. In any case, all of them are rated in the Clarivate Analytics' Web of Science Core Collections database. Analysis of gender equality in research can lead to information that can help policy makers to better respond to social needs by creating new perspectives on how equality can be achieved. In addition, research programs are placing gender as a cross-cutting issue, with one of the underpinning objectives being to integrate the gender dimension into research and innovation. These programs also provide tools to integrate the gender dimension into various fields of research and innovation, as well as concrete policy recommendations (https://ec.europa.eu/info/news/gendered-innovations-2-2020-nov-24_en).

The request for lists of information on gender (disaggregated lists by gender) faces legal and ethical constraints, as an increasing number of governments are imposing stringent requirements on the use of personal data. For instance, the European Commission issued the General Data Protection Regulation in 2016 to protect personal data and privacy (General Data Protection Regulation (GDPR) (2016). The Chinese government announced the Data Security Law and Personal Data Privacy Law, which came into effect in 2021 (China Passes New

Personal Data Privacy Law, Reuters 2021; A Close Reading of China's Data Security Law 2021). By contrast, some countries like the U.S.A. do not have a single law in force for protecting data, but several laws at the federal and state levels seek to protect its citizens. But if the lists are not disaggregated, it is very difficult to monitor whether the much-needed equity is met at all scientific levels. Many research programs already have mandates on their policies in research calls. For example, the very prestigious Marie Skłodowska Curie (MSC) postdoctoral fellowships requests at least 40 percent, and never more than 60 percent, of representation of one gender in evaluating committees. This is a good practice that should be implemented when updating boards at all levels.

It is becoming acceptable, or even recommendable, to include information about gender diversity in the policies of scientific journals. However, implementation of such policies is never strict and information on the quantitative analysis of this diversity is still scarce. The author believes that, in most cases, gender imbalance in the editorial structure of journals is probably unconscious. For this reason, visualizing the issue with pictures, graphics and publications is a very good approach to try to amend the situation. The publishing director for Elsevier's Energy and Earth Science program at the time posted an article (Logan, 2016) and initiated a reflection after attending an editorial meeting where she was the only woman among eighty attendants. This reflection included the realization that even in a research area such as Energy, which attracted as many women as men, Elsevier only had six percent of female editors-in-chief, despite over thirty percent of all submission contributions from female researchers. She noticed that the situation for Earth Science was similar. Since this is unlikely to be intentional, the most important step in changing the situation is to create awareness on the matter. Hence, the present article aims to create awareness within the editorial sector. Following the good practices advised by Elsevier (2021), editorials are encouraged to include gender information in their web pages, to be able to monitor the policy that most journals want to apply (Cho et al., 2014). But several journals remain still in the very low side of gender balance and transparency in the editorial board composition, including Elsevier's journals (e.g., Journal of Building Engineering, as described above, or Earth and Planetary Sciences, as published by Witze, 2016) as can be seen in the figures above. It could not be made a follow up of the evolution of the editorial board of China Geology and Applied Sciences, because the journals update the composition annually, but there is no record of the previous years. However, from the present data, that evolution is not expected to be optimistic.

A wide number of publications conclude that, even if women and men have a similar number of graduate degrees, women remain underrepresented in upper-level positions in all sectors (Cho et al., 2014). Unconscious biases against women have been found in hiring, promotion, publications, citing, and journal placements. One of the most important consequences of this unbalanced situation is the lack of female mentors and role models for younger generations. The editorial boards of scientific journals can act as gatekeepers that help maintain the scientific integrity and standards as well as identify emerging and innovative areas of research (Capdeville, 2019). Since journal editorial board membership is considered a marker of influence and prestige in academia (Morton and Sonnad, 2007; Alkhawtani et al., 2021), serving as subject or thematic editors in prestigious journals can help women

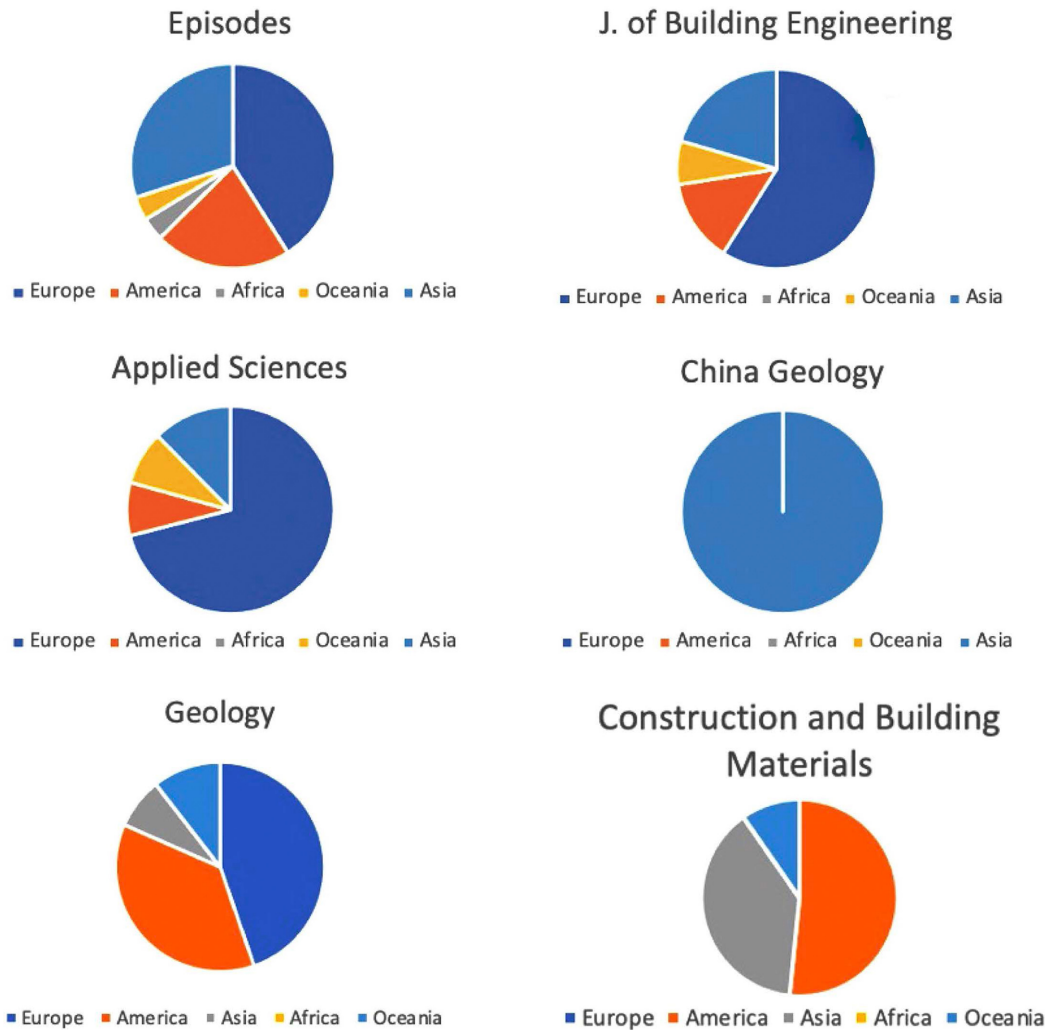


Figure 3. Geography diversity in the editorial board of the studied journals in 2021-2022.

to promote to leadership positions, as an associate editor and/or editor-in-chief is typically selected from those subject or thematic editors. However, the observations indicate that a large journal is farther away from gender-based equity in the editorial board, meeting the same conclusions as other studies in different scientific specialties. In contrast, a relatively small journal like *Episodes*, also open access and with important impact factors (Clarivate Analytics, 2021), has recently achieved full gender diversity and better geography diversity in the editorial board in recent years (Kim et al., 2021). This goal was achieved by introducing positive actions in selecting new editorial board members when it was time for an update (following the *Episodes* policy for renewing the editorial board) and, slowly, a parity in the editorial board was achieved (Fig. 4a). A positive action is an important tool to fight against discrimination, not only in gender. Positive actions serve to overcome the limits that specific collectives and persons have in the participation in the society. There is no specific formula to apply positive actions and they depend on the different circumstances (O’Cinneide, 2006). Unfortunately, due to national or international frameworks, positive actions have not always helped to sort out clear discriminations (O’Cinneide, 2006). Positive actions are not as drastic as discriminative actions. But observing that editorial boards still have fewer women, if

positive actions do not solve the problem of achieving a gender balance, discriminating the most representative gender in the pool should be implemented. Otherwise, the disparity would never be corrected.

Regarding *Episodes*, to update and renew the composition of the editorial board of *Episodes*, a call was issued every year since 2013, requesting expressions of interest through different IUGS media (e.g., twitter, Facebook, and the IUGS eBulletin). The IUGS Publications Committee oversees the process, evaluating the submitted curricula. As it should be, the final selection took always into account the expertise and experience of the candidates, but also their gender, as it was previously announced that the most under-represented gender would get preference despite same qualifications. It must be noted that from 2018 to 2022, the IUGS Publications Committee had a female researcher as a chair for the first time in its history.

The composition of editorial boards should represent the composition of the research teams. Even if female researchers are lesser in number in those teams; from the *Applied Sciences* journal reviewer panel, the author observed that a very small percentage of the list is made up of women. Despite being low, it is still an improvement from zero percent in the editor-in-chief list and sixteen percent in the editorial board panel. Considering these objective numbers, the recommenda-

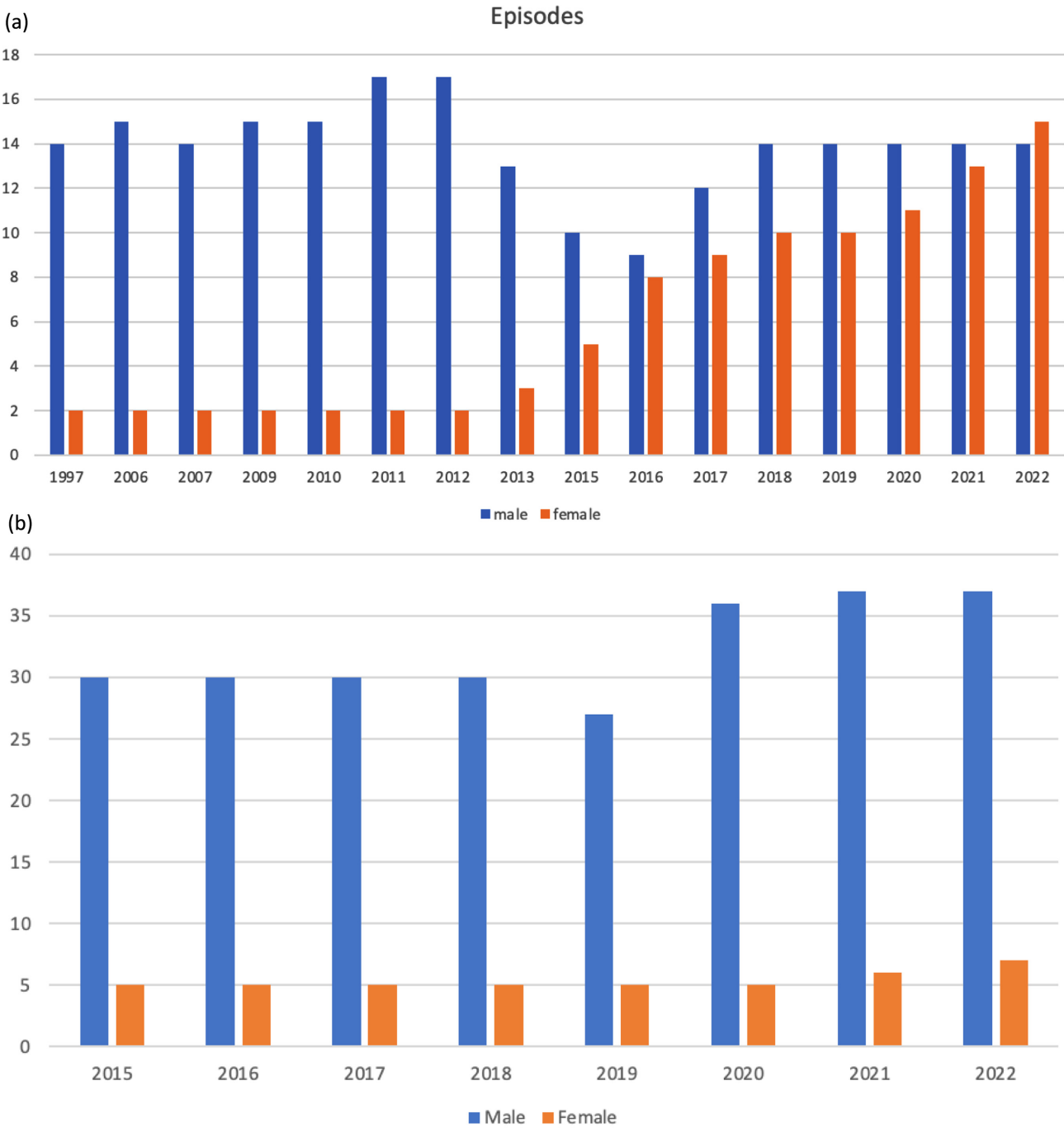


Figure 4. (a) Evolution of the gender composition in the editorial board of Episodes. (b) Evolution of the gender diversity (no diversity) in the editorial board of Journal of Building Engineering. (c) Evolution of the gender diversity (no diversity) in the editorial board of the journal Geology. (d) Evolution of the gender diversity (no diversity) in the editorial board of the journal Construction and Building Materials.

tion is to control the equilibrium of gender at all levels including authors, reviewers, as well as the composition and structure of the editorial boards.

Another interesting exercise would be to study the diversity related to geography, considering that many researchers at any of the editorial structure levels, are ascribed to more than one organization. The correlation between geographical areas and the involvement of female researchers in scientific journals editorials can shed further light on the discussion. Some societies implement a traditional policy on the

participation of women in all activities, making their numbers negligible compared to their male counterparts. We are leaving behind an important sector of scientist.

It has been observed that female researchers from some countries in Asia rarely involve themselves in publications, let alone in the role of reviewers and/or editorial tasks (see description for China Geology above). When checking the institutional pages for some of the editorial members of the studied journals, the author of this paper noticed the presence of female researchers with similar expertise that could

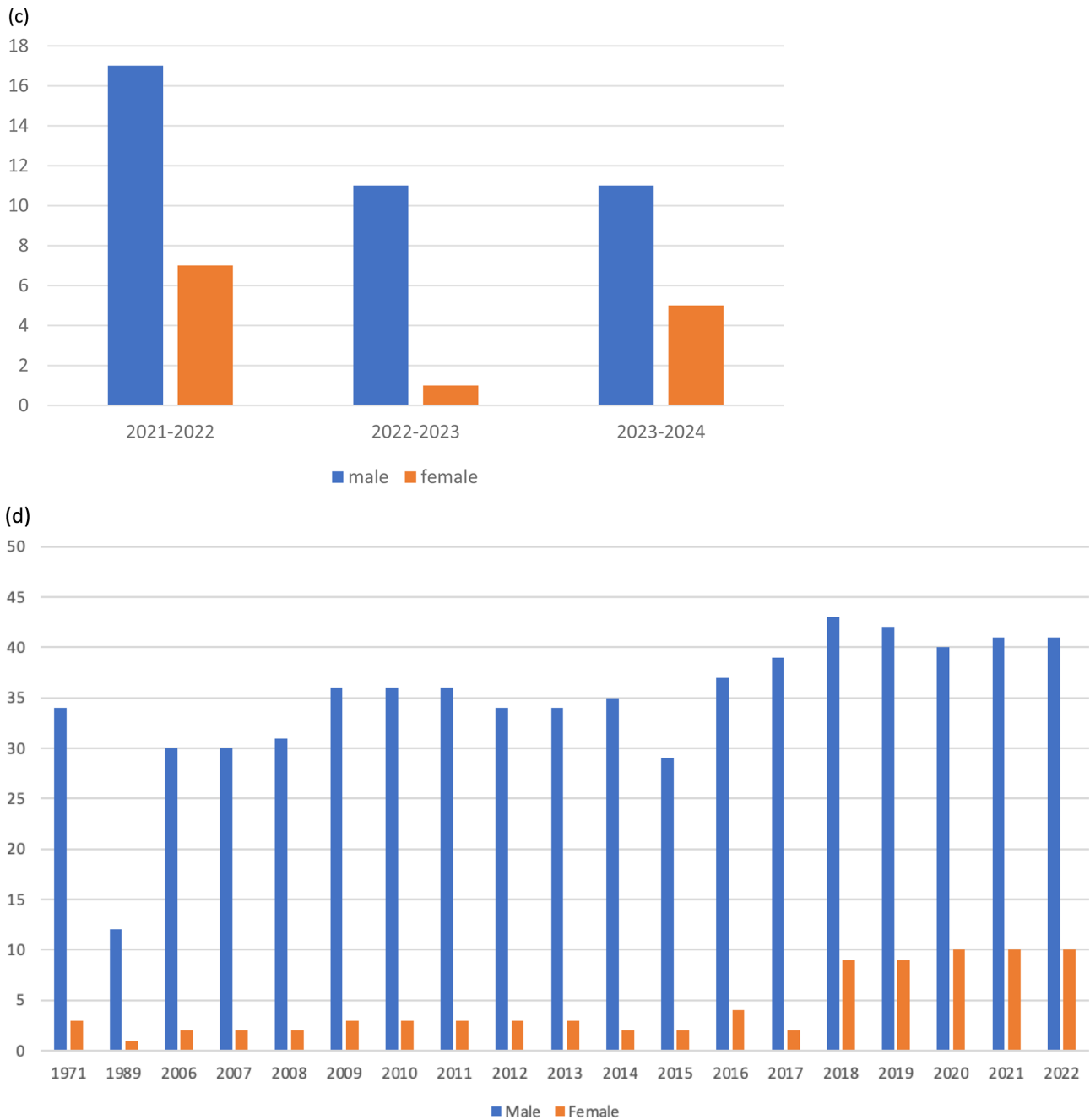


Figure 4. (continued)

enrich the lists of board members.

Researchers from Africa and South America, both male and female, are scarcely represented in the editorial structure of many journals, including the studied here. This was observed and published in Morton and Sonnad (2007) and the author of this paper has only found two researchers from Brazil in the list of editorial board members of *Applied Sciences*, two researchers from Argentina in the list of the editorial board of *Episodes*, only one researcher from Brazil in the first years of publication of *JOBE* (none at present), and none in the list of *China Geology*, as all the members of the board are from China. Situation in ultra-orthodox countries is even worse. Previous publications have demonstrated that open-access journals tend to have less gender diversity on editorial boards, but these are more international

(Altman and Cohen, 2021). The increasing number of journals that are described as “predators” (Oviedo-García, 2021 and references therein) inevitably will need an increase in reviewers and editorial board members to keep their reported average time from reception to the first decision. Many authors, mainly young researchers, are pressed by their institutions to publish as much as possible, preferably in JCR open-accessed journals. MDPI journals, including *Applied Sciences*, can become a perfect niche for these researchers, which should increase the number of female reviewers and female editorial board members, but this is not happening. Beall (2012) described some features of this kind of journals and one of them was the lack of gender and geography diversity, which agrees also with the observations of the author for this paper. Also, some academic institutions have started to filter the scien-

tific production published in the so-called “predatory” journals when evaluating researchers for their professional promotion (McQuarrie et al., 2020). Therefore, even in the case these journals increase gender diversity in their boards, it may happen that this action would not help to promote leadership in STEM female researchers in the medium-long run, which should be closely observed. Beall (2012) coined the term “predatory journals” to cover publications that charge fees to scientists to publish open access, but that do not offer quality standard publishing services such as peer review processes or transparent information on indexing and impact factors. This author updates a list of journals he thinks that act as predatory, but controversies have been opened when dealing with other journals from other editorials, like those of *Frontiers* (Bloudoff-Indelicato, 2015). The fact is that *Applied Science* and other MDPI journals do apply a strict peer review on the submitted articles and the information on the impact factor is registered and updated at Clarivate, where all important scientific journals are listed and indexed. Because this issue is of most importance when dealing with improving gender diversity in the applied science, the author of this paper advises to keep a close look to the issue.

Conclusions

Gender equality is Goal 5 in the list of the United Nations’ sustainable development goals to transform our world. It is imperative to implement gender equality in all aspects of our life, particularly our scientific life, towards a balanced influence in society. Gender is transversal to all subjects, including the Geosciences, and gender diversity is essential to get a more ethical balance in the application of science and technology. This paper demonstrates that a probably unconscious gender discrimination exists in the editorial board of the Geosciences journals that have been analyzed as representation of Earth Science publications. The Geosciences community should reflect on this diversity deficit, its consequences within the discipline and its impacts on people from underrepresented groups, including female researchers, but also other minorities defined by attributes such as race and ethnicity, sexual identity, disability and socioeconomic status (Mogk, 2020). It is certainly an important task dealing with Geoethics as well.

The editorials of most studied journals in this work do not accomplish this important mandate and it is necessary to send an alert on this anomaly. From the figures included in this paper, it is possible to see an attempt of amendment in some journals, going from almost 10% of females in the composition of the editorial boards at the beginning of the publication activity to almost 20% at present. Witze (2016) wonders how is it possible that Elsevier’s Earth and planetary science journals, that publish over 30% of papers written by women has only 13% of female researchers in the editorial board. At present, this number has changed: in the website of the journal it is announced that 22% of the editorial board is made of female researchers and 78% by male. In six years, the number has increased by almost ten points. This means that awareness is a useful and effective tool if taken seriously.

Episodes maintained the same lack of gender diversity in its editorial board for fifteen years. Only when female researchers became members of the IUGS Publications Committee (i.e., 2013) the situation started to change. While authors of published studies concluded that there was no gender difference in the proportion of invitees to review sub-

mitted articles, in general, women were less likely to accept invitations to serve on journal editorial boards than men (Fox et al., 2019). For this reason, it is very important to implement mentoring and positive actions that trigger the change of the scene, demonstrating the wide scientific community that the journal productivity does not change when including female researchers at the decision level, but in fact can be improved, as in any other kind of activity (Altman and Cohen, 2021). In fact, female mentoring throughout the research, publication of the research and outreach activities should be an important part of geoethics, as described by Mogk (2021).

Hence, the author of this paper, in conjunction with the experience and analysis of the presented data, concludes that unequal gender composition in editorial boards of Geoscience journals, using six major publications as research material, is still a fact. And therefore, recommends the following:

1) To publish information about the composition of the editorial structure in a gender disaggregated way to easily monitor its progress. As an example of good practices, Elsevier and some journals of the Geological Society of London include full information on its members on their website, which facilitates this task. This is an improvement, but more actions should be implemented, because it seems that the implementation has not been fully successful.

2) To implement positive discrimination if a positive action does not work satisfactorily, when trying to fill positions on the editorial board, to increase the number of the sex that is disproportionate (more likely females)

3) To encourage editors to reflect upon this situation when appointing editorial team members and approaching reviewers. A good practice would be to monitor the journal award committees to ensure that male and female researchers are equally represented.

4) Disaggregate the lists of reviewers for internal use for the editorial office and advise editors and guest editors to try to balance the reviewing invitations with respect to gender. This could easily be done by incorporating a filter in the reviewer’s panel of the journals, warning editors and guest editors when a clear unbalance is detected. Another good practice could be to include the gender of the reviewers with evidence on the male/female ratios as extra information for the reader. Also, to help in increasing the pool of female reviewers for other geoscientific journals. Always with the consent of the researchers. Reviewers can help at some point to increase the female number of the editorial board members.

5) To draw on experiences of publishing houses that applied positive actions, creating a community of practice for gender equality, following the collaborative approaches described by Thomson et al. (2022).

Clearly, it is easier to monitor the composition of the editorial structure of a smaller journal such as *Episodes* than a larger one like *Applied Sciences*. But gradually, these actions will increase awareness of the unjustified gender imbalance and could serve as a good practice to implement in publications that serve as models for researchers in Geoscience. Men may have traditionally had the upper hand at the time of being published and thus more cited than women, which could be due to a number of factors such as lack of awareness regarding the value of gender equity; an overwhelming masculine presence on editorial boards and as manuscript reviewers; and an overall weak network of female scientists. Nonetheless, changing habits will change the panorama, reflecting the diversity in science.

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