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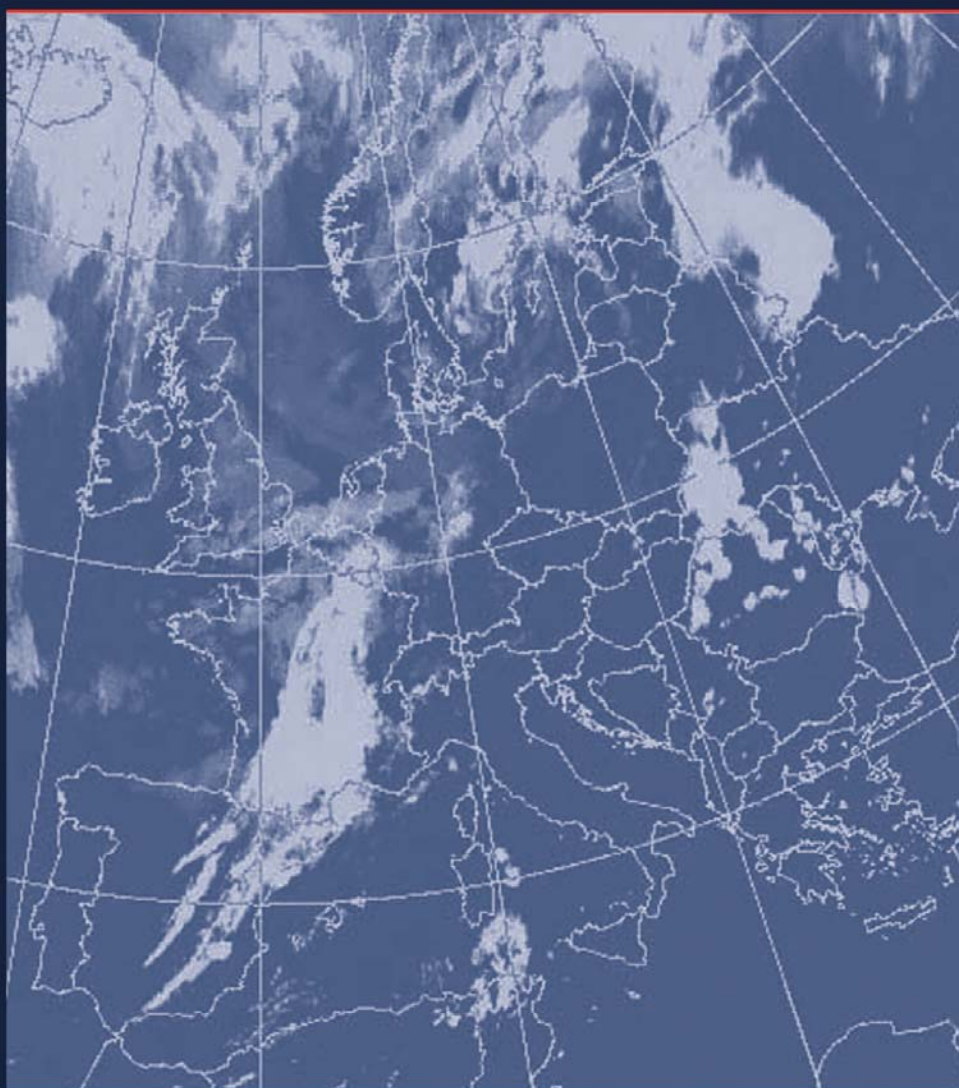

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Publishing in Academia: Digital Challenges

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Introduction to Publishing in Academia: Digital Challenges

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This *European Review* supplement is based on a conference on the topic 'Publishing in Academia: Digital Challenges' held at the Wenner-Gren Center in Stockholm on 10–12 May 2023 with the economic support of the Wenner-Gren Foundations. The conference was part of a series arranged by the HERCulES group within Academia Europaea. Since its formal establishment in 2004, the group – with the full name of Higher Education, Research and CULture in European Society – has organized the following symposia addressing issues in relation to higher education and research:

2005: *The Formative Years of Scholars* (Stockholm with the Wenner-Gren Foundations).
2006: *Quality Assessment in Institutions of Higher Education in Europe: Problems, Practices and Solutions* (Pavia with Compagnia di San Paolo).
2007: *The University in the Market* (Stockholm with the Wenner-Gren Foundations).
2009: *From Information to Knowledge, from Knowledge to Wisdom. Challenges Facing Higher Education in the Digital Age* (Stockholm the Wenner-Gren Foundations).
2009: *Diversification of Higher Education and the Academic Profession* (Turin with the Compagnia di San Paolo and Accademia Nazionale dei Lincei).
2011: *Trust in Universities* (Stockholm with the Wenner-Gren Foundations).
2013: *Migration and Mobility in Science. Impacts on Cultures and the Profession in Institutions of Higher Education in Europe* (Rome with Compagnia di San Paolo).
2013: *Bibliometrics. Use and Abuse in the Review of Research Performance* (Stockholm with the Wenner-Gren Foundations).
2014: *Humanities and Social Sciences, Globalization and China* (Beijing with the support of the Bank of Sweden Tercentenary Foundation).
2015: *From Books to MOOCs? Emerging Models of Learning and Teaching in Higher Education* (Stockholm with the Wenner-Gren Foundations).
2016: *University Governance. Impeding or Facilitating Creativity* (Hannover with Volkswagen Stiftung).
2017: *Crossing over to the Future. Interdisciplinarity in Research and Higher Education* (Stockholm with the Wenner-Gren Foundations).

2019 (May): *Mind the Gap – Bridging Secondary and Higher Education* (Stockholm with the Wenner-Gren Foundations).
2019 (November): *Missions of Universities over Time: Global Actors, National Champions, or Local Power Houses?* (Stockholm at the Royal Swedish Academy of Letters, History and Antiquities with the support of the Bank of Sweden Tercentenary Foundation).
2022: *The Internationalization of Higher Education Institutions* (Uppsala with the support of the Åke Wiberg Foundation).

Contributions to this Supplement

After the first article, which provides my analysis of academic publishing in modern society, eight papers follow that illustrate various aspects of the system for academic publishing. Five of these refer to the European context, while three give evidence from non-European countries. In the first group, those by Astrid Söderbergh Widding and by Åse Gornitzka and Bjørn Stensaker provide experiences of Academic Leaders. After that follow three contributions, by Christine Musselin, Charlotte Wien and Pil Maria Saugmann on the experiences of Faculty Members. Finally, this supplement concludes with the three papers by Osman Aldirdiri, Chengzhou He and Abel L. Packer reporting from non-European countries.

Academic Leaders and Publishing

In the first of the contributions by Academic Leaders, Astrid Söderbergh Widding, President of Stockholm University, deals with the way universities handle open access. Her article refers to Sweden, a country where the ambition was to reach 100% open access by 2021, and where, in 2023, about 82% of publications are open access. The latter is a result of governments of different colours pushing for the adoption of open-access publishing but also tough negotiations between university representatives and publishers. For this, a consortium, founded as early as 1996, has been very important. It has, in particular, made strong efforts to avoid double-dipping – the phenomenon of publishers charging both for publishing and for reading. In this way, there has been a certain transition from subscription deals to payments just for publishing. However, Söderbergh Widding shows that publishers continue to have a strong position vis-à-vis academia because of their possession of high-ranked journals that lend researchers academic prestige. For the Swedish consortium, like its counterparts in other countries, it is therefore an important task to challenge the publishers in order to cut costs further. In so doing, the movement towards article processing charges only is the goal. In order to achieve this, Söderbergh Widding points to the importance of Academic Leaders working together in the negotiations. She also reports that there are voices in Sweden that argue that universities should not renew their deals with Publishers when they terminate. Instead, these representatives of the research community suggest that universities should develop platforms of their own for publishing.

In the second paper providing perspectives from Academic Leaders, Åse Gornitzka and Bjørn Stensaker, Pro-Rector and Vice-Rector, respectively, of the University of Oslo, report on their experiences. They discuss the implementation of Plan S, i.e., the principle that all publicly funded research should be published Open Access. In analysing this development, they point out that European policymaking in the knowledge area is complex, driven on different levels by a large number of actors handling several different issues. Empirically, they first offer evidence regarding the Norwegian research system, which since 2006 has been rewarding academic institutions economically for the publication performance of their Faculty Members at the same time as the Ministry requires Open Access publishing. This has had effects on the costs for academic publishing but also on the output of Norwegian researchers as well as their citations. It has also affected promotion practices and Open Access publishing. As part of the top administration at the University of Oslo, the two authors have handled these changes on the institutional level. While they found the principle of Open Access publishing logically justified, they have faced considerable resistance. It was obvious for them that the requirement of Open Access publishing was in conflict with another fundamental principle in academia, namely academic freedom in the sense that the researchers should be able to publish their results in publications of their choice. In other words, as university leaders, they are, on one hand, expected to protect the academic freedom of the faculty members of the university. On the other hand, they experience pressure to follow the rules of Plan S. This in turn has had significant economic implications due to increasing charges from publishers.

Faculty Members and Publishing

Christine Musselin, in her article, provides two perspectives on publishing. First, she discusses the idea of strategies in publishing. As a researcher with long experience, she points out that in the earlier days of her career such strategies were absent. Over time, she has found it appropriate to pay more attention to where her research results are published. In so doing, she chose not to completely abandon her earlier publication channels but instead adopt what she labels as 'a balanced strategy'. This means that she has continued to publish in French, but also to publish in English. In addition, it has implied a combination of publication outlets, i.e., books, papers in journals, and edited volumes as well as Open Access. She feels this diversified strategy is under threat in view of the increasing focus on publications in high-impact journals. Musselin's account of her own development is a good demonstration of the transition of publishing conditions for researchers in a non-English speaking country.

The second part of Musselin's article, based on her experiences as editor of two journals, is another demonstration of the transition of publishing towards an English-dominated world. It is very clear from her article how the power of publishers has increased. A significant factor behind this has been the development of information technology that provides advantages for publishers through their platforms and their ability to turn to digital publishing. Musselin also points to the increasing commercialization of the industry, with cost cuts and strong marketing

efforts to sell journals in bunches. At the same time, academics play a significant role as editors and reviewers. Thereby, Musselin underlines, it is important to develop collegial decisions both within journals and in relations to reviewers.

The peer-review system is also the focus of the article by Charlotte Wien. She starts by discussing this selection mechanism as an act of communication. In a subsequent section, she demonstrates – based on the existing literature – the costs of the peer-review system. From this account, it is clear that many working hours are devoted to reviewing manuscripts. In the current competitive academic world, many researchers, particularly those who are early in their careers, are hesitant to allocate time for peer reviewing. As a result, there are increasing difficulties for editors to find qualified and willing reviewers. Charlotte Wien thus concludes that there is a gap between the demand and the supply of quality peer review. Another problem that she addresses is the bias that those who accept review assignments may have. In view of the problems she has addressed – costs, recruitment difficulties and bias – in the latter part of the article she discusses possible improvements in peer review procedures. One possibility would be to move from double-blind peer review towards open peer review. After such a change, according to studies, reviews become less negative and less subjective. However, at the same time, the willingness to review appears to decline. An opportunity would then be artificial intelligence as an instrument, although it still has to be developed and – since such systems are based on earlier human behaviour – it will tend to have the same biases as the ordinary reviews.

In the third account from a faculty member, Pil Maria Saugmann discusses publishing with a focus on an Early Career Researcher (ECR). In so doing, she starts by elaborating on the purpose of academic publishing, i.e., 'to facilitate the dissemination of new knowledge and research findings to the research community and even beyond'. Therefore, she commends open access as a principle that makes research results and data available. She also points to the role of publishing as a significant part of research assessment, and to the tendencies to use bibliometric data for this purpose. In addition, her paper offers a discussion regarding the use of artificial intelligence in research. However, her focus is particularly on the precarious working conditions of ECRs. She thereby points to the frequent use of short-term contracts. For young scholars, this implies difficulties in being included in the general social and economic community, which in a number of cases forces ECRs to leave academia. Saugmann reports that ECRs generally see advantages with open access and open science. However, she also points to the fears of ECRs that research assessments will not consider open science practices. Therefore, in concluding her article, she suggests reforms of the research assessment system. In addition, she asks for more in-depth training of ECRs in open science and the strengthening of academic freedom.

Non-European Experiences

The articles from non-European countries demonstrate other problems than those of the European countries. In particular, the paper by Osman Aldirdiri points to the fact that,

although European scholars experience a number of problems in relation to academic publishing, they are in a favourable position in relation to their counterparts in developing countries. This is evident from Aldirdiri's account of the opportunities for academic publishing among African scholars. He reports that, as on other continents, there are many advocates for the need to strengthen research and academic publishing, but at the same time a number of challenges on the way to achieving this. A basic problem is that African research suffers from limited funding. This is already hampering the research itself. Obviously, it is also a serious problem in relation to the access to international publications, as well as the increasing publication costs. In addition, African scholars face poor infrastructure, particularly internet connectivity, which is a fundamental problem in a world where digital communication and publishing have become so important. The limited resources and the poor infrastructure have in turn resulted in low research output. An important reason for that is language barriers on a continent with more than 1500 different languages. This language diversity, Aldirdiri points out, also contributes to difficulties in pursuing quality assurance and peer review, a circumstance that tends to lead to predatory practices. In addition, copyright and intellectual property laws in scholarly publishing appear underdeveloped in most African countries. Likewise, African scholars and institutions largely lack the resources to maintain proper data management systems. More generally, they suffer from a lack of policies and regulations.

The Chinese situation, on the other hand, examined by Chengzhou He, is at the same time both similar and different from the European one. Thus, both in Europe and China researchers face strong counterparts. However, while the Europeans are facing strong commercial publishers, their Chinese colleagues have to deal with a Chinese journal national database giant, called CNKI (Chinese National Knowledge Infrastructure). This database, with a monopolist position, has met criticism both for charging high subscription fees and infringing intellectual property rights. The latter is of particular concern for Chinese scholars, who at a time when they become more dependent on digital publishing face difficulties in protecting their academic autonomy as well as their intellectual copyright. In addition, He points out that the strong market power of CNKI has hurt domestic academic justice. It has been deleterious for the development of Chinese academic journals as well as the international transmission of Chinese scholarship. In view of the negative features of the CNKI, at the end of the article the author discusses possible alternatives at a time of digital opportunities in order to develop a new academic ecosystem locally as well as globally. He points to the dependence, in the future of Chinese scholarship, on both the progress of Chinese journals and databases as well as the international academic journals in a world shifting to open access and publication fees. He envisages both cooperation and competition between Chinese and international databases, as Chinese scholars increase their publishing in international academic journals.

In the final article on non-European experiences, Abel L. Packer reports on the open-science programme SciELO Brazil collection. It has been in operation for 25 years and, as of 2023, has brought together more than 320 open-access journals from different disciplines and thematic areas, with a cumulative repository of 490,000

documents. In order to overcome the phenomenon 'lost science in the third world', it has raised the minimum indexing criteria regarding the share of articles in English or Spanish. As a result, since 2016 more than 50% of all journals in the collection have been published in English. This is particularly the case in Life Sciences and Physical Sciences, while Social Sciences and Humanities exhibit a lower figure, 40%. At the same time, the number of accesses per document for all disciplinary areas is higher for publications in Portuguese than for those in English. The article therefore demonstrates the importance of platforms such as SciELO Brazil for multilingualism by facilitating opportunities for diffusion of research results in languages other than English. Nevertheless, it is clear that publications in English have a higher chance of being cited, which is manifested by a high correlation between the share of publications in English and citations.

Acknowledgements

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About the Author

Lars Engwall is professor emeritus of Management at Uppsala University, Sweden. His research has been particularly directed towards organization studies. Among his publications in the last decade can be mentioned *Bibliometrics* (2014, ed. with Wim Blockmans and Denis Weaire, Portland Press), *From Books to MOOCs?* (2016, ed. with Erik De Corte and Ulrich Teichler, Portland Press), *Defining Management* (2016, with Matthias Kipping and Behlül Üsdiken, Routledge), *Corporate Governance in Action* (ed. 2018, Routledge), *Missions of Universities* (ed. 2020, Springer), *Internationalization in Higher Education and Research* (ed. 2024, Springer). He has received honorary degrees from Åbo Akademi University and Stockholm School of Economics, and he is an elected member of a number of learned societies.

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Academic Publishing in Modern Society

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This article analyses academic publishing in modern society by means of a governance model focusing on three groups of governors: Regulators, Market Actors, and Professions. It demonstrates how these three groups have interacted and how this interaction has put pressure on faculty members to produce publications for top journals. It also points to the strong position of publishers, which leads to high profit margins. The article therefore also discusses different possible measures to change the publishing system.

The Context of Academic Publishing

Since the Second World War, academic publishing has undergone considerable changes. The academic community has grown in the past, and the number of researchers is still growing considerably. For instance, in the United States, the number of PhD degrees awarded in the early 1960s was around 10,000, a figure that had grown to about 40,000 by the early 1990s (Snyder 1993: 87). Thirty years later, in 2020, the number was around 55,000 (Flaherty 2021). Similar developments have occurred in other countries all over the globe with a rising number of researchers in an increasing number of academic institutions with more and more students (see, for example, Meyer *et al.* 1977).

Another aspect of the growth of the academic system is an increasing demand for channels for the diffusion of research results. The Observatory of International Research (OOIR) reports that the three top publishers each publish more than 2,000 scholarly journals: Springer 3,692, Taylor & Francis 2,909, and Elsevier 2,467, respectively, i.e., together more than 9,000 titles! After these three publishers at the top, three others follow with more than 1,000 titles: Wiley 1,646, SAGE 1,310 and

De Gruyter 1,100. In addition to these six, the organization lists as many 127 publishers that handle more than ten publications each (OOIR 2023).

Against this backdrop, this article will provide an analysis of the system for academic publishing by means of a governance framework. The reason for this approach is the central role that publishing has come to play in the modern academic world. It has become a major force in the governance of academic institutions and their members. Three actor groups are significant in this context: *Regulators*, *Market Actors* and *Professions*. The following section presents their general roles in governance, while a subsequent section discusses the interaction between them in relation to publishing. After that follows a concluding discussion regarding the future.

A Framework for Analysing Academic Publishing

In relation to the governance of academia, Clark (1983) pointed out 40 years ago that, in principle, three basic actors govern university systems: States, Markets, and Academic Oligarchies. As can be seen in Figure 1, he labelled the USSR system as state-dominated, the US system as market-dominated, and the Italian as governed by the academic oligarchy. Other countries he classified as having systems with mixed governance. He considered Sweden and France to have a mix of state governance and the influence of the academic oligarchy, while Canada, Japan, and the United Kingdom, in his view, had more of a mix between market governance and the influence of the academic oligarchy.

Clark's framework focuses on the governance of national systems of higher-education institutions. However, a similar approach is useful for the analysis of the governance of individual academic institutions and their actors. Here, a framework regarding the general governance of institutions (Engwall 2018) is relevant (Figure 2). Using this model, instead of the State, it is appropriate to look at *Regulators*, since regulation in current society is

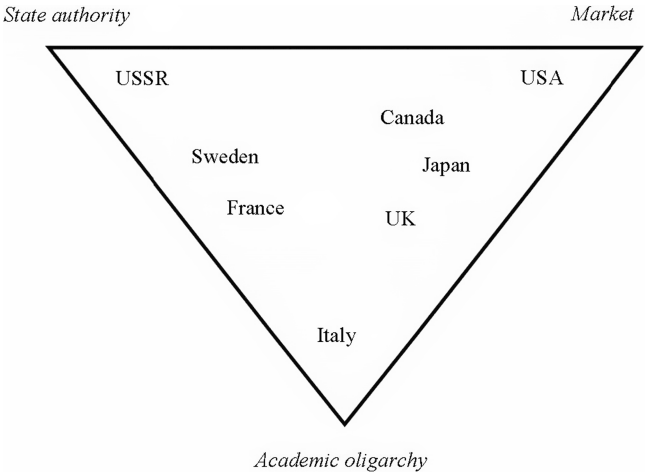

Figure 1. University governance (modified from Clark 1983: 143).

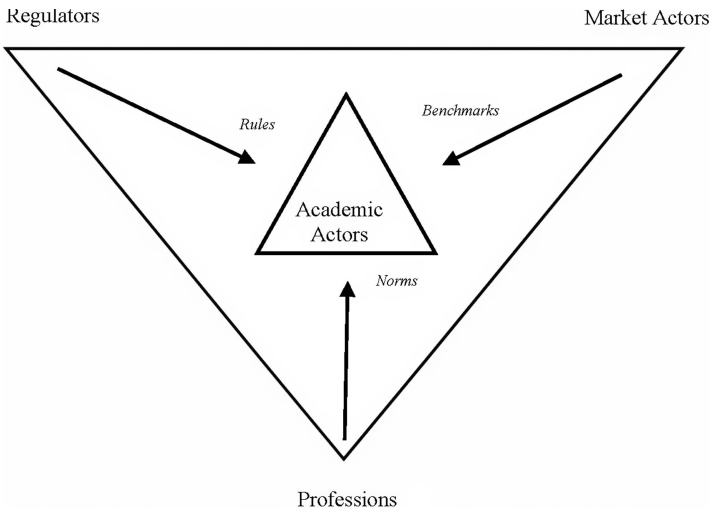

Figure 2. A model for analysing academic publishing.

coming from actors at different levels: international, national, and local. Similarly, it is relevant to focus on *Market Actors* rather than just the market since there are many market actors that influence institutions. Finally, *Professions* appears to be the proper label for the academic community at large with its wide range of disciplines from the hard sciences at one end, many other disciplines in between, and the humanities at the other end. As shown in Figure 2, Regulators, Market Actors, and Professions influence Academic Actors (Academic Leaders as well as Faculty Members) through various signals. Regulators provide *rules* for Academic Actors, while Market Actors signal by means of *benchmarks*. Professions, finally, play a significant role by providing Academic Actors *norms* of proper academic behaviour.

In the following, this last model will be used for an analysis of academic publishing, particularly in a European context (for accounts from other continents, see the contributions by Aldirdiri, He and Packer in this issue).

Governance by Professions

Looking at Professions, we can identify that they have a direct influence on Academic Actors, i.e., Academic Leaders and Faculty Members. It is also possible to recognize influences on Market Actors.

Professions and Academic Actors

Members of a large, and increasing, number of disciplines constitute the Professions. However, among them there are variations. As demonstrated by Whitley (1984), academic disciplines differ in terms of (1) task uncertainty and (2) dependence between researchers. In disciplines with low task uncertainty, scholars agree on

which problems to solve and how to handle them, and in disciplines where the dependence between researchers is high, they are closely connected. As a result, low task uncertainty and high dependence between researchers will result in a high integration of the field. Such disciplines are labelled by Whitley (1984) 'conceptually integrated bureaucracies'. His example of such a discipline is physics.

Disciplines at the other end of the scale in terms of integration, with high task uncertainty and low dependence between researchers, he labels 'fragmented adhocracies' and exemplifies them with social science disciplines. It is obvious that the disciplines with high integration, i.e., the hard sciences, have become the norm for the rest. In terms of publishing, it means that researchers in the social sciences and the humanities have followed their counterparts in the natural sciences and turned from monographs towards journal articles as the important means of communication. An increasing organizing of disciplines has reinforced this development. As shown in Engwall and Hedmo (2016), the founding of many journals is the result of efforts to gather scholars with similar interests in professional associations. Many of these journals have been the result of the resistance that academic entrepreneurs have met in their various countries. However, as they have looked out internationally, they have found colleagues with the same ideas abroad. This in turn has led to informal networks, which over time have become more and more formalized. Often, this process has led to the launching of journals. Since these journals are international, their language has become English, the present-day *lingua franca*.

Again, the hard sciences, where the universality of the study object and the formalization of the presentation are high, provide the general role model (see Figure 3, upper right). This creates problems for disciplines at the other end of the scales (see Figure 3, lower left), i.e., the humanities and the social sciences. As a result, there are efforts in these fields to play down the context and increase the formalization in order to be published. In this way, the pressure to publish has effects on research. An example is economics, where researchers tend to leave aside national policy problems and increasingly work with general problems in a formalized way (Forslund and Henrekson 2022).

The gist of the above arguments is that the academic Professions in a wide sense have developed a culture that favours journal publications in English over monographs in domestic languages. The creation of a large number of specialized journals has reinforced this trend. Obviously, this development has implications for Academic Actors, be they Academic Leaders or Faculty Members. As will be discussed below, it also has effects on the prestige of the different journals.

Professions and Market Actors

Publishing requires resources and competences. Early out in academic publishing were a number of university presses, with Cambridge University Press and Oxford University Press as the frontrunners in the sixteenth century (Sutcliffe 1978), followed by other university presses from the late nineteenth century and onwards (Jagodzinski 2008). Before and during the nineteenth century a number of other

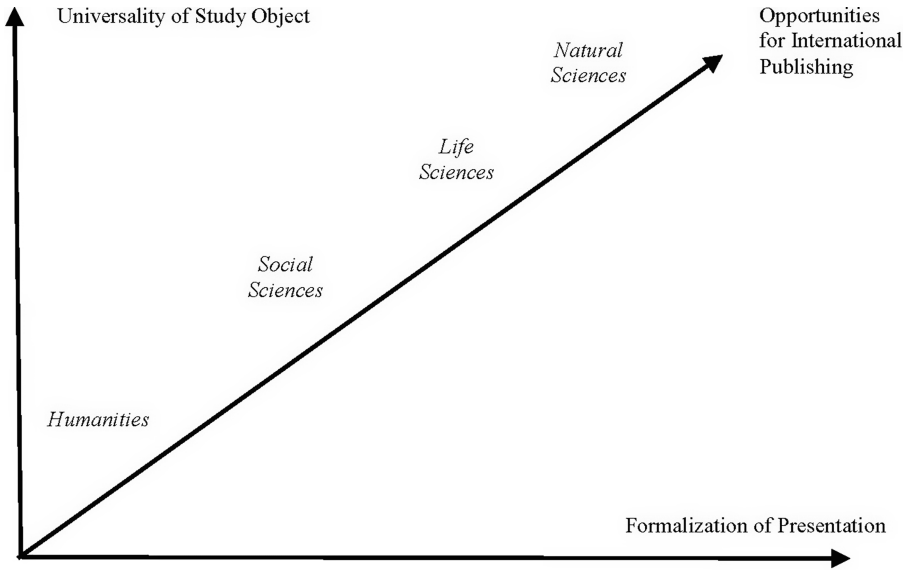

Figure 3. Opportunities for international publishing in different disciplines (modified from Engwall 2022).

publishers also ventured into the market: Longman (1724), Wiley (1807), Harper (1817), Collins (1819), Hachette (1826), Springer (1842), Macmillan (1843), Routledge (1851), Blackwell (1879), Elsevier (1880), and McGraw-Hill (1889) (see further Engwall *et al*. 2016, Chapter 6).

Originally, these publishers were focusing on the publication of books. However, over time some of them became significant publishers of academic journals. Among their titles today, there are, as already mentioned, a number of journals started by professional associations. As technology developed, with digital platforms, and due to the growth of submitted manuscripts, quite a few of these associations chose to hand over their journals to commercial publishers.

In parallel to this transfer of journals to commercial publishers, the publishing industry has undergone a considerable restructuring through a number of mergers and acquisitions. In terms of the publication of scholarly journals, this has become concentrated in the hands of a few actors. At the same time, the demand for academic publishing has grown considerably (cf. above). In this way, publishers as Market Actors have enjoyed considerable revenues. The *Economist* (2013) thus reported that Elsevier in 2012 had a profit margin of 38%. However, as early as a decade earlier the dominant publishers such as Elsevier had met a new challenge. In 2001, representatives of Professions, at a meeting in Budapest, took an initiative towards Open Access (BOAI 2023). It led to a declaration, which in November 2023 had 1,633 signatures from organizations and 7,042 signatures from individuals. This document defines Open Access as the

> free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited.

It concludes with the following statement:

> We invite governments, universities, libraries, journal editors, publishers, foundations, learned societies, professional associations, and individual scholars who share our vision to join us in the task of removing the barriers to open access and building a future in which research and education in every part of the world are that much more free to flourish.

As will become evident below, governments and the academic community were more positive towards the invitation than were publishers, who wanted to protect their income streams.

In 2003, BOAI was followed up by two initiatives: the Bethesda Statement on Open Access Publishing in the United States (Bethesda Statement 2023) and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (Berlin Declaration 2023) in Europe. Both were initiated by representatives of Professions. Recently, they have even argued that open networks under the governance of the scholarly community should replace academic journals (Brembs *et al*. 2023). However, a full decade earlier Regulators adopted the principle of Open Access (see further below).

Therefore, briefly, as shown in Figure 4, Professions provide the norms for Academic Actors. In addition, they have developed a relationship with Market Actors through (1) the transfer of professional journals to commercial publishers and (2) more recently challenged the commercial publishers by demanding Open Access.

Governance by Market Actors

Among Market Actors, there are two particularly significant groups: Publishers and Assessment Organizations. The first group provides the opportunities to publish scientific research, while the second takes advantage of data generated from the publishing industry and stimulates the publishing race. In this way, the two groups of market actors live in symbiosis.

Publishers

The most significant interaction between Market Actors and Academic Actors in terms of publishing is that between individual researchers and Publishers. In fact, the

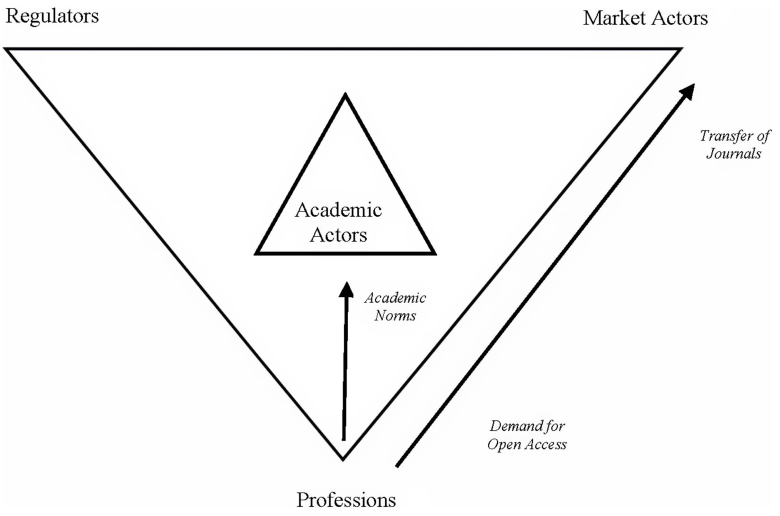

Figure 4. Professions versus Academic Actors and Market Actors.

entire publishing industry depends on the Academic Actors supplying manuscripts. As the academic community has grown considerably since the mid-1950s and researchers are increasingly eager to publish their findings – largely for career reasons – the inflow of manuscripts is massive. A basic issue in that context concerns the principles of payment. Even earlier, some journals charged submission fees. However, with the advent of electronic publications, Article Processing Charges (APCs) have become widely used for Gold Open Access, i.e., for papers accessible without restrictions. A less costly alternative, Green Open Access, permits authors, normally after an embargo period, to post an earlier version of their manuscript in a repository online without paying an APC (Taylor & Francis 2023).

The introduction of APCs has put pressures on academic institutions and research funding organizations to pay these fees. However, this has not eliminated the inclination of Publishers to charge for reading. Earlier subscription models, although modified, are still there. In addition, there are instances where individual researchers have to pay for the downloading of articles. This phenomenon of publishers being able to earn money twice, labelled 'double dipping', has aroused criticism. Therefore, some publishers have responded to their critics by setting up policies. Cambridge University Press (2023), for example, states:

> We aim to price our journals fairly and transparently. In particular, our subscription prices should reflect the amount of subscription content in a journal. It is unfair to 'double dip' by charging subscribers for open access content that has received funding through an institutional open access agreement, an article processing charge (APC), the Cambridge Open Equity Initiative, sponsorship from a third party, or some other mechanism.

Likewise, Elsevier has adopted the following policy (Elsevier 2023):

> We do not 'double dip'. We can be reimbursed for an article in two ways – through an Article Publishing Charge (APC) to publish the article and make it available to read by everyone, or a subscription fee to pay for reading the article. We either charge for publishing an article or reading an article but we never charge for the same article twice. We have a strict no double-dipping policy.

Yet another alternative, without charges, is Diamond Open Access. This refers to publications to which neither authors nor readers pay. These are 'community-driven, academic-led, and academic-owned publishing initiatives' (Plan S 2023b). Furthermore, some publishers apply Bronze Open Access, which means that they publish papers on their website free to read but with restricted access (Piwowar *et al*. 2018).

Whereas the dominant publishers have a strong position in the market, a large number of entrants into the market are challenging existing market members, as new scientific fields develop and specialization increases. The development of information technology has reinforced this expansion, which has included numerous journals that have limited or no editorial screening but charge for publishing. In order to counteract these predatory journals, organizations have been created to set standards for publishing. Two such organizations are the Committee on Publication Ethics (COPE) and the Directory of Open Access Journals (DOAJ).

Founded in 1997, COPE is an association of editors of academic journals. In 2021, it had more than 12,000 members in 103 countries from all academic fields. As the name of the organization indicates, its purpose is to set standards within academic publishing. It has established ten core practices regarding issues such as allegations of misconduct, authorship and contributorship, complaints and appeals as well as conflicts of interest (COPE 2023).

DOAJ, like COPE, has formulated a best-practice code providing 'selection criteria, resources and tools for the identification of reputable open access journals'. This organization – founded in Lund, Sweden in 2003 – has indexed close to 20,000 open access journals covering all academic fields in 135 countries as of 2023 (DOAJ 2023). In this way, DOAJ, like COPE, aims at weeding out non-serious actors among journals.

Assessment Organizations

In addition to the publishers, Assessment Organizations – some of them closely related to the publishers – are significant Market Actors. They are part of the system as providers of data on individual researchers and academic institutions. Major players are the Web of Science, Scopus, and Google Scholar. Among them, the *Web of Science* is the frontrunner. It stands on the developments of the work of Eugene Garfield in the 1950s and his foundation of the company, Institute for Scientific Information (see further, Garfield 2006). In 1992, the media conglomerate Thomson

acquired the business and kept it until 2016 when it became a part of the British-American company, Clarivate Thomson ISI. For the academic community it is not only important for its provision of citations for individual scholars but also as the provider of data on the Journal Impact Factor (JIF), i.e. the yearly mean number of citations of articles published during the preceding two years. Thus, the higher the impact factor, the more prestigious the journal. Obviously, this affects the submission behaviour of researchers (see further below).

The second Assessment Organization mentioned above, *Scopus*, is run by the publisher Elsevier, which is an abstract and citation database that has been in operation since 2004. Twenty years later it now covers 'more than 25,000 active titles and 7,000 publishers [...] with millions of author profiles and 1.7 billion cited references' (Scopus 2023a). Scopus uses an alternative to the Journal Impact Factor called CiteScore. The basis for this indicator is the number of citations by a journal in a preceding four-year period to articles, reviews, conference papers, data papers as well as book chapters divided by all Scopus documents in the same period, and published in those same four years (Scopus 2023b). Scopus thus takes more publications into consideration, a circumstance that has prompted the criticism that it will favour Elsevier publications (cf. for example, Straumsheim 2016).

Another competitor to the Web of Science is *Google Scholar*, also launched in 2004, an academic database provided by the Californian multinational technology company, Google. It uses a web crawler for the selection of titles to be included and thus covers a very broad population of publications. It has been criticized for also containing predatory journals (Beall 2014). Because of its simplicity, Google Scholar has enjoyed wide use. Its attraction has been reinforced by its automatic calculation of the h-index, i.e. the h number of papers of an author that have been cited at least h times.

The data provided by the bibliometric platforms are widely used by ranking organizations (Espeland and Saunder 2007). Some of these organizations rank whole universities, while others rank programmes of professional education. Among the former, Times Higher Education (THE), World University Rankings (QS), and Shanghai Ranking (ARWU) are dominant. The first two have collaborated since 2004. However, since 2009, THE has been part of the multinational media company, Thomson Reuters (Baty 2009). Since 2014, it has been collaborating with Elsevier using its Scopus data (Hanafi and Boucherie 2018). In this way, THE, like other rankers, is closely connected to the publishing industry by using bibliometric data as well as pushing academic leaders to stress top publications among faculty members. In addition, the Assessment Organizations have an impact on Regulators, who are inclined to ask if they are getting value for money. It also happens that Regulators use bibliometric data as a parameter in resource allocation (cf., for example, Gornitzka and Stensaker in this issue).

Summing Up

Figure 5 summarizes the reasoning above. In relation to academic publishing, the basic relationship is that between Market Actors (Publishers) and Academic Actors

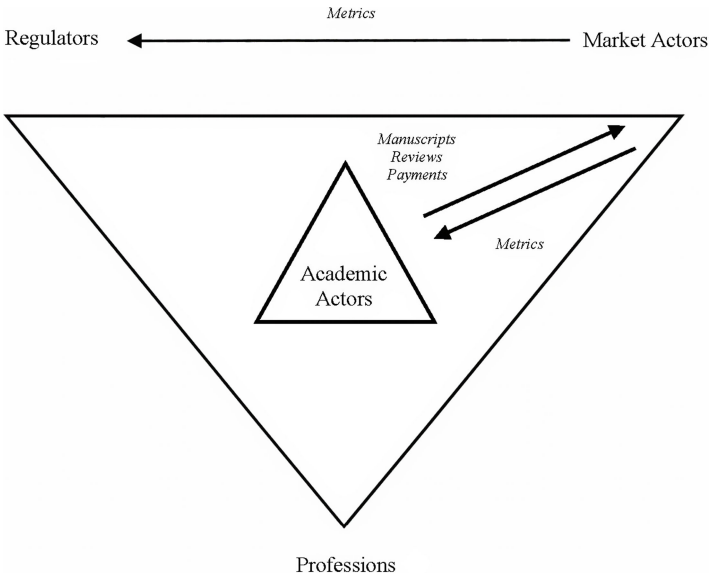

Figure 5. Market Actors versus Academic Actors and Regulators.

(Faculty Members). Researchers submit manuscripts, while publishers process these manuscripts through screening, editing – with the assistance of Academic Actors (see further below) – and, for the papers selected, publication. In relation to the latter, a significant issue concerns the payment for publishing and reading. For this, academic leaders play a significant role by facilitating the necessary resources. At the same time, Market Actors provide metrics, which academic leaders tend to take on board as a basis for strategic decisions. They have also been used by Regulators as a basis for resource allocation.

Governance by Regulators

As demonstrated in Figure 1, the role of Regulators varies across countries. However, since the early 1980s, when Clark published his book, there has been a general trend towards more market governance (Engwall and Weaire 2008). Regulators in previously strongly regulated countries have thus had an increasing tendency to delegate resource allocation to the market. Even in countries without tuition fees, academic institutions are nowadays more dependent for their income on the number and the performance of their students. Likewise, the share of project grants to individual researchers or research groups has increased at the expense of block grants. In addition, as mentioned above, bibliometric data are used in some countries by Regulators for the allocation of block grants. In this way, publishing has come to play a significant role in resource allocation. In addition, Regulators tend to launch various evaluations in order to assess the performance of the Academic Actors. In so doing, they rely on representatives of Professions, often from abroad.

The prime example here is the research evaluations in the United Kingdom, the Research Evaluation Framework (REF), and its successor, the Research Evaluation Exercise (RAE) (see, for example, Martin and Whitley 2010; Otley 2010). Similar projects followed in other countries, for example, in Italy (Rebora and Turri, 2013), and in Australia (Williams and Grant 2018).

A basic task for Regulators, in addition to providing resources, is obviously to provide the rules for Academic Actors. These rules are national through Higher Education Acts such as the British *Higher Education Act 2004* (2023), the French *Code de l'éducation* (2023), the German *Hochschulrahmengesetz* (2023) and the US *Higher Education Act of 1965* (2023). However, with time, Regulators have become increasingly international. This is particularly the case for Member States of the European Union. In terms of the regulation of publishing, the rules for Open Access have been very important. Already in 2012, the European Commission published a recommendation on access to and preservation of scientific information (European Commission 2012). Later on, in relation to the funding schemes, Horizon 2020 and Horizon Europe, the Commission required that all recipients of grants should 'make sure that any peer-reviewed journal article they publish is openly accessible, free of charge'. In order to facilitate this aspiration, the Commission has launched the platform Open Research Europe, which is 'an open access publishing venue for European Commission-funded researchers across all disciplines, with no author fees' (European Commission 2023). The ambition is also to move towards Open Science, thereby not only open access publishing but also open access to all scientific research data. (For the corresponding conditions in China, see the contribution of He in this issue.)

In the same spirit, a number of mostly European national research funding organizations got together in 2018 to form the organization cOAlition S with ten principles and the following general rule (Plan S 2003a):

> With effect from 2021, all scholarly publications on the results from research funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in Open Access Journals, on Open Access Platforms, or made immediately available through Open Access Repositories without embargo.

This means that cOAlition S members require in the first place Gold Open Access (cf. above). However, they also appear to accept Green Open Access, thereby advising authors to use what they label a Rights Retention Strategy (RRS). It means to put the phrase 'CC BY or equivalent licence is applied to the AAM arising from this submission' and to deposit the Author Accepted Manuscript (AAM) in a public repository. Obviously, they also accept Diamond Open Access (Eglen 2021).

Figure 6 summarizes the above arguments. Regulators govern Academic Actors by means of statutes and principles for resource allocation. In addition, through their funding agencies they have adopted the principle of Open Access to a considerable extent. Regulators also tend to launch evaluations of Academic Actors, thereby engaging distinguished, often foreign, representatives of Professions for this task.

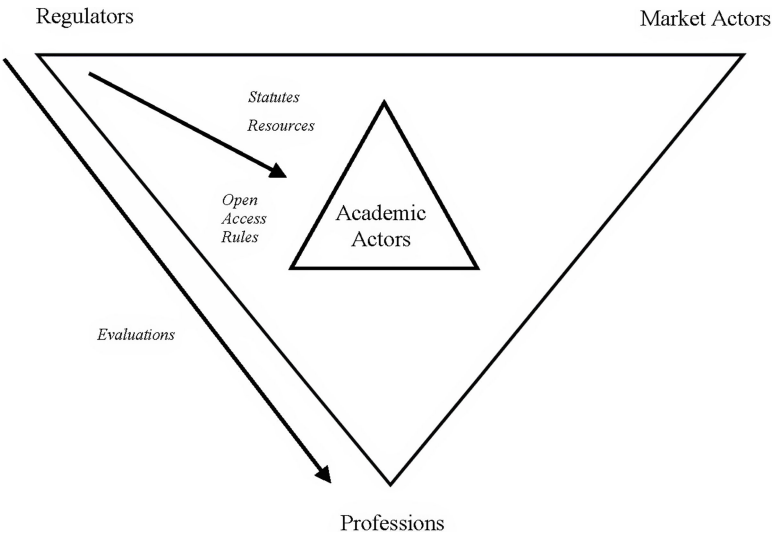

Figure 6. Regulators versus Academic Actors and Professions.

Effects for Academic Actors

As already mentioned above, Academic Actors are significant for the publishing industry. Among them, Academic Leaders tend increasingly to feel the pressure to raise the rankings of their institutions and therefore try to encourage faculty members to publish in journals with high prestige. In this way, they transfer the pressures from Professions, Market Actors, and Regulators inside their institutions. The publishing race indeed plays a role in the governance of modern academic institutions.

However, publications also have an increasing impact on the financial conditions of academic institutions. Even before the digitalization of the publishing industry, university leaders had to deal with growing costs for journal subscriptions. This was a result of the growth of the academic community with an increasing number of titles, and the considerable bargaining power of publishers. The issue then was the pricing of reading. With the advent of digitalization, the dispute between Academic Leaders and Publishers is the pricing of not only reading but also publishing. However, Academic Leaders challenge the occurrence of double dipping, i.e., that some publishers charge for both publishing and reading (cf. above). Therefore, negotiations with publishers have become a significant task for Academic Leaders. In so doing, they have increasingly come together in consortia in order to increase their bargaining power (cf. Carbone 2007 and the contribution by Söderbergh Widding in this issue).

While Academic Leaders are influenced by the publishing performance of their faculty members and must negotiate with publishers regarding pricing issues, their Faculty Members are those most dependent on publishers. They submit manuscripts, they review manuscripts, and some even provide editorial services (on the

experiences of the latter, see Musselin in this issue). In this way, they offer input to the journals as well as quality control.

In terms of manuscript submissions, rankings and bibliometric data – not least the Journal Impact Factor (JIF, see above) – play an important role. Since researchers want to go for prestige, they tend to adopt publication strategies (see further, Musselin in this issue). They seek the top journals in their field and adapt their manuscripts to what was previously published. However, since only a small fraction of the papers submitted to high-prestige journals are accepted, there will be a flow of rejected manuscripts to less prestigious journals. As they are eventually accepted by one of these, the result will be a homogenization of the journal contents in the field. For the individual researcher, the effect may be that they do not get credit for their publication, since a practice of counting only papers published in top journals has spread into many disciplines. Those doing so have thus outsourced the quality assessments to outsiders without making their own assessments. However, there are counter reactions to this development. As early as 2012, at the Annual Meeting of the American Society for Cell Biology (ASCB) in San Francisco, a group of editors and publishers developed a number of recommendations regarding the assessment of scientific work under the label DORA. Their general recommendation was the following (DORA 2023):

> Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring, promotion, or funding decisions.

Obviously, this recommendation is particularly important for early career researchers (ECR, see Saugman in this issue).

A similar, more recent, initiative is the Coalition for Advancing Research Assessment (CoARA) launched in 2022 by Science Europe, the European University Association, and the European Commission. Among its core commitments are (CoARA 2023): 'Abandon inappropriate uses in research assessment of journal- and publication-based metrics, in particular inappropriate uses of Journal Impact Factor (JIF) and h-index'. This, like the DORA initiative, is welcomed in the scientific community as important for the freedom of research. However, at the same time, there are tendencies that metrics nevertheless are informally used in assessments and in the competition for resources (Engwall *et al.* 2023).

As far as quality control through reviewing and editorial work – key activities for publishing – is concerned, the role is becoming less attractive. The reason is the strong focus on the publishing performance of scholars, while their rewards for reviewing are limited. This has led to increasing difficulties for editors in recruiting reviewers. In the words of a European editor (Engwall 2014: 101):

> Our problem was reviewers never responding [. . .] Often I had to contact 6–7 people to get 3, and too often I had to contend with 2 reviewers.

In order to handle this problem and to acknowledge undertaken reviews, the platform Publons was created in 2012. Clarivate took over as owner in 2017, and since 2022 Publons has been part of the Web of Science platform (Teixeira da Silva and

Nazarovets 2022). Obviously, this is not a silver bullet. It has therefore to be acknowledged that the review system is far from perfect. There are thus a number of examples of accepted papers that have turned out to be scientific frauds, but also rejected manuscripts that eventually have turned out to be ground-breaking (Engwall 2014). Nevertheless, the peer review system is the best we have (see, further, Wien in this issue).

Figure 7 summarizes the above arguments. At the bottom, it points to the governance of Academic Leaders and Faculty Members (the Academic Actors above) by Academic Norms from Professions. In terms of Market Actors, Metrics constitute a strong governance mechanism. At the same time, Faculty Members serve the Publishers by submitting manuscripts and providing reviews. Academic Leaders have to negotiate the Payments for publishing and reading. Regulators, in turn, govern by Statutes and Resources and more recently by Open Access Rules. All this puts pressures on Academic Actors, among whom Academic Leaders tend to transfer the pressures on their institutions to individual Faculty Members (see the arrow between Academic Leaders and Faculty Members).

Quo Vadis?

The gist of the above arguments is that Academic Actors are under strong pressure from Professions, Market Actors, and Regulators in relation to publishing. Scientific output – not just *that* papers are published but primarily *where* they are published – has thereby become a key indicator of academic performance of individuals as well as institutions. This has had two consequences: (1) a strong tendency to assess research by means of quantitative indicators, and (2) a strong position for a few strong publishers who enjoy large profits from university payments. For both, it is

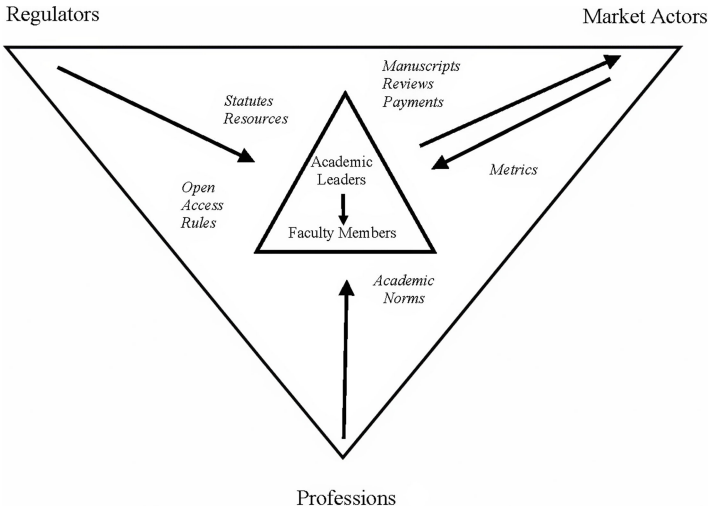

Figure 7. Effects for Academic Actors.

appropriate to ask about possible future developments. In answering this question, let us return to the governance model used above for the analysis.

Professions and the Future

Obviously, Professions have a considerable responsibility for future developments. One important step would be to change the academic norms that they communicate to Academic Actors (see Figure 4 above). In so doing, it would be important to continue along the lines of the DORA and CoARA agreements (see above) and further limit the use of journal- and publication-based metrics in assessing institutions and individual scholars. This would mean a focus on contents rather than publication channels, which in turn would be particularly important for disciplines where books are better means of communication than journal articles. It would also be beneficial for scholars who are not native English speakers, permitting them to publish in their native language. Worldwide, it is also likely to contribute to the valorization of teaching as a significant task for faculty members (see further below). In fact, although research is important for academic institutions, universities without able educators will suffer in the end.

Another step for the Professions would be to increase their control of journals. Professional associations may consider reversing the transfer of journals to the commercial publishers or at least making conditions for Publishers less advantageous in cases when contracts are up for renegotiation. Obviously, those professional associations that are considering the launch of new journals should be restrictive in handing them over to the commercial publishers. Instead, they should develop their systems of quality control and dissemination of research results by exploiting modern information technology. In so doing, Professions could be significant collaborators to Academic Leaders as they negotiate with Publishers regarding their remuneration (see further below).

Professions indeed have a special role to play in relation to quality control. This has always been so, but the task will be more and more urgent in the future with the development of artificial intelligence. As information technology develops, papers may increasingly be computer products, which means further demands on peer review systems. However, the other side of this coin is that artificial intelligence may also be helpful in revealing the origin of such papers and other kinds of fraudulent behaviour.

Market Actors and the Future

The discussion above regarding Market Actors concentrated on Publishers and Assessment Organizations. There is little hope that these two groups will step back. Instead, we could expect that they will take advantage of their positions and even make efforts to take an even firmer grip on the publishing market. Mergers and acquisitions among publishers and an increased integration between Publishers and Assessment Organizations can be expected. In this way, the resulting companies will become even stronger counterparts to Academic Actors.

However, there are also Market Actors other than Publishers and Assessment Organizations. Among them, it is important to mention those actors that want to benefit from the output of academia. One such group, already mentioned in the previous subsection, is the student body. There would be strong signals in the system if they protested against what they get from teachers who put publishing in top journals before excellent teaching. Interestingly, it appears that such voices – not least from parents – are more likely to appear in countries with tuition fees.

Yet another group that can hamper the publishing race are business organizations, which are particularly interested in research that is relevant for their economic results. They could therefore favour researchers that produce results that provide the basis for innovations and patents rather than publications in top journals.

It is also appropriate to consider the recruitment of future generations of researchers. Universities have to recruit these in the market in competition with other employers, who may be able to offer better economic conditions without any pressures to publish in top journals. For universities, in contrast, the publishing race may have negative effects on their abilities to recruit young people who could be the future top scholars.

Regulators and the Future

Obviously, Regulators are very important for the future of publishing. First, there are reasons for them to reconsider the idea that the publication records of faculty members should determine the resources to universities. This is particularly important in relation to the above-mentioned need to put more focus on the task of educating students.

Second, Regulators already today have a tendency to channel research resources towards specific problems that they find urgent to solve. There are reasons to believe that this behaviour will continue and even increase. This in turn may lead to the appreciation of other types of output than the publication in journals with high impact factors.

Third, Regulators could have views on the concentration of the publishing industry in the same way as both US and EU antitrust legislation has put restrictions on the market power of big companies. However, this may be sensitive due to the strong foundation of publishing in the idea of freedom of speech. It is clear that such measures against the publishing giants would require multinational collaboration.

Academic Actors and the Future

Among Academic Actors, Academic Leaders can play a significant role in the negotiations with publishers regarding their remuneration for their services. This was the case even earlier regarding subscription fees. However, in a world of digital publishing, this issue has become more urgent. As demonstrated in the article by Astrid Söderbergh Widding, present-day Academic Leaders need to come together in negotiating deals. In her case, it is a Swedish consortium. For the future, it would be to the advantage of the academic world if leaders from many different countries could join together and in this way put pressure on publishers. This could be a task for multinational university organizations such as the European University

Association and the International Association of Universities as well as national and multinational academies. The result could be lower fees, better finances for universities, and less spectacular profits for Publishers.

Academic Leaders could also be instrumental in a change in publishing climate by paying less attention to citations and rankings in their leadership of Faculty Members. The use of these metrics is based on the assumption that there is a global competition among universities. However, for the majority of universities worldwide – even for well-endowed US universities at the top – home markets for students are fundamental. Therefore, playing down citations in top journals and rankings may create better academic conditions for faculty members and thereby more creative research and better education. It is worth noting in this context that US law and medical schools boycotted the rankings of *U.S. News & World Report* in 2022 (Hartocollis 2023).

An additional reason to play down the use of metrics is that an increasing reliance on these figures may eventually constitute a severe threat to the influence of faculty members in hiring and promotion decisions. An extreme scenario is that such decisions in the future would no longer be collegial but instead taken by human resource departments based on the data they get from computers.

Academic Leaders can thus play an essential role in moderating the publication race. However, Faculty Members are likewise important as providers of editorial services and manuscripts. Thus, it would be reasonable to consider to what extent they should offer their services to journals that are charging outrageous payments. A boycott is likely to lead to difficulties in the production process and eventually a decline in reputation, even scandals due to the publication of fraudulent papers. Of course, this would require much more collaboration between Faculty Members at different institutions in different countries. This would be even more the case regarding the submission of manuscripts. However, a strike of Faculty Members against academic journals would of course be much more challenging than the one undertaken by the unionized movie and television writers in the United States in 2023 (Koblin and Barnes 2023).

All Together

Figure 8 summarizes the above reasoning. Expressed in words, the figure says the following.

Market Actors may be influenced by

- Professions increasing their control over journals;
- Regulators taking antitrust measures;
- Academic Leaders bargaining over charges;
- Faculty Member boycotting journals.

Academic Actors may be influenced by

- Market Actors other than Publishers and Assessment Organizations with other demands;
- Regulators putting more focus on education and practice;
- Professions getting together to limit the use of metrics.

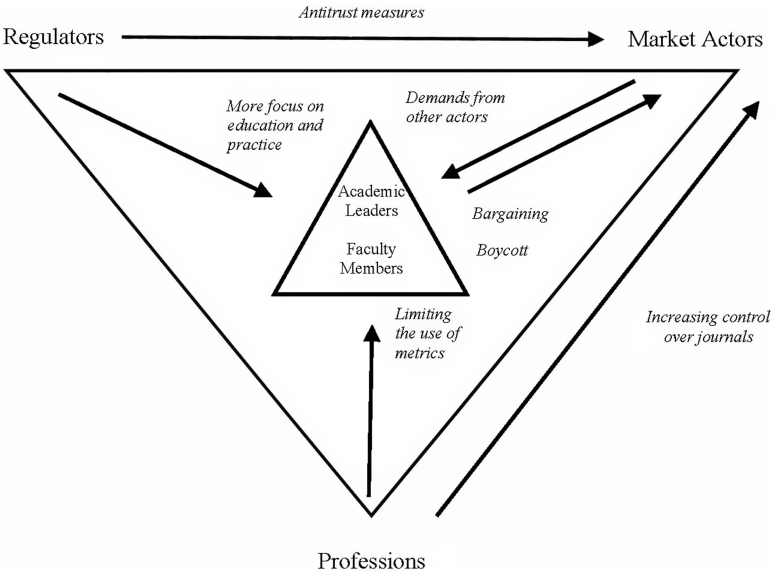

Figure 8. Possible future actions in the publishing system.

To what extent the discussed measures will be taken is of course difficult to say. Nevertheless, the above reasoning may demonstrate that there are possibilities for future Academic Actors to escape the present iron cage of academia.

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Beyond Transformative Agreements: Ways Forward for Universities

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This article deals with the transition to open access in Sweden, as part of the general transition to open science. Goals set by the Parliament and the government are discussed, as well as the strategies of the national Bibsam consortium, handling national deals with publishers, and of the Swedish Association of Higher Education Institutions. The development from the first stages in this process, where a main goal was to gain cost control, over a period with read-and-publish agreements to a situation where transformative agreements seem to tend to become permanent, is analysed. Finally, a number of possible scenarios for future developments are discussed, arguing for the need for university leadership to take an active part in the work towards a transition; it is not only an issue for individual researchers, or for librarians, but for the research community as a whole where universities are key players.

Background

In the midst of the ongoing transition to open science, issues of open access (OA), open data, citizen science and other related matters engage universities and many others more than ever, globally as well as locally. In 2021, UNESCO adopted a recommendation for open science, which it pointed out as crucial to reach the sustainable development goals. Within the European Union, the issues have been high on the agenda ever since the Council conclusions were adopted in 2016 on the transition to open science (UNESCO 2021; Council of the European Union 2016). In 2023, new Council conclusions were decided upon under the Swedish chairmanship (Council of the European Union 2023). Finally, in Sweden, governments of different political colours, have highlighted open

science as a means to reach both higher quality of research, higher research impact and increased collaboration and innovation.

In the following, I will mainly focus on one aspect of open science, namely on open access to scientific publications. Let me first attempt to frame this discussion. It is important to remember that the open access movement was researcher-driven from the start; it aimed at reclaiming the rights to the researchers' own results, to spread them openly to other researchers and to society at large and not least also, through openly sharing both publications and data, to enhance the reproducibility and general quality of research. Since then, politicians, in Europe as well as more recently in the United States, have largely adopted the open access vision. Fundamentally, there is nothing wrong with that – in general, academia tends to be pleased when politicians listen to researchers – but there is a risk that researchers' memory may sometimes be too short and that this might lead to a backlash, where researchers instead argue that open access policies and goals are envisioned and driven by politicians and are fundamentally hostile to research needs. Swedish politicians, through several research bills, have set ambitious goals for the transition to open access. This has led to universities, which in Sweden are mostly state authorities, striving to steer in this direction, which in turn has led to some researchers claiming that this is a threat to research quality, among other things through the growth of predatory open access journals.

In Sweden, the goal set by the Parliament was to have reached 100% open access in publications as early as 2021 – while, in 2023, Sweden has reached approximately 82% OA. In 2026, Sweden is supposed to have reached 100% open access when it comes to research data. This of course exerts high pressure on universities to accelerate their work to make the transition happen. The National Library has had its specific government directives since 2021, to promote and coordinate the work of introducing open access to scholarly publications, which includes submitting a comprehensive survey, analysis and assessment of the national work with open access to scholarly publications, and, since 2022, also including the task to set up a national policy framework. In addition, through the 2020 research bill, which since then has been adopted by the Swedish parliament, higher-education institutions are called upon to advance their work, primarily by helping the Swedish Research Council and the National Library of Sweden in their respective directives to coordinate open science by contributing material. It is clear from this government directive, but also from previous attempts to point out the role of universities and university colleges, that Swedish governments, regardless of their political colour, tend to underestimate the role of higher-education institutions as the central actors in the transition to open access, and that this has contributed to the problem of allowing costs to increase. Universities and their researchers are both drivers in the transition and bearers of the increasing costs. Hence the need to collaborate nationally and internationally.

The Swedish Approach: The Bibsam Consortium

The Bibsam consortium was founded in 1996 in order to coordinate the deals of Swedish universities with publishers and to reduce costs by sharing parts within bigger deals. The National Library of Sweden administrates it. To date, 93 organizations are participating in Bibsam. All universities and university colleges are members, but also a number of government agencies, including research funders and research institutes. Bibsam works as an opt-in consortium, with separate agreements where participating organizations have the choice to join or not, and only in the first case pay its full costs. To date, the consortium has 44 agreements in all, 28 of which are transformative agreements and four pure OA agreements. The turnover is approximately €48.7 million. Bibsam is governed by a steering committee, which is chaired by a university president from one of the research-intensive universities. The Swedish Association of Higher Education Institutions appoints all the members, except for one member representing the smaller libraries, which do not belong to any higher education institution.

The steering committee of Bibsam has decided on the preconditions for its work, which might also be called a policy. When entering into negotiations with publishers, the Bibsam consortium thus has had three major preconditions during the transformative period: (1) immediate OA to all articles published by researchers affiliated with participating organizations; (2) continued reading access for those organizations to previously subscribed content; (3) a sustainable price model that enables the transition to an OA model and thus allows for redirected revenue streams. Contract renewal must include an OA provision, and if no acceptable OA provision is offered, the contract renewal will be limited to one year or even cancelled, as was the case with Elsevier in 2018.

The mission of Bibsam to reach the target of immediate open access has been quite efficient. The main way has been for the payment streams to be re-channelled from the financing of read licence agreements to the financing of publishing costs within transformative agreements, that is: read-and-publish agreements. During the past eight years, from 2014 with the first new open access agreement, until today, with – as mentioned above – 28 transformative agreements plus four agreements with purely OA, there has been a considerable development. However, unfortunately, not only has the number of agreements increased but so have the costs, as read-and-publish agreements may bring costs both for reading and for publishing.

Chasing the Double Dipping

When first taking office as chair of the Bibsam consortium in 2016, I soon became aware of the fact that there was little or no control over the total publication costs at the universities. Researchers paid for publishing in a number of journals and universities paid the subscription fees for the same journals. Moreover, researchers of course had already invested their time and resources not only to do the research but also to act as peer reviewers, serving on editorial boards or as editors and so on.

Much has been said about this strange commercial model, where both researchers and universities become losers in a system where the profit margins, not least for the big publishing houses, are only increasing. Since then, much has happened – but still not enough, because the fundamental problem remains largely the same.

At the time, however, the first priority was to gain better control of our total costs. The subscription fees were already well known. But as the consortium decided to also strive for control of the publication costs (the article processing charges, or APCs), we chose to gather information in several ways. Through an initiative by the Swedish Association of Higher Education Institutions, we started to collect information on APCs paid. This took place in parallel with the development that a number of universities decided to pay all APCs from central funds within the university, having first signed the Berlin Declaration for Open Access and later also the Open Access 2020 Declaration. However, as mentioned, the money flows from public research to publishers have traditionally been uncontrolled, with no transparent overall picture of the total costs, which is why in 2019 the National Library of Sweden was tasked with annually collecting and presenting the total cost of scholarly publishing. A first overview showed that scientific publishing costs (not including administration) were close to €49 million annually. This means that approximately 1% of public research funding was set aside to pay for scientific publication at Swedish universities in 2019 (*Kungliga biblioteket* 2019). Today, it is close to 1.5%.

In 2018 and 2019, there was a substantial reduction in subscription expenses, due to the Bibsam Consortium's termination of the Elsevier agreement at the end of the first half of 2018 (approximately €11.5 million in total). At the same time, costs for transformative agreements have become a growing item of expenditure; they increased by 50% between 2017 and 2018 and just over 25% between 2018 and 2019, and this has only continued.

Due to these measures, however, the Swedish research community has good cost control today. Therefore, knowing where the money goes and how, it was time for the consortium to start confronting the publishers in the negotiation processes with the double dipping that was taking place. In fact, the separate funding streams, with both subscription agreements and agreements concerning OA publications in hybrid journals, benefit the system, with publications behind paywalls. To break this vicious circle, the funding streams must be redirected towards full and immediate OA. However, there is enough money in the system as such.

At one of the first high-level meetings with one of the largest publishing houses, in which I took part, the company had their OA person and the person responsible for their subscription deals seated at the same table at the same meeting for the first time. They strongly maintained that they only did so because Bibsam had explicitly required it and that these two branches of the company had absolutely nothing to do with each other. Moreover, they told us that it was not on the agenda even to discuss the two within the same framework, and even less so to reach an agreement where both cost streams would be included. Since then, we have indeed come a long way. At that time, it was unthinkable to negotiate both publication costs and reading costs within the same agreement. Today, it has become standard. Plan S and later

Coalition S have been quite decisive in accelerating this process, as in making a number of pioneering agreements in different countries, which are now being realized. Transformative agreements were initially seen as the privileged way to move towards a full-scale transition or transformation, flipping from subscription deals to pay-for-publish only.

In Sweden however, we have accelerated the process for open access to the extent that we are one of the world-leading countries today (ESAC n.d.). This, of course, has certain advantages – having reached approximately 80% OA in 2022, Sweden is at least quite close to reaching the national goal. However, this position also contains numerous challenges, not least when it comes to cost control. We have always argued that there is enough money in the system. The main issue concerns what it is that we pay for. The transformative agreements have already reduced the total costs to a certain extent, as the last Elsevier agreement shows. A continuation with APCs and subscriptions in two separate funding streams would have led to considerably higher costs. In that case, the reading agreement plus the list-price value for publishing would have amounted to €22.5 million, whereas the read-and-publish agreement in 2022 totalled €14.3 million. Still, costs generally continue to increase. Why is that? For a number of years, Bibsam has argued to Swedish politicians that the period of transition would be very expensive for universities, as they would have to pay for read-and-publish agreements, thus still risking increasing the costs in a short-term perspective. The vision in the long run, however, was to bring down the costs once the transition is a fact and the whole system has been flipped. What we have seen so far, though, are still mostly increasing costs even for transformative agreements once the two pillars, publishing and reading, have been established within the same agreement. It is thus necessary to move further ahead.

It is clear that Bibsam managed to substantially bring down the costs when first changing from subscription deals and separate APCs to transformative agreements including both publish-and-read, but now there seems to be nothing more to gain from continuing those agreements. Rather, they risk turning the transformation, which presupposes a change, into 'a permanent transformation': a fixed state where the publishers can continue to increase the costs for both reading and publishing. If publishers might not be very eager to move forward, this is not hard to understand; rather, the state of transformation becoming permanent would benefit their interests. Such a development would not only threaten the very concept of transformation but also undermine the motivation to flip the system. At this stage, several large publishing houses honour both the principles and the goal of reaching OA, still claiming that the needs of the researchers steer the process. In the meantime, their own profit margins are maximized, at the expense of the universities' research funds – in the Swedish case, publicly invested moneys, which go directly to private commercial publishing companies. The reason why this model can still be maintained is, to a large extent, the existing model for research assessment, where the publishers offer their services to uphold research quality for the academic community, which instead should be a responsibility of academia itself.

An article – written by a number of researchers from the network Open Science Community Sweden and published in the Stockholm daily *Svenska Dagbladet* in the spring of 2023 (Nilsonne *et al.* 2023) – also argues in the same direction, i.e., that the situation becomes more and more untenable with double dipping and increasing costs, as Swedish universities and libraries today pay more than half a billion Swedish crowns for subscriptions, while at the same time also paying for publishing. Therefore, they challenge the Bibsam consortium and encourage it not to renew the agreement with Elsevier. The money, they argue, should instead be invested in open infrastructure, which would allow for immediate OA publishing. Furthermore, they argue that journals hiding their research results behind paywalls have played out their role. In the era of the internet, research should be immediately distributed and not be communicated according to the outdated principles of the printed press. The possibilities of rapidly and freely spreading results outside of journals are still quite limited as the high-level journals continue to give prestige to careers, especially those of young researchers: 'The research community therefore goes totally out of sync as obsolete publication models are supposed to lead us to the research front' (Nilsonne *et al.* 2023). The authors further argue that it is not technology, but attitudes, that need to change, with adequate quality control and better ways of the assessing scholarly merits of researchers, where they are assessed not by the prestige of the journal where they were published but rather by the quality of their actual publications.

European Initiatives

In the Council conclusions prepared under the Swedish EU presidency, the problems were clearly addressed and taken into account. In the conclusion, the Commission is encouraged, 'in the context of ERA policy action 2, to propose measures to remove barriers to access to and reuse of publicly funded research results and publications and data for research purposes at EU level.' Furthermore, member states are invited 'to update their national open access policies and guidelines as soon as possible to make scholarly publications immediately openly accessible under open licences and to make research data FAIR' (Council of the European Union 2023: 7).

In its comments to the draft Council conclusions before adoption, LERU – the League of European Research Universities – stated that:

> it is important that the upcoming Council Conclusions recognize that the *increasing costs for scholarly publishing* associated with certain business models may cause inequalities in communities and actually prove to be unsustainable for research funders and universities. Many people are now aware of the increase in publishing prices and the spread of transformative agreements, a result of which is a consolidation of the oligopoly in the publishing system. (LERU 2023, emphasis in the original, also in the quotes below)

The global increase of OA articles due to transformative agreements has been quite impressive. However, with this positive picture of the accelerating transition there also follows a reverse side of the coin, as the costs are also increasing accordingly. LERU (2023) again:

> The essential problem occurs when there are no reductions in *price* but *increases*, and where the resulting coverage is low. The threat is what will happen if everything is flipped to Open Access with high APC charges, both individual and under an agreement.

LERU also emphasizes that it has become increasingly difficult for OA publishers 'to agree financial contracts' and also notes that this leads to a problematic inequity in the system – between those countries which can afford to pay and those which cannot. There is also a problem with fully Open Access publishers with regard to research funders: how to claim eligible costs. While publishers provide flat-rate agreements, funders require individual 'payments'. This problem is not easy to deal with 'unless funders are included in the agreement', as LERU concludes.

Beyond Transformative Agreements

It is clear that Sweden has now reached the point where it is necessary to move beyond transformative agreements, to pay only for publishing and no longer for reading, as the country has almost reached the level where we are supposed, and want, to be. The next necessary step must be to cut the costs, that is, to reduce the total costs for the agreements, which have become an increasing problem especially for research-intensive universities, whose publishing costs are gradually increasing whereas the reading costs are not being cut. Of course, universities should pay for the actual costs related to publishing. But it is also clearly necessary to allow for the public money spent on publish-and-read agreements, where the costs are not transparent and clear, to go back into research, in order to be able to do more research as well as to reach the most important goal for open access. It is important to remember that the goal is not in itself to reduce the costs; it is to be able to share our results openly without hindering pay walls, and thus also to enhance research quality and transparency.

Against this background, the Swedish Association for Higher Education Institutions, in close collaboration with the Bibsam Consortium and the National Library, decided in 2021 to set up the task-and-finish group*, Beyond Transformative Agreements*. The goal was to propose a strategy for transitioning from transformative agreements to a financially sustainable system that stimulates the ongoing transition to a fully open publishing system. The group contained representatives from university leadership, researchers from different academic disciplines, research-funding agencies and library representatives, including the National Library of Sweden. The idea was also to investigate different publishing routes, and the work was supposed to build on international discussions and cooperation. Finally, it all

winnowed down to four scenarios, which are not to be seen as mutually exclusive, but rather as four parallel paths to explore further and to implement in part or together. A final report has now also been submitted, based on these four scenarios.

The first of these scenarios is either not to renew or to quit transformative agreements and/or end agreements with commercial publishing houses, and not to renew agreements containing publication in hybrid journals, as this is – or was – not supposed to be Coalition S-compatible after 2025. Now that Coalition S allows for exceptions, the strategy remains basically the same, but rather emphasizing the goal of immediate open access and stressing the importance of moving beyond transformative agreements, that is, going from publish-and-read agreements to publishing agreements only.

The second scenario would be to establish a national Swedish open platform for publications, or to join forces with the European Union and their platform Open Research Europe (ORE). LERU (2023) argues in this connection that ORE has made a start by providing an alternative publishing platform, but there are still challenges to be addressed before the platform really becomes embedded in European research infrastructures. They suggest that what Europe may really need is 'the development of *an open, inter-connected, publicly owned infrastructure* where all parts are inter-connected and speak to the rest'. They also argue that a 'single pan-European system is not likely to work successfully', and stress that next step should be to examine and build the case for such a development. Even though LERU here points to a weakness with ORE – from a Swedish perspective as a small nation – joining the European platform would mean connecting to other European countries in the same endeavour. It would also mean a link to the European Union, which throughout the years has become an active driver in the transition to Open Science, rather than Sweden isolating itself by establishing a national platform.

The third scenario would be to further explore avenues for diamond open access, in order to reach full open access without individual APCs or publication fees. The real publishing costs would then instead be covered by research-funding agencies, universities or learned societies, to mention three possible examples. This includes improving the opportunities for migrating researcher-owned journals from traditional publishers to other platforms.

The fourth scenario would be to further explore the rights retention strategy, adopted for example by several universities in Norway and in the UK, where the rights to the publication stay with the author, fully or partly. In connection to this, secondary publishing rights can also be explored. The latter are emphasized in the European Council conclusions on high-quality, transparent, open, trustworthy and equitable scholarly publishing. The conclusion 'welcomes the introduction of secondary publication rights by a number of Member States into their national copyright legislation, enabling open access to scholarly publications involving public funds' (Council of the European Union 2023: 7).

The Beyond Transformative Agreements working group delivered its final report, 'Charting Sweden's path beyond transformative agreements – analysis and proposals for strategic direction', in September 2023 (Association of Higher Education

Institutions 2023). The main conclusion of the report is that 'it is vital for control of scholarly publication to reside in the research community, while also emphasising the need to reduce publication costs.' Its primary recommendation, therefore, is for the Bibsam consortium

> to refrain from entering read and publish agreements in hybrid journals, beginning in 2026 at the latest. Instead, it should only sign agreements for publication in fully open access journals.

After having proposed a number of initiatives and actions in line with the four scenarios already mentioned, the group finally concluded that (Association of Higher Education Institutions 2023):

> there may be a need for a better understanding within the research community of the benefits that a change in existing publishing practices can bring, and that communication and engagement with both higher education institutions (HEIs) and the research community will be essential aspects of the work.

As early as 2019, a common group had been established with representatives from the research funding agencies as well as from the Bibsam consortium, with the aim of exploring the redirection of funding streams, but its active work was put on hold to wait for the final report from the Beyond Transformative Agreements group. Since the preliminary conclusions of this group have become public, the common group has taken up its meetings in order to establish a joint initiative in this direction. In line with the primary recommendation in the fall of 2023, the group has now agreed in principle to co-fund agreements with fully OA publishing houses, using a step-by-step approach with increased participation from the funding agencies, although the details concerning each agreement still have to be decided. This means that the research-intensive universities will not be alone in bearing the costs for the transition to OA, which is also fully in line with the 2020 research bill, later decided by parliament, which calls for research funding agencies and universities to work together to advance the transition.

Concluding Remarks

There are several voices from within the community of researchers that see the need to enhance the transition even further, as already mentioned above in connection with the article by Open Science Community Sweden (Brembs *et al.* 2023). Its authors argued, more radically, that academic journals need to be replaced by a more modern solution. They maintained that not only affordability, but also functionality and replicability in science are at stake. The solution that they propose (Brembs *et al.* 2023: 1) is one that may not only

> resolve the current problems but also be capable of preventing takeover by corporations: it needs to replace traditional journals with a decentralized,

> resilient, evolvable network that is interconnected by open standards and open-source norms under the governance of the scholarly community. It needs to replace the monopolies connected to journals with a genuine, functioning and well-regulated market.

Finally, they also argue for

> a redirection of money from legacy publishers to the new network by funding bodies broadening their minimal infrastructure requirements at recipient institutions to include modern infrastructure components replacing and complementing journal functionalities.

As a follow-up to that article, Nilsonne (2023) emphasized in the Stockholm daily *Svenska Dagbladet* the arguments for a new publication model. He also underlined that this needs to go hand in hand with a new model for research assessment, which has been taken into account by CoARA, the Coalition for the Advancement of Research Assessment, a joint initiative by the European Commission, Science Europe and the European University Association (CoARA n.d.). The initiative may be joined by universities, funding agencies and other research organizations, and the idea is to shape and develop a new assessment model together. In Sweden, the Swedish Association for Higher Education Institutions has joined the initiative, as well as several universities and funding agencies. It is important to closely follow the development of CoARA, both on a national and a European level. And the need for close collaboration within the academy is only increasing. In the words of Nilsonne *et al.* (2023): 'Through working together, the academy can reclaim control over publication and research assessment, and deliver us from the private companies' paywalls, whose profit interests will not be in the service of humankind' (my translation from Swedish).

It is thus indeed a primary goal for academia to reclaim control over its own research results. The role of the Bibsam consortium, however, is not primarily to turn away from negotiations, at least not as its first option. The role of the consortium, following its general policy, is to conduct negotiations with the aim to cut costs maximally and to move away from publish-and-read to publish-only agreements. However, if this strategy turns out to be impossible, the consortium may at any time opt for turning down specific agreements. But this should not be dictated from the outside; it has to be decided by the universities together, just like when the previous Elsevier agreement was at first turned down.

Therefore, it has also become increasingly important to emphasize, again and again, that issues of open access are no longer a responsibility for the libraries, as they used to be for many years, but indeed a strategic question for university leadership. University leadership is responsible for the strategic priorities and the costs of the universities. It is necessary to maintain and, indeed even to a greater extent, to gain control also over the costs for publications. The goal should be to create a sustainable financial model that will allow universities to choose the right priorities for the future, both to enhance research quality and to promote the open sharing of results and data, in the service of humankind.

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Players or Pawns? University Response to the Introduction of Plan S

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The European Plan S initiative intending to transform the field of academic publishing towards open access has been received with both enthusiasm and criticism. This article reflects on this case as an example of how policymaking in 'the Europe of Knowledge' – characterized by increasing complexity caused by problems of multi-level coordination, combined with multi-actor divergence of norms, ideas, and interests – affects and triggers university responses. The analysis of response to this initiative for reform of scientific publishing takes the concept of normative match and mismatch as its theoretical point of departure, and the article provides an overview of how Plan S has been implemented in Norwegian higher education, where the challenge for universities has been to find a balance between responding to political expectations and expectations from societal and academic stakeholders. Our findings suggest a normative mismatch related to the Plan S initiative. The article argues that the university level was left with the task of defending the academic freedom of the individual scholar, while also being delegated the responsibility of controlling the rising costs of publishing services. As a result, issues relating to academic publishing are currently of strategic interest to universities.

Introduction

The role of science in societal development is one of the core arguments that lend legitimacy to all activities related to science and knowledge development (Boltanski and Thèvenot 1991; Altbach and Knight, 2007). The outputs of this activity – especially via the academic publishing industry – have been the key mechanism for science not only to foster internal communication across the various academic fields, but also to communicate with society and provide updated knowledge (Merton 1973). However, the fact that most of the science communication industry is controlled by a

limited number of private publishing companies that normally demand a fee or a subscription for accessing the scientific results has been an issue drawing increasing attention as one of the main obstacles for improving the links between science and society (Smits and Pells 2022). It is increasingly recognized by both public and private research funding bodies as well as the broader public that science results should be openly accessible to all. Open science has not least been a key policy initiative fronted by the European Commission, to make scientific data both accessible and re-usable; to create a scientific infrastructure allowing for storing, sharing, and safe-guarding scientific data and information; and to make scientific publications freely accessible to the public (European Commission 2019).

In 2018, Plan S was launched as a possible solution, realizing the ambition of open access and open science, stating that from 2021 all scholarly publications on research results funded by public or private grants provided by research councils and other funding bodies must be published in an open access journal, or made available in other ways – for example through open access archives or repositories (European Commission 2019). Science Europe, an association of major research-funding bodies in Europe, and the more recently established cOAlition S – an international consortium of research funding bodies including the European Commission – was a key supporter and a key driver of Plan S (Smits and Pells 2022).

A recently published and interesting 'insider' account of how the Plan S policy initiative was born and later developed provides more detailed evidence of both formal and informal negotiations between EU commission officials and various stakeholders that eventually led to the formation of the cOAlition S consortium (Smits and Pells 2022: 83–85). As such, the development of Plan S for open access and the forming of the cOAlition S is an interesting case of the multi-level and multi-actor configurations that tend to characterize European policymaking in the knowledge area (Chou and Gornitzka 2014), where complex interactions connect different levels of governance, driving overlapping and intricate processes of change (Maassen and Stensaker 2011; Torfing 2012).

After the implementation of Plan S within the countries where major research-funding bodies were part of cOAlition S, much criticism has also been directed at the unintended consequences of the policy initiative (Wenaas 2022). Key points of criticism include: (i) that costs are rising as a number of academic journals currently charge fees not only for subscriptions but also for reading access; (ii) that the freedom of researchers to choose their preferred journal to communicate research results is more limited, and finally; (iii) that scientific quality may suffer due to the rise of predatory academic journals and a weakened peer review system (see, for example, Anderson 2015; Carling et al. 2018; Wenaas 2022; Wenaas and Gulbrandsen 2022; Karlstrøm et al. 2021).

Thus, for universities – the key institutions in the system of knowledge production – the quest for open science and the consequences of Plan S present a huge challenge. In short, they need to balance between responding to societal expectations concerning open science and defending academic freedom for the individual academic, while also controlling the rising costs of publishing services they have to pay for.

The ambition of the current article is to shed more light of how the shifting landscape of academic publishing affects the role of universities. The research questions asked are:

- How can the policy context embedding the drive towards open access and Plan S specifically be conceptualized?
- How are universities navigating the different expectations directed at them with respect to open access?
- Under which conditions are policies for OA likely to take effect, and what is the role of the university level in responding to political expectations and demands from both national and international levels of governance?

The latter two questions are answered by providing more detailed insight into how the Norwegian publishing landscape has changed and by offering reflections on the initiatives and dilemmas facing research-intensive universities, focusing on the University of Oslo as a case study.

Organizational Manoeuvring in a Complex Policy Terrain – a Theoretical Reflection

European policymaking in the knowledge area has always been characterized by complexity, often driven by multi-level, multi-actor, and multi-issue configurations (Vukasovic et al. 2018), which may sometimes lead to creative solutions, while at other times resulting in destructive outcomes (Hooge and Marks 2001; Peters 2015, Chou et al. 2017).

Behind many of the policy initiatives driving European integration in the knowledge area is the ambition of modernizing the science system (Maassen and Olsen 2007). The key argument is that the main European science producers, i.e., public universities, have not reached their potential to act as catalysts of innovation and transforming knowledge breakthroughs that can be utilized to foster economic growth and societal development (Olsen 2007). In short, the links between science and society need to be strengthened with the support of supra-national coordination and stimulation (Chou and Gornitzka 2014).

The theoretical contribution of the multi-s (multi-level, multi-actor, and multi-issue) perspective is the recognition that authority is distributed and embedded across levels and actors (Hooge and Marks 2001), shaping particular institutional logics (Thornton et al. 2012) in the form of domestic–international, centre–periphery, and state–society configurations (Piattoni 2010).

However, whether the specific configurations always appear in a distinct and clear-cut way has also been challenged (Chou et al. 2017), for example, in that both public and private stakeholders may appear at various governance levels, thus challenging the distinction of the three multi-s. As a response to this, Chou et al. (2017) have called for empirical studies that take a closer look at the various combinations that can appear in multi-level, multi-actor, and multi-issue governance frameworks. Not least, it is possible to identify new forms of organizing that cut across the various multi-s – for

example in the form of meta-organizations (Ahrne and Brunsson 2008), such as Science Europe, a (private) European association consisting of major national research funders in 41 European countries.

The establishment of meta-organizations – organizations where other organizations make up the membership (Ahrne and Brunsson 2008) – is interesting, as it hints at the possible ways individual universities might respond to an environment characterized by multi-level governing actors, a range of public and private stakeholders which, taken together, may bring a rather complex set of issues to the table. As such, the establishment of a meta-organization implies that individual organizations infuse and attempt to 'control' their own environment (Maassen et al. 2022; Stensaker et al. 2023) by producing ideas, refining their interests and suggesting new templates for action. In short, they contribute to and constitute the ingredients of their own institutional environment (Scott 2014: 125). Of course, individual universities may also respond in other ways and by other means (Lounsbury and Crumley 2007; Frølich et al. 2013). The point to be made here is that individual organizations are far from passive pawns when asked to comply to new standards and rules, or when facing mixed and even conflicting sets of expectations directed at them (Brunsson and Jacobsson 2000; Djelic and Sahlin-Andersson 2006; Greenwood et al. 2011). The specific capacity a focal university may have to respond to policy developments such as the quest for Open Access and Plan S specifically could still be questioned. Two issues are of particular interest here.

The first challenge is related to the level of intra-organizational coordination needed to provide a coherent response to open access/the Plan S initiative. Gornitzka et al. (2017) have shown, on the one hand, how European universities have strengthened their capacity for internal coordination, although studies also suggest that internal coordination remains a challenge in universities, where the administration also has become professional and specialized (Maassen and Stensaker 2019). From a university perspective, initiatives such as Open Access/Plan S may also create tensions with other academic *values and norms*, not least academic freedom, which also must be taken into account (see also Stark 2009).

The second challenge concerns how to coordinate the external attempt to influence Open Access/Plan S processes. While establishing and working through a meta-organization is certainly one option, there are other ways of organizing interest articulation and fostering policy uploading (Vukasovic 2017; Vukasovic and Stensaker 2018), not least through expertise (Gornitzka and Sverdrup 2013). From a university perspective, the existence of various options must be weighed against the potential effectiveness of actions taken, as well as a university's capacity to be a consistent advocate for policy initiatives taken (Gumport 2000).

Hence, the perspective developed here is not so much emphasizing the need for bold strategic institutional leadership (Salmi 2009; Wildavsky 2010) as the need for more reflective institutional strategies that navigate a landscape with many conflicting and legitimate interests. Borrowing from scholarship on institutional change and reform (Olsen 2002), we take as our key theoretical point of departure the concept of normative match and mismatch and how that plays a role in the process of

shaping university response. Policy instruments may be effective in terms of achieving policy goals. Such efficacy and efficiency can make policy measures appear to be legitimate, i.e., having instrumental legitimacy or yielding output. On the other hand, where norms and beliefs within an institution do not match the underlying ideas and objectives of the policy, even technically effective and efficient policy means will generate opposition and attempts to undermine or block implementation.

Consequently, we will explore how the legitimacy of Plan S and the normative (mis-)match of this plan has influenced the responses of universities and their academic staff as key drivers of implementation (Olsen 2002: 586). Our initial assumption is that the more mismatch there is in the norms embedded in the policy and the norm sets that are held high in the academic communities, the more university response will involve filtering and 'editing' government policy. Furthermore, the central level of the university can act as a filter between policy and 'shopfloor' actors, while also working with the major actors at national and international levels that promote the policy initiative. The more the mismatch, the more filtering will take place to accommodate key veto-players in the university. In addition, we also expect that the degree to which policy is clear or ambiguous will also affect the leeway for interpretation in university response.

A Note on the Empirical Context and Data

Norway is an interesting setting for investigating implications of Open Access/Plan S, as it has been an early supporter of Open Access initiatives, and as the Norwegian Research Council was also one of the founding members of the cOAlition S consortium. The Ministry launched national guidelines for Open Access in 2017 with the goal of full open access from 2024 onwards. These guidelines responded to earlier policy initiatives from the government in 2008 where Open Access was defined as one of the key ambitions of the national research policy (Wenaas and Gulbraandsen 2022). Following the Plan S initiative, Norway has also implemented so-called transformative agreements with several major international publishers.

Norway has had a sharp focus on academic publishing over the last few decades – not least as this has been a key dimension in the national higher-education funding system – resulting in a number of evaluations and studies of how the field of academic publishing has changed over time (Sivertsen 2022). The current article uses this knowledge base to describe and analyse changes in publication patterns and the implications of Open Access policy initiatives.

To shed light on how higher education institutions respond to Open Access/Plan S, we also identify initiatives and analyse strategy and policy documents from the University of Oslo, providing a case study of how research-intensive universities are trying to navigate the new landscape of academic publishing. The fact that the authors of the present article are positioned within the institutional leadership of the University of Oslo should also be mentioned, both as a caution regarding possible bias in the story told and to point out that this 'insider' perspective could also be seen

as a strength, given that the institutional leadership perhaps has a broader overview of the many possible factors and events that shape the decisions made.

Implications of Open Access Policies and the Plan S Initiative Higher Education in Norway

The Norwegian Publishing Landscape – an Overview and Recent Changes

In Norway, academic publishing became part of the funding system for higher education from 2006 onwards. In the funding system for higher education institutions, academic outputs in the form of journal articles and scholarly books have been one of several performance indicators in the funding system. Accountable to a national certification register of academic journals and publishers, higher education institutions are economically rewarded based on the number of articles (author shares in case of co-authoring), the quality of the journal/publisher, and whether there is a higher increase in publishing output compared with other institutions. Since its establishment the Norwegian system has also inspired similar systems in countries such as Finland, Denmark, Belgium (Flanders), Portugal and Poland (Aagaard et al. 2015). National governments and intermediate government bodies have been directly engaged in the international and especially the European research policy agenda, although policy downloading – adaptation of European policies – from the EU is routine in the Norwegian higher education system (Karlsen 2015). Key national actors have also been present and at times acted as key policy entrepreneurs in developing the OA agenda, not least the Research Council of Norway (RCN) (Smits and Pells 2022). A major factor in the Norwegian case of OA is the role that the then director of the RCN played in the European arena (Smits and Pells 2022). As the RCN is the only research council in Norway and in most areas has the monopoly on the distribution of research funding in the national competitive arena, its initiatives are important in Norwegian higher education. Hence, when the then director pushed for OA publication and the Ministry eventually made it a requirement, this decision had a huge impact on the direction that the whole national system for research would take. The RNC director's central position at the European policy arena through CoAlition S strengthened his position as a 'policy entrepreneur' in the domestic setting.

While the publishing indicator was introduced as part of the funding system for higher education, the system has also had unintended effects, not least impacting the individual academic, as the scores in publication points have been applied to other settings such as individual promotion, career-assessment processes, etc. The system has been criticized as being too focused on metrics and too much inspired by EU-driven governance reforms (Karlsen 2015), although it has also had its supporters, who advocate that sharing the findings of research projects and activities is closely aligned with key values and obligations for academic staff in developing a well-functioning science system (Carling et al. 2018). Hence, one could argue that the

publishing indicator was designed in a way that matched the norm set of scientific research (cf. Merton 1973).

Nevertheless, the success of the introduction of the link between the national funding system and establishing an indicator for academic publishing comes at a cost. In 2019 alone, the combined costs related to subscriptions and article processing charges were 482 million NOK – an increase of over 7% from the previous year (Karlstrøm et al. 2021).

The overlapping incentives related to funding and individual career development, and the matching of these incentives with academic norms, are probably important factors driving the rather rapid increase in the total volume of academic journal articles and books in Norway after the introduction of the new system, although a general increase in the funding level of the sector most likely has contributed as well (Aagaard et al. 2015). An evaluation of the publication indicator in the funding system found not only that the system increased the research output in the form of articles and books but had little impact on the share of international collaboration and research impact. More updated and longitudinal data have demonstrated that, over time, citation rates for Norwegian academic journal articles have increased to currently 20% above world average, and with a continuing increase in the number of articles and books produced. Hence, if citations should be regarded as a proxy for academic quality, the indicator seemed to have boosted both the quantity and the quality of Norwegian research output.

However, in the last decade, more attention has also been given to open access to articles, and between 2013 and 2020 the share of open access journal articles increased from 39% to 82% of all articles involving Norwegian academics in the higher-education sector (Karlstrøm et al. 2021). Hence, currently, the overwhelming majority of scientific articles with Norwegian authors/co-authors are published as open access. In the first part of this period, most of the growth was related to green open access articles (repositories), while hybrid and transformative agreements have strongly increased in the latter part of the period (Karlstrøm et al. 2021).

Transformative agreements – so-called publish-and-read (PAR) agreements – were launched in Norway in 2019 and since then have covered all the larger international publishing houses and more than 10,000 journals (Sivertsen 2022). These agreements have had a substantial impact on open access. In 2020, University of Oslo researchers authored or co-authored 5642 articles, and 1700 of them were published in 'pure' OA journals. The effect of the transformative agreements has been a further boost in open access articles, but they have also had the effect that so-called diamond open access articles have been reduced in favour of hybrid articles (Sivertsen 2022). For those publishers not included in the transformative agreements, the trend is that gold options – i.e. where the authors have to pay an article-processing charge (APC) – are increasing rapidly. New 'mega-journals' are also becoming popular outlets for Norwegian authors, especially journals from the Switzerland-based publishing house MDPI (Sivertsen 2022). The latter development may be worrisome as some of the journals may represent challenges with respect to the quality of the review process. An example is that the journal *Sustainabilty*

recently was removed from the certified Norwegian register of academic journals and books as an outlet qualifying for reimbursement in the national funding system.

In general, those journals experiencing the highest growth in articles from Norwegian authors are not those that are certified as being 'a leading journal' in the Norwegian register for academic journals and books. Hence, in a recent study, Sivertsen (2022: 16) concluded that despite existing transformative agreements, it is the gold options based on APCs that are evidencing the highest growth rate. A similar conclusion has been reached in another recent study by Wenaas and Gulbrandsen (2022: 19), which argued that current gold open access publication patterns correlate negatively with the journal rankings in the Norwegian register for journals and books. In fact, the overall consequences of the PAR agreements have had the exact opposite effect to part of the stated government ambition with OA policy, that is, to curtail the market power of private for-profit publishers, in particular the 'big five' (Open Science 2023).

However, the Norwegian government has also taken steps to stimulate open access journals embedded in diamond options and has taken the initiative to financially support 28 Norwegian journals in smaller disciplines within the social sciences and humanities (the NÅHST initiative) (UiO 2023). The 28 journals covered can be seen as a way to support Norwegian-language scientific journals, as the international market for scientific publishing is becoming more competitive.

Interestingly, the PAR agreements have also contributed to changes in the organizational ecosystem set up to fund and negotiate academic publishing in Norway. In the national setup for developing and implementing OA policy, the institutional level was given a key role in interpreting how to advance towards the 2024 target. The national consortia negotiating with the major publishers were used to push for changing the commercial regimes for scientific publishing. Traditionally, the 'ordinary' team of advisors to the negotiators (the Council for Negotiations, i.e., 'forhandlingsrådet') consisted of chief university librarians/University Library Directors. As such, the organizational setup was rigged to conduct the negotiations *within* the regime based on ordinary subscription agreements. However, entering into the new transformative agreements, an entirely different kind of organizing was established. The council and the government agencies that had the task of conducting negotiations with the publishers, the negotiation teams and council, were injected with university rectors representing the major research-intensive universities. In other words, policy development and implementation were directly embedding the institutional leadership level. The principles for the negotiations were codetermined by Universities Norway – the interest organization for Norwegian universities. This was an attempt to clarify the ambiguity of government policy. The process of negotiations became the practical link between the national and institutional levels. In practice, the university level of the four oldest universities became the bridge between policy and practice as well as the main interpreter of Plan S locally. The university leadership of the two oldest comprehensive research universities was active in voicing strong arguments against Plan S as top-down government policy, especially regarding the speed and processes of Plan S.

University Responses to Open Access and Plan S – the Case of the University of Oslo

Attempts to deliberately change the scientific publishing regime are of consequence for a comprehensive and research-intensive university. As the leading research university in Norway (26,000 students and 7000 employees) with approximately 5000 to over 6000 journal articles every year published in international journals, the effect and reception of the government policy for OA was met with very mixed reactions. This is hardly a surprise, considering the diversity of publishing practices and norm sets that thrive in various parts of the university.

Still, practices associated with OA policy and strategies were no strangers at the University central level. The requirements for archiving accepted publications (pre-print versions) was a demand the University of Oslo established quite early on, years before Plan S. Given that the performance-based funding regime featured the research publications indicator, reporting scientific publishing was already institutionalized. Champions of the Open Science agenda were also found much more broadly and radically within the University of Oslo, and in the different arenas, both normative and practical research policy issues were discussed.

Diverse interests regarding Plan S were not only found within the university but also in the environment related to Universities Norway – where the institutional leadership of the University of Oslo was represented. This interest organization saw the whole 'open' agenda as a domain where the various units within Universities Norway, and not least the secretariat, could play a leading role. Conferences and working groups were established and tried to connect with the universities. Internally at the University of Oslo, most of the work had already been done in terms of having a repository and taking part in various efforts to discuss the future of OA. A major outcry, however, was prompted by the fairly sudden announcement by the government and RCN of the quantitative target of 100% OA publishing in the future (Carling et al. 2018). This triggered a major public discussion. As the government policy was seen as lacking legitimacy and no required analysis of possible consequences had been conducted by the Ministry for Higher Education and Research, critical voices grew stronger at the University of Oslo, and beyond. This debate engaged virtually the entire research community. Strong voices and positions were articulated, although the policy positions differed both between universities and between different private and public research organizations For example, the University of Tromsø's pro-rector for research actively promoted the entire Open Science agenda, while opposition came from the Institute of Peace Research, from the Political Science Department, and the Department of Economics at the University of Oslo. The quality, effectiveness, and legitimacy of the policy were heavily criticized (Carling et al. 2018; see also Kamerlin et al. 2021).

This polarization intensified during the autumn of 2018. The debate demonstrated the ambiguity of government policy goals, their feasibility, and the wishful thinking concerning what role such a small country could take, especially as the first mover. But the most impactful counterargument was the Government and the Research Council

of Norway's failure to pay attention to what this could do to the quality of research and the quality assurance system that had been institutionalized in the decades running up to the announcement of Plan S and the requirements issued by cOAlition S. The debate engaged 'the lab floor' and the regular professors opposing cOAlition S and Plan S. Hence, the discussions and attention to Open Access, which until then had been dominated by voices *promoting* OA policies (both within and outside the universities), were now challenged by strong spokespersons from within internationally leading research groups. Arguments launched by the latter group mainly reflected issues related to academic freedom (of where to publish), and the potential negative impact OA might have on scientific quality.

The strategy developed by the University of Oslo could be said to reflect both positions and was a tangible expression of how the university actively dealt with OA in a way that tried to match values, norms, and perspectives on the significance of scientific publishing. In this way the institutional response to Plan S embedded the identity of the university as a comprehensive research-intensive university, emphasizing the normative dimension as the main foundation of the OA strategy. As an illustration, the introduction to the strategy reads as follows (UiO 2023: 1):

> The strategy builds on the research community's demand for quality assurance and academic freedom and research integrity. The main objective is to ensure these values in the further development of open publishing and open access to research result.

In summary, the polarized debate and the stark and coercive measures that the Plan S implied were in this way filtered at the University level through regular decision-making procedures, as well as through appointing working groups with strong research leadership representation. The normative mismatch that had become so obvious in the, at times, rancorous public debate, was translated into ideas that matched core value sets within the university.

Eventually, the institutional rights retention policy that had been pushed at the international, European, and national levels, was also introduced and adopted by the University Board. A major impetus was the fact that other universities had introduced it, despite the uncertain implications of practising such a policy. However, this was a risk that the university was willing to take, not least due to the previous consultations with other Norwegian universities.

Overall, the road ahead and ways of translating internal policy into practice are not settled. The ambiguities of national policy remain, as do the unpredictable actions of the commercial players. Policy ambiguity could provide the universities with the opportunity to define acceptable and effective ways of proceeding towards OA and to avoid becoming the pawns of an OA game where other actors call the shots. Some initiatives have been taken by the University of Oslo in this respect. With the ambition to stimulate more high-quality diamond options, the FRITT initiative is one example, including 21 journals supported by the university, with a service to set up new journals.

Conclusions

While Norway is among those countries that have established transformative agreements, driving open access albeit with much higher costs, it is possible to identify a more global trend in academic publishing, where APCs (the 'gold option') are the dominant form of funding academic publishing. Such 'gold' publication options where quality cannot be guaranteed also drive a higher degree of concentration in the international market for scientific publishing (Sivertsen 2022). Thus, one could ask whether we are heading towards a situation where the 'rich' and the 'rest' are becoming even more separated.

Recent studies show that gold options currently dominate the market for open access and that APCs are gaining ground as the key financing mechanism. A recent calculation covering 12 large international publishing houses suggested that the income from APCs covering open access articles could be estimated to reach US$2 billion in 2020 (Zhang et al. 2022). The major players in the market are buying up smaller publishing houses, increasing the concentration in the publishing market, and the gold option linked to new mega-journals is the winning combination. As such, it is not difficult to agree with Zhang et al. (2022) in their argument that while Plan S was initiated by national governments and the EU, it is the private market, where a limited number of key publishing houses dominate, that actually runs the development. Given the bleak global picture, what can smaller countries and individual universities do? The Norwegian case provides evidence that joint policy positions are needed and that academic values and norms need to be taken into account also regarding OA, especially as current OA policies seems to have a damaging impact on the peer review mechanism and scientific quality in general.

Returning to our theoretical point of departure, we can clearly see how our initial expectations do seem to carry some weight. Once the national ministry and the Research Council of Norway had issued guidance and 'signals' about open access, and turned it into 'hard law', the normative mismatch between the champions of OA and the parties became obvious. The debate was vocal and polarized, i.e., in terms of being for and against creating a situation where the universities had to act as negotiators – internally and externally. As such, Plan S is indeed an example of a 'stone thrown into the water – with rippling effects' as Smits and Pells (2022: 131) recently formulated it. If the idea behind Plan S was to shock and add speed to the process of OA, the plan has indeed succeeded.

Yet, the jury is still out with respect to the consequences. For the individual university, Plan S has probably driven open access issues higher on the institutional agenda – involving the institutional leadership more. As such, Plan S has contributed to stronger intra-organizational coordination and has elevated issues about scientific publishing higher on institutional agendas. Here, one could find evidence that universities are becoming more active players in the evolving publishing landscape.

At the same time, transformative agreements seem to be a hindrance for fully green options. In the case of the University of Oslo, the response to the policy had to deal with a considerable normative mismatch, with conflicting perceptions and assessments

of OA and Plan S within academic staff. Still, the policy ambiguity on the part of national authorities created some space for how to proceed in a way that is both effective and legitimate – suggesting some leeway for acting both within and outside the university. Individual actions taken by universities – exemplified by the FRITT initiative at the University of Oslo – are still probably too small and fragmented compared with the major impact of the dominant publishing houses. Thus, teaming up with universities nationally and transnationally in defence of OA approaches that are normatively compatible with the quest for scientific quality and values is imperative, as partly evidenced by the Norwegian case, although the capacity for such inter-organizational coordination could be questioned (Maassen et al. 2022). Existing meta-organizations at the European level, such as the Guild, LERU, and others, are nevertheless more important than ever as voices defending academic quality in the OA debate. If academic quality is absent, do we really need open access?

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Transformed Publication Strategies

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This article looks at publication strategies from two perspectives. First, the author describes her own publication strategy. She shows how it evolved over time and explains why she adopted a balanced strategy mixing books and papers, English and French, collective and individual authorship. She then builds on her experience as co-editor of two journals, one French and one international, analyses the consequences of the passage of the first to a big commercial publisher and compares the decision-making processes in the two cases. She finishes by pleading for decision-making procedures that allow more discussions and collegial work than the current systems of editors soliciting reviewers.

This article has an uncommon status. It is not based on any extensive research but on my personal experience as an author and as a member of editorial boards. It is therefore a subjective testimony and a personal reflection. It builds on two different sources. The first one is an online article (Musselin 2019) published in a symposium of *Sociologica*, directed by Elena Esposito and David Stark on 'What is your publication strategy?' (Stark 2019). Here, I will sum up the main ideas in that article and stress that the notion of 'publication strategy' came to me late and that I have adopted what I describe as a balanced strategy that voluntarily combines publications of books and papers, publications in French and in other languages (mostly English), private editors, and open science. The first part of the paper will thus draw on my experience as an author of publications.

My second source is my experience as editor-in-chief (from 1991 to 2005) of the French journal, *Sociologie du travail*, and as co-editor (from 2008 to 2013) of the international journal, *Higher Education*. My objective is not only to compare the two journals and the way we made decisions, but also to reflect on the transformation of the journal's production as the French journal left a French publisher (or rather was abandoned by it) and joined Elsevier in 1998 in order to be simultaneously printed and published online. The main argument of the second part will be that this move to Elsevier quite significantly affected the physical production process and the

definition of the audience of the journal. At the same time, the peer-based decision-making process remained as before, based on regular meetings of the editorial board. I will stress the advantages of this model of reviewing papers and defend the idea that it could advantageously replace the more industrial and impersonal decision-making process practised by various international journals.

From No Publication Strategy to a Balanced One

The notion of a publication strategy was not on my radar as a PhD student in the 1980s and when I began my career in academia. Choosing which journal to publish in, going for international journals, adapting the content of the paper to the 'style' of the journal it will be submitted to, all these were not considerations taken into account before writing a piece. It does not mean that no norms existed: monographs were at least as important as articles, publishing in French journals was expected, and single-author publications were favoured in order to 'prove' one's intellectual autonomy. It was more about ticking the boxes than developing a strategy.

In fact, I first discovered that publishing could be strategic when, at the beginning of the 2000s, I collaborated with a colleague in management studies. As we were ready to publish our results, he said we should not go for a monograph (as I implicitly supposed we would) but that we should target high-impact-factor journals. He looked at a list of potential journals ranked by impact factors, all in English, and identified two or three that could be of interest, recognized by his own institution, a business school.

Indeed, this reflection on where, what, and with whom to publish, as well as how to write a paper according to the 'style' of a specific journal, has become more of an issue in the last two decades. What seemed awkward to me at that time has become rather usual today. Even if I am still not as far along as my management colleague in my own publication strategy, I pay more attention today to what and where to publish, and tend to avoid papers in non-peer-reviewed journals or chapters in edited books. Therefore, I now have a publication strategy, which I describe as a balanced one.

First, this strategy means that I publish not only papers but also books. Papers cannot replace books because only books can provide the space to coherently develop multiple angles and rather comprehensive stories linking different mechanisms together.[a] Reciprocally, papers are great to expose one's argument and mobilize the specific empirical data attached to it. Therefore, we need both. As I explained in the aforementioned article (Musselin 2019: 47):

> When I [. . .] wrote the French version of the book translated as *The Market for Academics* (Musselin 2009 [2005]), it was important for me to be able to put in the same piece the analysis of the different phases of academic hiring: decision to (re)open a position, definition of the position's profile, selection of the candidates and academic judgment, negotiation of the 'price' of the selected candidate. And then, to show how these phases are more or less

> articulated and to insert this specific moment of hiring within a wider understanding of academic labor markets in the three countries under study in the last chapter.

I then also published papers deriving from this book.

Second, I publish in English but also in French. Publishing in English started early, not as a strategy but because higher education does not exist as a field in France. Therefore, the only way to exchange ideas with colleagues in higher education studies was to attend international conferences and to publish in English. This was also the only way to find readers beyond the francophone community. If publishing in English was not required when I started my career, it has become more and more assumed from universities and national research organizations nowadays. However, too often English is a synonym for international publications, while French publications in contrast are considered parochial.[b] There is thus an assumption that all journals published in English immediately reach an international and large audience, while articles in French are low-level, with a restricted audience. This is, of course, wrong.

Furthermore, one should be aware that the way of writing – the way of mobilizing the literature, developing an argument, using data, finding an outline that deviates from the standard 'state of the art, method, results, discussion,' etc.) – is different in French and in English. For me, writing papers in French is important to keep this French tradition of writing sociology, but also to maintain the discussion with the French-speaking community. Therefore, I favour publishing in French journals that are well-reputed peer-reviewed journals in order to reach a rather large audience. As for my books, I always wrote them in French. Although I can directly write papers in English, I must recognize that I have never been able to conceive a whole book in a language other than French. I was lucky that some of them have then been translated to, and published in, English first, and more recently Turkish and Spanish.

A third dimension of this balanced publication strategy deals with individual or collective publications. I again use both but have clearly increased my participation in co-authored publications, owing to the development of collective research projects and the fact that it has become much more accepted than at the start of my career: at that time, co-authorship was often understood as evidence of a lack of independence, especially when a senior and a junior were publishing together. Today, papers with more than two authors have become more frequent. Nevertheless, although I have very much appreciated my collaborative writing with wonderful colleagues in the last years, I still prefer solitary exploration and personal reflections. I also advise younger colleagues to write some single-authored publications, because evaluation remains individual, and single-authored publications remain the only way to appreciate a scholar's contributions.

Finally, and more recently, publication strategies must aspire to promote open science. In France, higher-education institutions, national research organizations (such as the CNRS), the French national research council, and the Conference of

University Presidents, are all pushing in this direction. They ask authors to publish with a CC BY license and to have a strategy of rights retention. Diamond Scientific Publishing is also encouraged. This is fine because it is important to make science as accessible as possible. However, again I think that, on this matter, balanced choices should be made.

In fact, so far, not all the measures that have been taken have stopped the development of big publishers, which are becoming more concentrated and always earn more money and sign national agreements with countries or large academic institutions. They also develop new services (data management, data archiving, etc.) in order to complement classical editorial activities. It is therefore not certain that the solutions advanced by cOAlition S (a consortium of research organizations and funders backing Plan S, an initiative for open-access science publishing) are always suitable and efficient. Let me take three examples of questionable implementation. First, the Diamond option. It requires public higher institutions to take over the editorial tasks performed by private publishers: this is costly, requires human resources, and, for the moment in France, no supplementary resources have been allocated for such purposes.

The strategy of rights retention also raises some problematic issues. It means that authors forgo any possibility of blocking the use of their work. The control exercised by private publishers on scientific production no longer exists. Thus, AI, such as ChatGPT, can freely use it. This seems rather paradoxical at a time when journalists, media, and websites accuse ChatGPT of using their work without paying for intellectual rights. Should we allow ChatGPT to freely use all scientific production?

Finally, this also raises questions about the future of books. Can we really do without publishers for books? I always received very valuable support for the editing and the distribution of the books from the private French publishers I have been working with. I do not see how their contribution can be replaced if we want books to remain a vector for science communication.

In sum, my situation as author has changed considerably since I started my career. Publishing papers, in English, and with colleagues has become more and more frequent. However, I think that writing books, publishing in one's native language, or being a single author should not be abandoned. I am afraid that this balanced publication strategy is under threat.

In the Name of the Editors

Let us now turn to the point of view of the editor in charge of selecting papers for academic journals. Here, I will provide two rather disparate experiences. The first is with a French journal, *Sociologie du travail*. In that journal, I started as a member of the editorial board before becoming editor-in-chief for about ten years. When I started, the journal was only printed but has more recently been published online as well. The latter transformation reveals the in-depth transformation of the publishing industry more broadly and the increasing control of publishers in the production of

journals. However, this did not affect the way decisions were made in this journal, a decision process that differed considerably from the one I experienced later, particularly as co-editor of *Higher Education*.

The Reorganization of the Publishing Industry with Online Publication

Sociologie du travail, which was my first editorial experience, was created in 1958 by Michel Crozier, Jean-Daniel Reynaud, Alain Touraine, and Jean-René Tréanton (Borzeix and Rot 2010). It is run by a professional association, to which the title belongs, and publishes four issues each year. When I entered the editorial board, it was published by Dunod, a French publisher. However, in 1997, shortly after I became editor-in-chief, Dunod changed its strategy and informed us that they would stop publishing the journal. The editorial board decided to look for a new publisher. It also decided that this would be an opportunity to change the distribution of the journal and to have both printed and online versions. With three members of the editorial board, we contacted a number of French publishers. Some were interested in publishing the journal, but they told us that online publications were not on their agenda. We therefore also contacted international publishers. Finally, only Elsevier was both interested in a social sciences journal published in French and willing to publish it online. The contract signed with Elsevier France guaranteed sufficient revenues to the association. It also assured that the individual and institutional subscription prices would remain about the same as before and comparable with other French journals (far less expensive than the international standard). As I will develop later, the way we made decisions about the papers in this journal remained unchanged. Editorial decisions were never an issue during the yearly meetings we had with our Elsevier liaison. A likely explanation is that our authors were French and that the software managing the review process was only in English.

It is clear that online publication, especially as we were a prime mover in the French context, had positive consequences for the visibility of the journal within the francophone audience. We thought that it could also work on the English scene and decided to publish each year, online only, translations of a selection of three or four papers. However, they hardly found a readership, probably for the reasons mentioned above: writing in French is different from writing in English, and an English translation of a paper written in a French way does not produce an English paper.

Beyond online publication, the transition to Elsevier also brought some important changes that affected the technical production process, which was a continual issue with the publisher. First, as mentioned, the price of subscriptions remained about the same, but the quality of the final product declined. Each issue became much thinner because the paper thickness was considerably reduced, the font became smaller, and the overall presentation denser. Second, after many years of resistance, we had to accept that the editorial assistant of the journal only got the opportunity for one proofreading instead of two.[c] The latter had been important in order to guarantee a

high quality of the content in terms of syntax, grammar and orthography. After the suppression of the second proofreading, the editorial assistant was desperate each time she discovered missed first-proofreading corrections and found that new errors had been introduced. She, and the editorial board, felt that the objective of a high level of quality for the French language was not fulfilled.

We furthermore experienced the development of a new organization of the publishing industry. With Dunod, we were used to an integrated firm, managing the whole process from the subscriptions to the final printed version. With Elsevier and the transition to online diffusion, we faced the disconnection of the different activities being led by different independent entities. With our contact person at the journal, we discussed our results and our activities: the number of published papers, the number of papers downloaded per month, the number of subscriptions, the rate of rejection, and the level of sales revenue. However, she had no control over the branch that wound up in charge of printing and – more problematically – on the sales department, which joined ScienceDirect. The latter determined the sales policy and sold *Sociologie du travail* to university libraries bunched together with other journals. Because the university libraries 'bought' bunches, and no single titles, it became very difficult to know what our real audience was or to get a sense of the sales revenue. With Dunod, we had to trust them about the number of subscriptions and the level of the sales revenue – strictly linked to the number of subscriptions – that they shared with us. However, we had no idea of Dunod's net income, i.e., how much they earned from the journal. With Elsevier, it became even more obscure: we had no idea of the revenue linked to the number of downloads. As they became steadily higher and as subscriptions dramatically declined, we were increasingly dependent on the sales strategy of ScienceDirect, and the variation in the sales revenue became more and more abstract. We therefore clearly observed how ScienceDirect became the main actor, with the progressive reduction of printed issues and the dependence of our contact person on the marketing strategies. Following the recent doctoral dissertation of Marianne Noël (2023) on scientific publications in chemistry, more work should be done on the redistribution of power relationships within the research-publishing industry.

Peer-review: Yes, but Why not a More Collegial One?

The transition to online distribution was a turning point in the production of *Sociologie du travail*. It finally led the editorial board to decide in 2017 to leave Elsevier, opt for online only via OpenEdition, and become a Diamond publication (Demazière 2017).

Despite these important changes, the scientific decision-making process evolved only marginally. The editor-in-chief and the editorial assistant still allocate each paper they receive to three members of the editorial board. If none of the latter are specialists in the field covered by the paper, an external scholar is asked to produce a review, although this is rarely the case. Then the committee meets (until the Covid pandemic this entailed in-person meetings). During these meetings, all papers are

successively discussed. For each of them, the three reviewers present the paper they had been asked to review, relate what they find interesting or problematic, and propose whether the paper should be accepted or revised (and how), and lead the discussion until the whole editorial board comes to a common conclusion. One of the three reviewers is in charge of writing a letter to the author with the decision and the pros and cons, along with suggestions for revisions. The letter is finally sent for approval to the two other reviewers, to the editor-in-chief and finally to the author. The same process is repeated for all the papers with a different trio for each.

Higher Education follows a very different process, one I already knew because I am regularly asked by international journals to write reviews. In this case, the whole procedure is digitalized by means of a common software package. There is no editorial assistant: everything is run by email and uploading. The only staff that the co-editors are in touch with is the person in charge of the journal at the publishing house. We sometimes had in-person meetings with the contact person regarding the presentation of data about the situation of the journal: the number of papers received, accepted, rejected, revised, and resubmitted, as well as the average time for review, readership, etc. Authors were only in email contact with the co-editor organizing the review of their paper and, if their paper was accepted, with the person preparing the manuscript, somewhere on the planet.

This is a well-known process for all those who have been editors, reviewers, or authors of journals published by the main publishers. It is very convenient, easy to work with, and probably cost efficient. Nevertheless, it raises many caveats. The most crucial one is the overly central role given individually to each co-editor.

The first reservation is that a co-editor is responsible for choosing the reviewers. Such a decision is never completely neutral, and it is therefore a rather important decision. This responsibility also rapidly becomes a burden, because finding reviewers has become a challenge (see for instance Zaharie and Osoian 2016; Zaharie and Seber 2018; Kaltenbrunner *et al.* 2022). In a panel I recently attended, the editor-in-chief of a highly selective journal said that she had to contact 12 reviewers to get a paper reviewed. If one considers that most reviewers are more likely to accept reviews for well-known journals, one can imagine how many email messages the editor of less-reputed journals must send to find reviewers. Finding reviewers who accept the task of writing a review and doing so in a qualified manner and ahead of a reasonable deadline is a problem, which I experienced as co-editor of *Higher Education*. I remember spending hours on Sundays, reading the new incoming papers of the week, thinking of names of reviewers for them, finding new names for papers whose reviewers did not accept the assignment, sending the new version of papers to the reviewers who read the first one with the hope they would be willing to review the next one, and so on. I recognize that my behaviour changed rapidly. In the beginning, I gave papers a chance that I found potentially interesting although not completely convincing. After some time, I decided to desk reject these papers, since I thought they would be rejected at the end of the process. I felt ashamed for doing this for at least three reasons. First, because I think that getting reviews, even with a 'reject' decision, is important for authors wishing to improve their writing and that it

provides a better return than the rapid paragraphs co-editors write to justify a desk rejection. Second, having experienced desk rejections myself, I knew how much more difficult it is to accept such a rejection than a rejection based on reviews. One feels overlooked, not seriously read. Finally, it gives excessive power to the co-editor. I led this co-editor mission with a lot of commitment and tried to be as fair as possible, but who am I to be sure that I did not make any mistakes, that I did not reject a paper another co-editor would have saved? This gives, from my point of view, too much power to one single person.

The process again gives too much power to the co-editor when the reviews are received. If they converge, it is rather easy. However, when they differ – and this is rather frequent – either about the final decision or about the revisions required from the author, the co-editor is the sole person who decides which of the reviewers he or she will follow, which arguments he or she will especially stress.

In order to overcome the defection of reviewers as well as the power and the two heavy responsibilities placed in the laps of co-editors, I suggest that we should revert to a more collective decision-making process, leaving more room for *discussion* and consensus building. One of the problems encountered by the process followed by *Sociologie du travail* was the necessity to meet in-person. It was at the same time a very pleasant moment, very intense, with a lot of concentration but also a lot of laughs and pure collegiality. We probably made some mistakes nevertheless, but at least they were collegial and collectively assumed.

Now that we are all used to meeting online, why not come back to a more collective form of work among members of the editorial board? The editor-in-chief and co-editors – probably a larger number than today – could share the reading of the papers received, discuss their reviews, come to a collective decision, and prepare a common draft. This would of course mean a lot of work for the members of the editorial board, but I am sure people would accept to do this for a limited period, and the rotation of one third of the co-editors every year should be the rule. For the members of these editorial boards, the work will be much more interesting than spending hours finding reviewers. Furthermore, the overview such positions provide of the field and the possibility they give to influence the development of the field should serve as excellent motivation to accept the task of being a co-editor for three years.

Conclusion

It has been more than 40 years since I started my PhD. The expansion in the number of journals, the stratification among them, the transformation of the publishing industry, and the emergence of major players within it have radically changed the relationships of authors to publications. However, the academic profession has also changed. Preparing a dissertation and entering an academic career have become much more ‘organized’ than in the past. PhD candidates are now trained in writing papers, advice is given about the journals to aspire to, future candidates take part in

mock auditions in order to be prepared when they are invited, etc. The requirements for a chance to enter academia are also more clearly specified: international publications are expected, as well as papers in peer-reviewed journals, some teaching experience, etc. Thus, having a publication strategy has become increasingly important. Nevertheless, I think that this should not be at the expense of quality and creativity. Both are at risk today, especially in the humanities and social sciences, where books and publications for a native audience should be preserved.

The pressure to publish has led to the development of numerous journals and the standardization of a review process, organized around co-editors soliciting reviewers and making decisions based on their reviews. However, this is reaching a limit. It requires too many reviews, and co-editors spend more and more time finding reviewers. Thus, desk rejections tend to increase, and peer-review is becoming less and less collegial. Instead of trying to develop incentives for reviewers, we should probably rethink the review process and leave more room for exchange and co-decisions among members of editorial boards.[d] In other words, we should not only focus on the transformation of the publishing industry but also improve what is in our hands: collegial academic decision making.

Notes

a. For that reason, I highly prefer PhD monographs to paper-based dissertations. A transversal introduction cannot replace the articulated development of an argument along chapters.

b. Just to give an example of that: The *American Journal of Socio*logy is considered by many French higher-education institutions as a top international journal. Having collected data on the institutional affiliation of all the authors published in this journal between 2001 and 2010, 82% of the papers were authored by academics of American institutions, 92% with at least one author in a US institution. These figures amounted to almost 90% and 95% for the *American Journal of Political Science* (Musselin 2019).

c. The editorial assistant is a CNRS staff member, whose role is to run the administrative tasks for the journal (receiving the papers, sending them to the reviewers, collecting the letters of revision, etc.), to organize the in-person meetings every six weeks, take notes of the decisions made, interact with the authors, read the proofs and make sure that the authors also read them, prepare the manuscripts for edition, and run the online process. In a nutshell, she performs the work that is distributed among different people or processes in international journals.

d. See for instance the token system proposed by Amy J. Ko at https://medium.com/bits-and-behavior/sustainable-peer-review-via-incentive-aligned-markets-a64ff726da56.

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Is Living Easier With Eyes Closed?

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Blind peer review has become the gold standard of many scholarly disciplines. However, this seems like a paradox since openness is deeply embedded in the DNA of research. Over the last 30 years changes in the managerial paradigms of academia have also induced so many changes in the ecosystem of scholarly communication that many scholars describe the present situation as a crisis. Therefore, in light of the availability of new technologies and the changes in the scholarly communication ecosystems, it might be time to review how we assess research quality and address the paradox of the blindness of peer review.

Introduction

> I am against open peer review because if I'm supposed to reveal my identity to the authors, I will have to do a much better job when I review, and I don't have time for that . . .

These words came from a PhD student recently at a seminar on the topic 'open science', hosted by the Faculty of Health at the University of Southern Denmark. The room went completely silent after her statement. On the one hand, participants recognized their own dilemma when peer reviewing, while, on the other, they realized that perhaps it is time to revisit our current peer-review practices. Questions such as 'Are the current procedures optimal for both reviewer and reviewed?' and 'Do current procedures ensure best-quality assessment of research?' arose from her remark.

The purpose of peer review is to assess the quality of research. It can be done in a variety of ways, but the most prevalent types are single- or double-blind. Single-blind peer review is when the reviewers are aware of the authors' identities, but the authors

are not aware of the reviewers' identities. For double-blind peer review, neither the authors nor the reviewers are aware of the others' identities (Shema 2014).

The double-blind procedure is generally considered less biased and consequently seen as being of higher quality than the single-blind. However, given the remark made by the PhD student above, there are reasons to doubt that, and several researchers have also questioned whether it is in fact possible to mask author identities among the research colleagues working in narrow research fields (Lee *et al.* 2013).

The peer review process was first introduced to scholarly publications in 1731 by the Royal Society of Edinburgh, where a procedure was established that resembled those used in modern scholarly publishing. Materials sent to the Society for publication would be inspected by a group of society members, who were presumed to be knowledgeable about the matter, and whose recommendation to the editor was influential for the future progress of the manuscript (Spier 2002).

Adopting the peer review practice was slow and only gained momentum around the middle of the twentieth century. A famous story tells how Albert Einstein was 'incredibly offended' in 1936 when his manuscript submitted to *Physical Review* was sent out to be refereed. He withdrew it, protesting that he had not authorized the editor to do so (Al-Mousawi 2020). And, several of the last century's greatest publications, such as Einstein's four famous papers in *Annalen der Physik* and Watson and Crick's work from 1953 describing the double helical structure of DNA, were never peer reviewed (Spicer and Roulet 2014).

The modern peer review process found its current form after the Second World War, apace with a gradual and steady increase in scientific research, the specialization of articles, and competition for journal space (Al-Mousawi 2020). Spier (2002) also notes that an important driver in this respect was the commercial availability of the Xerox photocopier from 1959, making replication of manuscripts much easier.

Journals such as *Science* and the *Journal of the American Medical Association* (JAMA) started performing peer review in the 1950s and 1960s, *Nature* in 1973, and *The Lancet* in 1976. However, it was not until by the middle of the 1990s that peer review became commonplace (Al-Mousawi 2020).

Many authors in countless publications have discussed the double-blind peer-review process. Those in favour of the current system argue that peer review is perhaps not perfect, but it is the best we have for now (e.g., Anderson and Ledford 2021), while other authors are critical of the procedure, although they do not present alternatives (e.g., Kern-Goldberger *et al.* 2022). I will take a slightly different approach, arguing that in the light of the current changes in the scholarly communication ecosystem, the constantly increasing publication pressure on researchers, and technological developments, perhaps it is time to reconsider this procedure, to review the workflows and seek means of improving our current system. That is the purpose of this article.[a]

This article is structured as follows. A section will raise the question of whether peer review is an act of communication and, if so, what the implications of this are.

Then follows a section that summarizes the literature on the costs of peer review in terms of researcher work hours. I will then move on to a discussion of the consequences of the phenomenon known as the peer reviewer crisis: it is becoming increasingly difficult for editors to find qualified and willing peer reviewers. The section before the conclusion of the paper will summarize the discussions on biases in peer review. Finally, the conclusion will address to what extent new technologies and practices of the research community offer a potential for improving our current peer review procedures.

Peer Review as Communication

Any transaction where a message travels between a sender and a receiver is in its classical sense an act of communication (see for example, Burnett and Dollar 1989). Shannon and Weaver developed one of the first communication theories describing this in 1948 (Shannon 1948; Shannon and Weaver 1949).

Although their focus was technical, the model rapidly gained momentum due to the introduction of the concept of 'noise'. The model acknowledges that 'noise' can result in distortion of the message at any point of its travel from sender to receiver. Although the model has been criticized for being too simplistic and has had several more advanced incarnations since 1949, it remains a solid frame of reference in communication research and is useful in this context, since it may be used to draw attention to the following point: at any time in any communication process, when the message travels between a sender and a receiver, there is a chance that the message will become distorted, leading to misunderstandings and/or unintended actions.

The peer review process can be considered a communication process since it involves a (series of) message(s) that travel(s) between sender and receiver. Furthermore, there can be no doubt that peer review is also a rather complicated process. For those who want to ascertain the truth in this statement, Googling 'peer review process flow chart', selecting display of images, gives a hint of how complex the process is, seen from the publishers' and the authors' points of view. While Shannon and Weaver's model contained three elements (sender–message–receiver), some of the various flowcharts retrieved by the search suggested above contain more than 25 elements including author, editor, editorial assistant, editorial board, verification and plagiarism check, the actual review process, resubmission process, and so on. With such complicated procedures, it is highly likely that the messages (i.e., the manuscript, the peer-review report, the rebuttal) will be exposed to 'noise', leading to misunderstanding between the author and the reviewer.

It is well known that the most efficient way to reduce the noise-based distortions is by allowing the receiver to provide the sender with feedback, to ask for clarifications or indicate a lack of understanding of the message, and so on. Therefore, since the days of Shannon and Weaver, communication research has consistently shown that one-way communication is not nearly as effective as two- or multi-way communication. What adds to this is that it is also well known that the more complex

the message, the more imperative it is that the communication be two or multi-way, to minimize misunderstandings (e.g., McQuail 2008).

Due to the blindness of the peer review processes, the possibilities of the reviewed to ask the reviewer for clarifications are limited, and consequently the peer review process is to a large extent a one-way communication. One could argue that since the reviewed is often encouraged to write a so-called rebuttal, an opportunity for feedback exists. But this is only the case if one can assume that the message of the reviewed was correctly understood by the reviewer to start with; second, that the review report was correctly understood by the reviewed; and, third, that the rebuttal letter is correctly understood by the reviewer. Bearing Shannon and Weaver's model in mind, with all its potential for infusion of noise, it is hard to imagine that this is an efficient way of conveying a message. In other words, we have allowed the cornerstone of academic quality assessment – the peer review – to rely on a communication process where the chances of misunderstandings and misinterpretations are quite large.

What may be even more puzzling is that, while the Mertonian CUDOS norms – Communalism, Universalism, Disinterestedness, and Organized Scepticism (Merton 1973 [1942]) – are generally accepted as institutional imperatives comprising the ethos of modern science, one could argue that the double-blind peer review process does not truly encourage organized scepticism. Reviewers may be biased against certain theories and approaches, and, due to the anonymity, the reviewed cannot defend him-/herself against such potential prejudices.

Similarly, when it comes to the principle of communalism, the double-blind nature of the process hinders collaboration and communication between the reviewers, since they are not able to build relations or engage in a constructive dialogue due to the enforced blindness. But still, we use blind peer review for almost all processes where research or researcher quality are assessed: for hiring, tenure, promotion, institutional assessments, funding, and publishing (e.g., Moher *et al.* 2018). Since the peer review practices of the scientific journals are the ones that are most thoroughly studied and that researchers are subjected to most frequently, the remainder of this article focuses on those.

The Price of Peer Review

It is well documented that a lot of time is spent on peer reviewing scientific journal articles. A study from 2021 conducted by a group of Hungarian psychologists made the following simple calculations based on publicly available data (Aczel *et al.* 2021): using a reference database that indexes approximately 87,000 scholarly journals, they found that in 2020 at least 4.7 million articles were published. It should be noted that even though the database covers 87,000 scholarly journals it does not cover all scientific journals. Consequently, the calculations to follow are based on a conservative estimate.

Their research also revealed that, on average, across all journals in the database, only 55% of manuscripts submitted to the journals are published. Consequently, they assumed that an additional 3.8 million articles are submitted, peer reviewed, and rejected. To assess how many peer reviews are needed to process this number of articles, they made another conservative estimate. Each published article on average needed three peer review reports, and each rejected article needed two. Therefore, they made the following calculation: (4.7 million × 3) + (3.8 million × 2) = 21.8 million. This means that in the year 2020 a total of 21.8 million peer reviews were carried out to publish the 4.7 million articles.

The next question is how much time it takes to do this. Figures vary across disciplines, but, again based on data from Publons (2018), a conservative guess would say 6 hours per review.

As a result, one can calculate the number of hours spent on peer reviewing journal articles to be 130.8 million hours annually, or just about 15,000 years of working 365 days of 24 hours. So, assuming that peer review is only done during an 8-hour working day, the peer reviewing done in 2020 for these articles equals the annual workload of 45,000 researchers. Based on these calculations, it is fair to say that the peer review processes are quite time-consuming. That is not a problem in itself: Research is by nature time-consuming. The problem is that due to the blind nature of much of the peer review work, many institutions fail to acknowledge peer review as researcher workload (Bernstein 2013).

The Gap in Demand and Supply of Peer Review

To this should be added that the growth rate of scientific articles has been around 4% annually (Bornmann *et al.* 2021). The growth rate of the number of researchers far exceeds the growth in research output: the number of researchers has grown by between 10% and 15% annually over the last few decades (Naujokaitytė 2021). However, the growth in the number of researchers is not equally distributed around the globe. It is in countries such as India and China that this growth is the highest.

Furthermore, a recent study found that only 10% of the active peer reviewers are responsible for 50% of all peer reviews. That study also found that in 70% of the cases where researchers decline to carry out a peer review, their reason for declining is that they consider the article to be outside their area of expertise (Petrescu and Krishen 2022). This high percentage is probably a sign of editors' difficulties in finding qualified peer reviewers.

So, to be able to identify reviewers, editors must search further and further away from the centre of the disciplines and move down the academic ladder. For my own part, I am being asked on a regular basis to do peer review on topics that I have not worked on for the last 20 years, or even on topics that my co-authors from cross-disciplinary work have been working with, such as biology. In a survey of the qualifications of peer reviewers, 40% of them admitted that they have never received any training in peer reviewing (Petrescu and Krishen 2022).

To sum up, there is clearly a gap between the demand and the supply of quality peer review, often referred to as the 'Peer Review Crisis'.

The editor-in-chief of the *Journal of Psychiatric Research* described in an editorial letter how she receives more than 50 manuscripts weekly and how she must send out at least ten invitations to peer review to get two acceptances (DeLisi 2022), which amounts to sending 500 invitations to review weekly. Of the two that accept, on average only one of them will return a timely peer review. So, on top of the 500 weekly invitations, she must send an additional 250 emails to peer reviewers that do not deliver or to identify others who will.

On one day this editor decided to record all reasons for reviewers declining (DeLisi 2022):

> too many deadlines . . . I decline due to illness . . . illness in the family . . . I am on leave . . . about to have a child . . . on maternity leave . . . on paternity leave . . . on sabbatical for 6 months . . . not available at this time; try me another time . . . sorry, really have no time . . . due to my work schedule I am unable to do it at this time . . . not enough time right now . . . outside my area . . . don't have the expertise . . . current work load does not allow me to do this . . . this is a busy time . . . on holidays . . . won't review for your journal anymore because you took too long to get my own paper reviewed . . .

All these are very familiar and understandable excuses. Some editors experiment with APC vouchers or even 'best-peer reviewer awards', but none of these solutions have so far bridged the gap. Senior researchers are not in it 'for the money', APC vouchers only have value if the reviewer plans to submit to the journal he/she is reviewing for, and peer reviewer awards obviously lose their value if they are given to all peer reviewers. Studies on whether monetary rewards are effective have also been discouraging so far (Zaharie and Seeber 2018).

Biases of Peer Review

In a frequently cited essay from 2006, Richard Smith, a former editor of a highly ranked medical journal, summarized the flaws of the peer-review processes (Smith 2006). In an entertainingly eloquent style, he accounts for many of the experiments done to find out whether peer review serves its purpose. He concludes as follows:

> peer review is a flawed process, full of easily identified defects with little evidence that it works. Nevertheless, it is likely to remain central to science and journals because there is no obvious alternative, and scientists and editors have a continuing belief in peer review. How odd that science should be rooted in belief.

In one of the experiments, the editors of the journal inserted major errors into a series of manuscripts and sent them to regular peer reviewers. None of the peer reviewers identified all errors; some spotted none and most only about a quarter of them.

In another study dealing with the inconsistencies of peer review, he presents a series of examples of the subjectivity of the process. This example is among the most grotesque (Smith 2006).

> Reviewer A: I found this paper an extremely muddled paper with a large number of deficits.
>
> Reviewer B: It is written in a clear style and would be understood by any reader.

On top of the subjectivity of the process, one might add that it is also documented by several studies that peer review is often biased (Haffar *et al.* 2019) against, for example, gender (Kern-Goldberger *et al.* 2022) or institutions. In a study, 12 already-published articles by famous authors from famous institutions were selected. The names of the institutions were changed to names such as 'The Tri-Valley Center for Human Potential'. In only three instances did the journal editor and peer reviewers realize that the articles had already been published in the journal. The remaining nine were rejected (Smith 2006).

On a regular basis, social media are awash with stories about how peer review processes have been used to steal other people's ideas, to delay competitors' research, or to suppress interpretations of data or theories with which the reviewers disagree for one reason or another. For those who find such stories entertaining there is a Facebook group with the title 'Reviewer 2 must be stopped' dedicated to sharing horror stories on peer review.

Quo Vadis?

One could optimistically think that all or at least some of these failures could be overcome by adequate education and training of peer reviewers. However, when the editors of the above-mentioned highly ranked medical journal undertook a randomized test, the result was disappointing. They divided a group of peer reviewers into three subgroups: one that received no training, one that underwent face-to-face training combined with a digital learning program, and one that only received the digital training. The conclusion of the experiment was that there was no difference in the performance across the three groups (Smith 2006). A former editor of another highly ranked medical journal used to joke that he was not sure that anyone would notice if he swapped the pile of rejected manuscripts with the accepted ones (Smith 2006).

However, keeping in mind that there is currently no obvious alternative to peer review for assessing the quality of manuscripts for scientific journals, we should seek a means of improving our current practices. One obvious question to ask is: could opening the peer review processes be part of the answer? Not even such a simple question as this is easy to answer. First we need to agree what we mean by 'open peer review'.

A study from 2017 identified 122 different definitions of open peer review from a systematic review of 137 articles (Ross-Hellauer 2017). The analysis of the articles revealed that the each of the definitions contained one or more of these elements:

- Open identities: authors and reviewers are aware of each other's identity.
- Open reports: review reports are published with the article.
- Open participation: the wider community may contribute to the review process.
- Open interaction: a reciprocal discussion between author(s) and reviewers, and/or between reviewers, is allowed and encouraged.
- Open pre-review manuscripts: manuscripts are made immediately available via preprint servers such as arXiv ahead of any formal peer review procedures.
- Open final version commenting: review, or rather commenting, is done on the final version of the publication.
- Open platforms ('decoupled review'): reviews are facilitated by a different organizational entity than the venue for publication.

However, the core traits of the 122 different definitions were easily identified:

- Open identity is part of 90% of the definitions.
- Open reports are part of 60% of them and
- Open participation of 30%

If the three are combined with a Boolean 'or' then 99% of the definitions are covered. Consequently, the discussion should revolve around these three core traits and to what extent they will solve the problems discussed above.

There is little evidence in this matter so far (Ross-Hellauer and Görögh 2019). One might assume that open identity would lead to better-quality peer review and that it could create better incentives for researchers to do peer review work, since it would enable consistent registration of peer review activities as part of the researcher workload.

However, it could also hinder peer review. Peer reviewers may decline reviewing assignments due to a fear of unprofessional behaviour of the reviewed and vice versa. A study from 2019 reported that when faced with the opportunity to reveal their identity to authors, only 8% of 18,000 reviewers chose to do so (Bravo *et al.* 2019). Their study also showed that among those who chose to have both their name and the review open, the rejection rates were lower than among those who remained anonymous.

The researchers found no significant negative effects on referees' willingness to review, their recommendations, or turnaround time of open peer review. On the contrary, reviewers were keener to accept to review, more objective in their reports, and less demanding regarding the quality of submissions when under open peer review. The tone of the report was less negative and less subjective. Again, since only 8% of reviewers agreed to reveal their identity, we still need to understand the appropriate level of openness of peer review. In fact, more than 90% of the reviewers still preferred the blind procedure (Bravo *et al.* 2019).

Since the study only measured the effects on those who volunteered to do open peer review, it cannot be used to predict the consequences of making open peer review the default. There is a real danger that the gap in demand and supply of peer review may widen even more and that the increase in the quality of the peer reviews seen among volunteers would not apply in a full-scale setting.

In summary, opening peer review (defined as open identity and open reports) could be part of the answer, but could also have other unforeseen consequences: there is no guarantee that it will solve the deficit gap between supply and demand for peer review, and there is no evidence suggesting that it could solve bias problems.

Recent developments within the realm of Artificial Intelligence (AI) suggest that sometime in the not-too-distant future the role played by AI in peer review may become more significant (Checco *et al*. 2021). No fully automated AI peer reviewer tool has yet been developed. Nevertheless, editors and reviewers are already getting computer-based assistance with specific tasks relating to peer review, such as screening references, plagiarism detection, and checking compliance with journal policies (Hosseini and Horbach 2023). AI systems may also help identify reviewers, support reviewers' writing of constructive and respectful reports, assist in formatting so that reviewers may focus more on content than format, and assist editors with desk rejection of manuscripts (Hosseini and Horbach 2023).

Currently, the discussions about using AI for peer review are mostly centred on how AI can assist reviewers and authors rather than replacing human decision making or to what extent AI can be used to model human reviewer decision making and to expose possible biases. However, research has shown that AI-based systems are able to successfully predict peer review outcome (Checco *et al*. 2021). This is not surprising since AI, until now, has been mimicking human intelligence, and AI techniques are trained on data from the past. Therefore, any AI system will have the same biases as human reviewers have (Hosseini and Horbach 2023). Hence, while AI may be capable of performing full peer review in the future, it may have exactly the same weaknesses as the current practices.

Concluding Remarks

In summary, neither opening up the peer review processes nor using AI for peer review can solve the current peer review crisis here and now. However, both may provide elements of a future solution. While opening the peer review process through open identity and open reports may modernize the communication process, reduce bias, increase the quality of peer review and create better incentives for researchers to perform peer review, it may not narrow the gap between demand and supply since opening the process may also mean that performing peer review will become more time-consuming. This problem, in turn, may be solved by developing advanced AI to assist human decision making in peer review processes and thus save time and money. However, with current technology, such tools may reinforce bias due to the inherent conservatism built into the learning processes of AI-based systems.

So, apparently, there are no quick fixes, and the pressure on the scholarly communication ecosystem remains.

In this article, I have focused on peer review for scientific journals only. I have shown how the scholarly communication ecosystem is under significant pressure in relation to peer review in the publication process. In other areas of the ecosystem, the demand for peer review is also increasing. The European Researcher Assessment Reform under the Coalition for Advancing Research Assessment (CoARA) encourages the use of qualitative assessment of research and researchers for funding, promotion, and tenure. The intention of this is to reduce the irresponsible use of quantitative measures such as *h*-indexes, journal impact factors and citation rates for hiring and firing purposes. If this is successful and implemented in larger parts of the world, one must expect the demand for peer review to increase in the years to come. The question of how to manage this in the future still needs to be addressed.

Note

a. This article is based on a presentation given at the Wenner-Gren Foundations and The Academia Europea International Symposium 'Publishing in Academia: Digital Challenges' held in Stockholm, Sweden, May 2023. When I was first invited to give a presentation at this event, I was working as full professor of Scholarly Communication at the University of Southern Denmark. When the symposium was held, I had recently been appointed Vice President of European Library Relations at Elsevier. Consequently, my presentation at the event reflected my personal and professional views and was not a statement of any formal Elsevier company policies. Since the presentation, I have become aware that parts of this article may be interpreted as conflicting with company policies, although such interpretation would not be fair to the text. However, since the article must be aligned with the presentation given at the event, I have maintained the flow of the argument from the original presentation.

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The Precariousness of Academic Publishing in a Digital World

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The world around us is growing increasingly digital and data-intensive, affecting our lives and practices as citizens and researchers in a multitude of ways. We have to ask how we ensure that academic research remains trustworthy and transparent as digitalization disrupts our practices. This article draws attention to the multifaceted nature of the challenges early-career researchers face with academic publishing in the digital era. Thus, rather than zooming in on one aspect, and losing track of the complexity of the problem, it addresses (1) the purpose of academic publishing, (2) the type of material to be published, (3) the role and use of AI and data in research, (4) the entanglement of academic publishing and research assessment, (5) the role of Open Science, and (6) what makes early-career researchers as a group different from other researchers.

Introduction

When I was first invited to speak on behalf of the European Council of Doctoral Candidates and Junior Researchers (Eurodoc) at the Wenner-Gren symposium, 'Publishing in Academia – Digital Challenges', the title puzzled me. Somehow, it seemed to me that this title indicated that digital challenges are a niche set of challenges when it comes to academic publishing and can be separated from non-digital ones. As an early-career researcher (ECR) who qualifies as a millennial, my world is fundamentally digital, and such a distinction between digital and non-digital challenges struck me as artificial.

In the months since the symposium, I have come around; I now find that this title is timely and well chosen, and it points towards the future. The world around us is growing increasingly digital and data-intensive, affecting our lives and practices

as citizens and researchers in a multitude of ways. I have titled this article 'The precariousness of academic publishing in a digital world' because, as I see it, the digital world where everyone has access to almost any information at any time makes the foundation of academic publishing precarious.

One of the ways I see this precariousness is that there is a tendency to focus on text material, such as articles or books, when discussing academic publishing. These are objects that previously could only be published in physical copies, yet one was still able to mass-produce them and distribute them at a larger scale. Today, such materials are published both in a physical and digital format. For me, an ECR who has never experienced another version of academic publishing, the challenges with this form of publishing are not digital per se. These are simply the standard challenges with academic publishing. Genuinely digital challenges arise when we instead look at other formats of research materials that can only be shared effectively on a large scale in a digital format, such as images, audio, and videos and, as society and research are growing more data-intensive, the research data. If we focus mostly on the publishing of articles or books, we fail to recognize how different digital challenges can look depending on the type of material to publish. We have to ask how we ensure that academic publishing remains trustworthy and transparent as digital publishing disrupts what can be published and how we can publish.

These days, to speak about data inevitably introduces a discussion about artificial intelligence, typically in the form of large language models such as ChatGPT, and their use. Such a discussion quickly entails that one has to address privacy concerns, and we are all encouraged as private citizens to be careful with whom and what we share our private data. At the same time, we, as researchers, are encouraged to share our research as openly as possible, including our research data. These two viewpoints are not necessarily at odds with one another. However, there is a tension and potential challenge on how to merge potential privacy concerns of research subjects with Open Science policies.

Returning to the topic of the symposium, I want to draw attention to digital challenges ECRs face with academic publishing; they are multifaceted, which entails that if one zooms in on one aspect, then the complexity of the challenge is not seen. Thus, for me to address what digital challenges ECRs face regarding academic publishing entails addressing (1) the purpose of academic publishing, (2) the type of material to be published, (3) the role and use of AI and data in research, (4) the entanglement of academic publishing and research assessment, (5) the role of Open Science, and (6) what makes ECRs as a group different from other researchers.

It might have been natural to start with what makes ECRs unique as a group of researchers. However, I wish to begin elsewhere, namely in the next section, 'What is the purpose of academic publishing', with a discussion about the purpose of academic publishing, and then second, in the section 'The digital elephant in the room', with some reflections on how the increased use of AI in research needs to lead to reflections about how to manage data responsibly. Then, in the section 'What makes early career researchers special', I address the issue of how precariousness and its possible consequences make the situation of ECRs unique, and, in the context of

adopting Open Science practices, I discuss how this precarity affects the open science practices of early career researchers. In the section 'Open Research Data', I elaborate on what it is that makes the publishing of research data and in particular Open Research Data so complex. Finally, in the section 'Three thoughts on the future', as the title suggests, I provide three reflections about challenges that need to be addressed.

What is the Purpose of Academic Publishing?

With academic articles and books in mind, it is relatively easy to provide a generally accepted answer to this question, such as, 'to communicate research findings' or 'the purpose of academic publishing is to facilitate the dissemination of new knowledge and research findings to the research community and even beyond'. The publishing of academic articles and books plays a vital role by providing a platform for researchers to share their research with not only other researchers but also with students, policymakers, and the public. Through peer-reviewed journals and books, academic publishing contributes to the accumulation of collective knowledge. However, publishing and sharing research also allows other researchers to check, challenge, and rigorously review the research. If we consider the motivations for sharing research data, then the rationale behind it is that by doing so, researchers contribute to the transparency, reproducibility, and credibility of their research. When research data is open, it becomes a resource that not only other researchers can reuse but also educators, policymakers, innovators, and the general public.

Academic publishing has evolved from handwritten manuscripts to today's digital publishing. However, with the re-invention of the printing press in the fifteenth century, publishing, including academic publishing, was revolutionized by allowing for the mass production of written material. Thus, since the seventeenth century, academic journals have been a cornerstone of scholarly communication. Similarly, with the invention of the internet, a second revolution in academic publishing began, and today academic publishing involves both traditional print and electronic formats (Fyfe 2019).

As research in many cases relies on public funding, it can be argued that our collective knowledge is public property and that researchers should share their findings openly, so that everyone is ensured access without barriers, which is in alignment with the principles of Open Science that 'Science is to be as open as possible and only as closed as necessary' (UNESCO 2021). Open Science can, as a value, serve as a compass for what good science is, but at the same time, Open Science is also seen as a concrete set of practices that individual researchers must implement to realize the vision described above.

Academic publishing does not exist in a vacuum. Since the 1980s, academic publishing has been an integral part of research assessment, and the emphasis in today's research assessment system on journal impact factors poses a significant

problem that initiatives, such as the San Francisco Declaration on Research Assessment (DORA), aim at addressing (DORA 2022).

The lack of recognition of research that aims to reproduce previous research results in combination with the publish-or-perish culture is a factor that contributes to what has been called the reproducibility crisis, where researchers struggle to reproduce the findings of others (Baker 2016; Ioannidis 2005). It downplays the importance of the work of peer reviewers, which, as argued by Flaherty (2022) and others, can be considered one of the reasons it is hard to find peer reviewers.

In a growing digital world, it is striking how the current criteria used in research assessment fail to acknowledge the impact of other formats, such as data or code. The strong focus in research assessment on publications in the form of articles or books makes it easy to neglect the importance of communicating research findings in ways other than the traditional ones (Khan *et al.* 2022).

The Digital Elephant in the Room

As researchers and citizens, we all face the challenge of addressing the changes that artificial intelligence (AI) is bringing. In the media, over the past year, it has brought countless articles that discuss how AI in the form of ChatGPT, Dall-E 2, and the like will disrupt the labour market and change the educational system. The use of AI in our daily lives is not new, and most of us already rely on email spam filters or recommendation systems in streaming services to make our lives easier. All of these tools are constructed using similar techniques, namely machine learning (ML) (an introduction to AI can be found at the University of Helsinki MOOC centre).

Traditional computer programs can be viewed as a rule system; an algorithm receives data, and then, according to the rules, it can process the data to give us an output. If we already know the relation between the input data and the output, which can be expressed as a mathematical formula, then in principle, the algorithm is just automation of something we could have done ourselves. The advantage of using the computer program is that it is faster and can process more data than we can, but what the computer program does is fully explainable to us.

However, the examples mentioned, from recommendation systems and spam filters to ChatGPT, are constructed differently. Here, one initially does not know the relation between input data and the output. Instead, using ML techniques, such relations are statistical correlations found through training. The specific training method can vary; generally, one speaks of supervised, unsupervised, or reinforced learning methods.

All three methods of training modify the initial model. The information stored in the training data is inherited into the modified model. When presented with new data, the model has now learned to process this data, and depending on the type of learning algorithm, it can transform the input data into different forms of outputs, such as recommendations or solutions to optimization problems. However, the exact relation between input and output can only be retrieved if the structure of the model

is very simple or the dataset is small, and in contrast to traditional computer programs, it will remain unexplainable.

At the very heart of such models lies the fact that they need to be trained on data in order to be effective, and thus, the quality of the training data is crucial for the quality of the final model. This implies that if the outcome of the AI model is to be trustworthy, the training has to be unbiased. If the training data are intentionally or unintentionally biased, this bias will be inherited into the final model. For recommendation systems used to suggest what movies you should watch tonight, such a bias might only pose a slight annoyance. However, if the AI model is used instead to make medical treatment recommendations or produce court sentences, any such bias can not only have enormous consequences for the individuals but also affect our trust in the medical system, the juridical system, and democracy (Mittermaier *et al.* 2023; Hamilton 2023).

The Use of AI in Research

Moving closer to home, AI tools could be used for initial peer reviewing and thus would be used to judge what is published. However, the problem of bias is encountered here, because, as before, the tool is trained on a dataset, and if it or the initial model is biased, then this will carry over into the sentencing, whether in the court or the editors' room.

If we take it a step further, we can think of using AI tools for grammar checking our articles, finding references for specific paragraphs or identifying where counter-arguments are needed. Leaving aside the question about where the line is to be drawn for what is good scientific practice and what is not, there also is a challenge due to the risk of the tool inheriting a bias from the training data that must be addressed.

In addition to the above examples, which were chosen to illustrate how AI tools can support researchers in work by identifying different forms of gaps in their research but where the researcher still is left to do the actual research themselves, it is straightforward to think of situations where AI tools help the researcher with doing the research, such as writing suggestions for paragraphs for articles or books or suggesting counter-arguments. The exact line between scientifically acceptable and unacceptable practices is a discussion that needs to be had, but it is not what I wish to highlight here.

Instead, I want to highlight here that using any AI tools relying on machine learning techniques comes with questions and worries about potential bias in the data. Sometimes, these questions are quickly answered, and the worries can be dispelled, but sometimes, this will not be the case.

The above examples work well as examples of how AI tools can be used (and misused) within most research fields, but it still is only the tip of the iceberg regarding the potential uses of AI in research. If we have enough data, we can also use the same techniques to study the world around us and uncover new knowledge.

In physics, ML techniques have been used to rediscover Newton's laws of gravity, and we can envision how they might be used to find unknown laws of physics

(Li 2021; de Silva *et al.* 2020). The status of such physical laws certainly comes with epistemic questions attached. The issue of the potential epistemic value of correlations found using AI based on ML techniques is not a problem unique to physics.

The examples provided by Mitterrmaier *et al.* (2023) and Hamilton (2023) of how AI can be used to diagnose patients or to suggest sentencing for criminal offences can be reformulated to take the form of research. Say that researchers discover a correlation between where people live or their employment situation and how they are sentenced in court. Is the research finding to be shared a correlation or a bias, and how can this be determined?

As in other cases, working with data in research comes with ethical considerations. Among these are privacy concerns, which must be addressed to ensure responsible use and potential data sharing.

In the case of ML models, privacy concerns can be used and misused as an argument against sharing research data. However, one can also turn the argument around and instead use it to contend that the data that AI models are trained on and the code behind them need to be made open. As the code has trained on the data, the data are inherently in the tool, and thus, there is no guarantee that the privacy-sensitive data cannot be retrieved from the tool. Thus, one could also argue that if training data should not be shared publicly owing to privacy issues, then such data should not be used to begin with.

Responsible use and sharing of data in research that relies on ML models is a challenge, and it needs to be addressed. As many research fields that before were not considered data-heavy grow more reliant on data, it means that more researchers need to be trained to handle these challenges, and this is especially important when it comes to ECRs, as they are the ones with the longest part of their career in front of them.

How do we ensure that AI models are used responsibly in research? To what degree should we expect that researchers understand the AI models they use? To what degree do we need to train this and the next generation of researchers in the responsible use of AI models, data handling, and Open Science practices? These questions must be tackled to ensure that research is to be reproducible and that research practices are to be transparent in the future.

Researchers need to be trained on these topics, and research needs to be trained on how AI will shape research.

What Makes Early-career Researchers Special?

The challenges mentioned above are challenges that impact not only early-career researchers but more senior researchers as well. However, depending on where you are in your academic career, they will affect you differently.

A shift in research practices has taken place over the last 30 years. Compared with 30 years ago, more early-career researchers publish in academic journals during their

doctoral education. While doing so, doctoral candidates will often publish in the same journals and on the same conditions as senior researchers; thus, the work they submit meets the professional standards of the field (Kendal *et al.* 2022).

In 2020, there were around 650,000 doctoral candidates and just under 2 million other researchers in Europe (the numbers can be found through Eurostat 2023). Of these 2 million, around 30% were employed in the higher-education sector, comprising not only researchers with permanent employment but also other ECRs than doctoral candidates, such as postdocs. This means that the number of ECRs likely exceeds the number of researchers employed in the higher-education sector with permanent employment, and, as was also pointed out in a recent editorial in *F1000*, ECRs are not a homogeneous group (Mohammed 2023). Thus, it should be remembered that different groups of ECRs also face different challenges when it comes to publishing.

However, there are two conditions that most ECRs have in common, namely that they have precarious working conditions and that many of them are likely to leave academia (Hnatkova *et al.*, 2022; Boman *et al.* 2017). These two conditions are particularly interesting to remember when discussing any challenges ECRs face, as these conditions make them, as a group, significantly different from more senior researchers.

Precariousness is not only a question of the lack of permanent employment; it also concerns what this entails for the individual at their workplace and society. Precarious employment can entail reduced access to social security, such as sick leave, parental leave, unemployment benefits, or pension savings, compared with what would be considered the norm. Precariousness in the form of not having access to parental leave or not being able to get a mortgage due to non-permanent employment creates a lack of plannability in your professional and private life. Depending on your particular situation in life, precariousness has different consequences that not everyone can equally well afford. Thus, precariousness is a barrier to diversity (OECD 2021).

Academia is the workplace of ECRs, and their types of contract and funding influence the access to support at their workplace and their working conditions. If your working life consists of a sequence of short-term contracts or scholarships, you will likely have shorter or longer periods without a contract or a scholarship. While you have employment or a scholarship, you will likely have an official affiliation with an academic institution. It is likely that the institution, say through its library, provides a range of services related to publishing. However, when your contract or scholarship runs out, you will likely lose the right to use these services.

Whether an ECR is employed or financed by a scholarship can also have consequences on which services are provided by the university with which they have an affiliation. In some places, career guidance programmes will only be offered to those employed; similarly, affiliation can influence whether they are eligible to be a member of the labour union or not, and thus whether they have access to professional help if they have disputes at their workplace (OECD 2021; Tress Academic 2022).

No doubt, many universities wish to provide a good working environment for their ECRs. However, as an ECR, I experience that the consequences of precarious working conditions are forgotten or treated as an outlier problem. At the same time, ECRs, in many situations, have limited representational rights compared with others and, therefore, also lack a formal platform for raising their issues and concerns (Pizzolato *et al.* 2023; Kent *et al.* 2022).

The point I wish to stress with the above is that when discussing challenges that ECRs face compared with other researchers, one always has to ask how precarious working conditions influence these challenges in the best- and worst-case scenarios.

ECRs and Open Science

Several studies have been done to explore the Open Science practices of ECRs (Berezko *et al.* 2021; Nicholas *et al.* 2020; Gownaris *et al.* 2022; Toribio-Flórez *et al.* 2021, among others). ECRs are found to be favourably inclined towards Open Science practices, and they, in general, see many benefits with Open Science (see Gownaris *et al.* 2022, and Allen and Mehler 2019). However, they do not necessarily practise what they preach, meaning that they do not necessarily publish with open access.

When asked about which challenges they experience with open science, three themes are repeated: lack of impact, lack of financing, and lack of knowledge. Others have discussed and analysed these challenges thoroughly, and I refer the reader to the references mentioned above for such an in-depth discussion. What I want to focus on here is what it entails to consider these three issues through the lens of the precarious conditions that ECRs experience.

While publishing with open access can lead to higher citation rates (Lawrence 2001; Langham-Putrow *et al.* 2021; MacCallum and Parthasarathy 2006), ECRs still experience that it comes at the cost of a lack of impact, meaning that they experience that open-science practices will not be valued or rewarded or even considered in the research assessment practices, as discussed by Khan *et al.* (2022). If your chances of obtaining funding for your next employment depend on the journal impact factor of where you published your current research, then the indirect cost of choosing open-access publishing can be unaffordable.

However, there are not only indirect costs associated with publishing with open access. There are also direct costs associated, such as in the form of Article Processing Charges (APCs). However, the question is then: who is to pay the fee? Some institutions cover these fees centrally, but if this is not the case, the question of who pays remains. One option is that the fees are covered by the researcher's funding. However, for many ECRs, the use of this funding will not be theirs to decide upon as they will not be the primary grant holder. And, if all other options fail, do we expect ECRs to pay such fees out of pocket? It must be acknowledged that financial barriers pose an obstacle for some ECRs when it comes to adopting Open Science practices, and, as argued by Bahlai *et al.* (2019), Open Science is not equally open to everyone.

At the 2023 Wenner-Green symposium, in a discussion about whether publishers can legally forbid researchers from sharing preprints and thereby pose a legal challenge to Open Science, it was expressed that this would be interesting to test and settle legally.

As an ECR, it struck me that it was assumed that the imaginary researcher in the example would be protected by labour laws and that the university, as the employer, would protect and support the researcher. Not only does this directly assume that the researcher is employed by the university, but indirectly, it also means that this employment has to be permanent. For me and other ECRs, the question remains: if such a dispute were to arise, where would this leave us if we were financed by scholarships, were between employments, or had moved on to a career outside of academia?

Most ECRs have little legal training and cannot answer such questions themselves. The situation described above worries me. In general, when we discuss the legal protections that researchers have in their professions, many of those are actually tied to regular labour laws or are in other ways connected to stable if not permanent employment, and for the majority of researchers in academia today this is not the case. And this is something that academic institutions need to address better, whether it regards potential conflicts with publishers, access to research data, or something else.

Open Research Data

Open-access publishing is only one of many open-science practices relevant to ECRs. Open science, in general, aims at increasing the transparency in research. Other practices such as open research data, open code, open hardware, open infrastructure, and open educational resources must also be considered (Dolinar *et al.* 2023).

Open Research Data refers to the practice of making the research data openly accessible to other researchers and the public, and in its fullest version, this is done without restrictions, barriers, or limitations. However, this is easier said than done. Research data are the raw, factual information collected, observed, or generated during research activities. Even though numerical values and/or text are typical data formats, it should be remembered that research data can take various other forms. Data are as varied and diverse as research itself. For example, in the humanities, data will include cultural artefacts and textual materials, ranging from historical documents to modern visual artworks. On the other hand, in the natural sciences, such as physics, data include experimental measurements and observations that may be generated from particle collisions in high-energy experiments, astronomical observations, or computational simulations. As the examples show, data can be quantitative and qualitative, created with research in mind or for other purposes, and come in various formats. Speaking about implementing open research data practices encompasses all of this.

Historically, having access to data meant having access to where the research data were physically stored, and this limited who could have access. Today, much of what can be regarded as data can exist in a digital format, and thus, anyone, in theory, can have access to almost all data at any time.

One widely discussed way to support this move is to implement data management plans (DMPs) more rigorously. A DMP is a document that outlines essential aspects of research data management throughout a research project and after it has ended. DMPs outline how research data will be collected, organized, stored, shared, and preserved. By specifying metadata standards, data formats, access protocols, and preservation strategies, DMPs are a tool to ensure that the data are findable, accessible, interoperable, and reusable. Thus, it aligns with the FAIR (Findable, Accessible, Interoperable, and Reusable) principles, which aim at enhancing research data's (re-)usability. In the broader scope of Open Science, DMPs align with the movement's emphasis on transparency, reproducibility, and accountability.

However, while some studies show that open research data are also likely to increase the use of the data and related citation rates (e.g., Woods and Pinfield 2022, Piwowar *et al*. 2007; Piwowar 2013), it also adds another item to the list that ECRs and other researchers must do. ECRs already report facing challenges in adopting open data practices owing to limited resources, lack of training and education, and concerns about data privacy and intellectual property rights. Thus, moving to open research data is a complex task. If it is to work, then early career researchers must be trained and supported in doing so.

Three Thoughts on the Future

I want to finish by returning to the title of this article, *The precariousness of academic publishing in a digital world,* and offer my perspective as an ECR on how to address this precariousness.

I start with the easiest one, and that is the concrete suggestion that university libraries implement a much more comprehensive online guide to support the training of ECRs and other researchers in adopting online practices.

My second point is to highlight the importance of reforming the research assessment system. This is not an easy task, but right now the research community has a platform through the Coalition of Advancing Research Assessment (CoARA) that offers a unique possibility to do so – and this opportunity should be used.

The final point I wish to make is that when we discuss academic publishing, we should acknowledge that it has strong ties to academic freedom. Freedom to learn, freedom to teach, and freedom to do research require that research is published and shared. Across Europe we see that academic freedom is being threatened, and this should worry us and make us question our current practices, because academic freedom in all its forms is a prerequisite for democracy (West 2022). For me this is by far the hardest challenge to address, but I see the need for ECRs to be included and considered when it comes to academic freedom.

I have chosen these three topics, because, as I see it, one is straightforward to address, the second is timely, and the third, albeit hard, is absolutely necessary to address for the future of democracy. In the following subsections, I turn to each of these topics in greater detail.

The Role of Libraries in the Training of ECRs in Open Science Practices

Learning how and where to get your research published is part of being a doctoral candidate and often something you undertake with the support of your supervisor. In general, it is not uncommon for ECRs to follow senior researchers' advice about where to publish. This is not problematic in itself, and many senior researchers do an excellent job of supervising and supporting ECRs when they are new to publishing. However, if the senior researchers are not familiar or comfortable with open-science practices, then we cannot expect them to be the ones who train ECRs in such practices either.

Thus, the existing challenges with training ECRs in open-access publishing are likely to increase when it comes to training them in open research data practices. Tools such as DMPs will become necessary in research fields where it previously would have been considered overkill and, in many situations, it will be just as likely, if not more likely, that it is the ECR that will support the senior researchers in such practices rather than the other way around.

When ECRs report that they lack knowledge about Open Science practices and need better training on such practices, it should be taken seriously, but one straightforward path to addressing this challenge is to expand the (online) support that university libraries offer.

While many universities have adopted comprehensive open-science policies, which are often easily accessible through either the university website or the university library's website, the same cannot be said about guides and support. For inspiration on what such comprehensive online support could look like on open-access practices in general, I recommend considering the support offered by the Europe-wide initiative FOSTER and Leiden University in the Netherlands. However, it should be mentioned that FOSTER is no longer maintained. When it comes to inspiration on how to find support on the topic of Open Research Data, Leiden University, Oxford University in the United Kingdom, and Aarhus University in Denmark all offer comprehensive online guides.

These guides are useful to varying degrees, and they will definitely not suit all researchers perfectly; however, they can serve as a good starting point. I would, however, recommend including local ECRs and more senior researchers, from different research fields, when developing and maintaining such guides.

A Necessary Reform of Research Assessment Systems

The challenges researchers face with academic publishing are, however you phrase it, entangled with the challenges of the current research assessment paradigm.

This connection must be addressed to tackle these challenges and implement better and more sustainable practices to avoid repeating the problems with the current academic publishing systems (Deutsche Forschungsgemeinschaft 2022).

Many people have argued that it is necessary to reform the European research assessment system. However, the open question is what such a reform should lead to regarding actual changes. The heavy overemphasis on one metric has proved problematic not only as it can fail to recognize contributions in the form of peer review, reproducibility research, the sharing of data, and other Open Science practices but also for many other reasons. It has also been argued that it acts as a barrier to increasing diversity (Swidor-Cios *et al.* 2021), that it fails to recognize different kinds of impacts, such as the public value of research (Molas-Gallart 2014) or researchers' engagement with society (Rauchfleisch *et al.* 2021).

Some suggestions have been made to address this issue. It has been suggested, and also implemented in several places, that one should limit the focus on journal impact factors in research assessment by limiting the number of articles included in the assessment process (Kendal *et al.* 2022). A number of best practices for addressing issues with current hiring practices, promotion, and tenure of researchers can be found in Moher *et al.* (2018). It has been argued that a reform of the research assessment system needs to address all aspects, which entails that it should include considering what is being assessed, the procedure behind the assessment, who the assessors are and what their roles are, the environments that the research takes place in, as well as the coordination of all of this (Aubert Bonn and Bouter 2021). A point also worth mentioning is that what constitutes responsible research assessment is likely to be continuously adjusted (*Nature* 2022).

I want to draw attention to the Coalition for Advancing Research Assessment (CoARA), as I believe that it currently provides the best platform for reforming European research assessment. With the launch of its first ten working groups and five national chapters, CoARA could provide the necessary drive to change the research assessment system.

Each of the ten working groups represents an essential perspective on what reforming research assessment must address. Nevertheless, as an ECR, I believe that it is essential to include an early- (and mid-) career researcher perspective in such a discussion, because they are the ones who will be subject to research assessment the longest. Therefore, I find the working group 'Early- and Mid-Career Researchers (EMCRs) – Assessment and Research Culture' particularly interesting.

However, as this year's topic of the Wenner-Gren symposium was 'Publishing in Academia – Digital Challenges', it is also worth mentioning that the working groups 'Recognizing and Rewarding Peer Review', 'Recognizing and Rewarding Peer Review', and 'Multilingualism and Language Biases in Research Assessment' focus on issues brought up and discussed explicitly during the symposium.

So far, only five national chapters have been formed, and if this is taken to be a sign of the national interest in the topic across Europe, then there is reason for concern. I hope this is not the case, but the answer will depend on how much traction the working groups gain.

However, as the community of researchers, academic institutions, and other stakeholders have argued that the current research assessment system needs to be reformed, we also have a shared responsibility to make this happen. I am not suggesting that every one of us join one of CoARA's working groups actively – that would likely make them highly dysfunctional. However, I want to argue that if we care about research, then we all need to contribute just a little.

If you know nothing or close to nothing about what CoARA is and does, then either reading the agreement or looking into how your university or other organization is contributing is an excellent place to start. However, if you already have some knowledge, consider what you can do to spread this knowledge, and consider how your organization can contribute to the ten working groups, as they are likely to need contributions in different forms from the larger research community if they are to be successful.

The academic institution must extend the invitation to participate in reforming the research assessment system to the researchers who will be most affected by it, namely doctoral candidates, postdocs, and other early career researchers. As a group, we have a long career in academia ahead of us, and thus, those who remain will feel the full impact of the research assessment system for many years to come.

The Question of Academic Freedom

To conclude, the greatest digital challenge with academic publishing we face today is how digital the world has become. The emergence of AI models puts another layer of pressure on agreeing on how data are used and shared responsibly, putting pressure on implementing Open Research Data practices to ensure that the data are unbiased and the research reproducible. Making researchers adopt Open Science practices will require training and implementation of the necessary infrastructure and that such practices are acknowledged and rewarded in the research assessment system. As a growing number of the researchers working in academia have (very) precarious working conditions, doing all of this requires that this precarity is appropriately taken into account and that measures are taken to avoid the negative consequences of this situation.

However, academia does not exist in a vacuum outside of society. Academia educates society, by fostering critical thinking and inquiry-based learning and in the digital world, where anyone can access almost any information at any time. To ensure this role, and that research is as unbiased as possible, that research methods are transparent, and that knowledge is a public property, are key pillars of European democracy (West 2022).

Fulfilling this role requires academic freedom, but at the same time is a prerequisite for that same academic freedom. As researchers, we should not only focus on our own individual academic freedom, but also stand up for that of others. This includes standing up for citizens' access to research and knowledge, for students' right to an education that supports their critical thinking, for our colleagues' right to

teach, conduct research, and do outreach without fear of repercussions, and for their right to disagree with us.

I like to think of academic freedom as a conversation and as both a right and a responsibility we all share in a democracy, but, of course, it looks different depending on who you are and whether you are a researcher, a student, or another citizen. However, I find the phrasing by Blessinger and de Wit (2018), that academic freedom is a common good in a democracy, to be right on point.

It is a conversation we have in the decision-making bodies that contributes to securing institutional autonomy, and here ECRs and other researchers without permanent employment are often excluded as they can lack the representational rights enjoyed by students and researchers with permanent employment. From the perspective of an ECR, it is clear that this should be addressed. It should be a right and a responsibility of all researchers to partake in the conversation that is academic freedom, and ECRs should not be denied either the right or the responsibility.

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Navigating the Digital Divide: Challenges and Opportunities in Research Publishing for African Scholars

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From ancient times, African civilization has participated in knowledge production and dissemination. The nature of research production and publishing in Africa varied throughout the years according to the influences and infrastructures present at each point in time. The colonization era was a landmark in the evolution of research practice and research publishing in Africa. It had consequences that lasted long after independence and contributed to the underdevelopment of research production and publishing systems in Africa. Currently, Africa is lagging behind in terms of its contribution to global research. An increase in African research output and an improvement of its visibility are needed. The digitization of research publishing holds great opportunities for the enhancement of scholarly publishing systems in Africa, yet it is faced with challenges. This article identifies the major challenges faced by governments, institutions, and scholars in digitizing research publishing in Africa. These challenges include limited funding, poor infrastructures, low research output, language barriers, difficulties in establishing quality assurance, copyright issues, data-management issues, and lack of policies and regulations. Addressing these challenges in local contexts is necessary to enhance digital research publishing in Africa.

Introduction

In the current millennium, a number of voices have stressed the need to foster increased research publishing by African scholars. The first argument is that it will

serve as a tool to advance the knowledge and scholarship needed to accelerate Africa's academic and socio-economic development. In this way it will facilitate the dissemination of the continent's newly produced science, innovative solutions, and local insights and thereby contribute to the enrichment of the academic and professional disciplines (Ondari-Okemwa 2007).

Second, research production and publishing are crucial in order to address pressing societal challenges such as healthcare disparities, food security, and climate change adaptation with a lens more focused on African communities (World Bank 2014). Research publications are means to provide policymakers with evidence-based knowledge that helps them design more personalized and effective solutions (Porteous 2022).

Third, it is argued that increased research publishing by African scholars is important to foster innovation and entrepreneurship, which contribute to overall economic development. It creates a knowledge-driven economy that attracts investments and drives the technological advancements crucial to the advancement of economies in Africa and beyond (Szirmai *et al.* 2011). By translating research findings into practices, the professional industries can enhance their outcomes. It also serves as a means of capacity building and education for an opportunity to learn from and engage with local and global academic industries. In addition, knowledge sharing enhances the performance of commercial, public, and educational institutions (Al-Kurdi *et al.* 2018).

Fourth, research publishing is expected to enhance the global visibility of Africa's research output. Collaborations on research projects between African and non-African scholars will provide an opportunity to strengthen the capacity and reputation of African research institutions (ISJEM n.d.). Research communication promotes interdisciplinary learning and cross-cultural understanding. Supporting research practice, research communication, and the access to research publications is vital for Africa's future prosperity (Bgoya and Jay 2013).

In order to increase the research publishing of African scholars, digitization is indeed an opportunity. It will enhance the global visibility of African research outputs as online-published research papers are more likely to be cited. This increases the impact and recognition of African scholars and institutions. Digital research publishing will make scholarly content more accessible to a broader audience by removing physical and financial accessibility barriers. This will enable researchers, students, and policymakers across Africa and the world to access African research more conveniently (Branin and Case 1998; Ngobeni 2010).

Another advantage of digital publishing is that it will reduce the costs associated with traditional printed publishing. Institutions can allocate resources more efficiently and direct funds toward research and capacity building. Through digital publishing, researchers can share their work with the global audience in real time. This accelerates the exchange of knowledge, fosters interdisciplinary research, and encourages faster responses to critical issues (Steele 2006).

Moreover, digitization will provide affordable, quick, flexible, collaborative, and more accessible modes to disseminate research findings (Stojanović 2014). They will

also help in ensuring the long-term preservation and archiving of research outputs in areas of African interest, such as cultural heritage. This makes historical research content secure and available to future generations (Perera 2023).

Against the above backdrop, this article aims at identifying and analysing the different challenges of digital research publishing faced by scholars, institutions, and publishers in Africa. It aims to foster a deeper understanding of Africa's unique challenges in disseminating and accessing research digitally. The article first provides a historical background regarding research in Africa. Then it explores the contemporary challenges of (1) limited funding, (2) poor infrastructure, (3) low research output, (4) language barriers, (5) difficulties of quality assurance and peer review, (6) copyright and intellectual property issues, (7) data management, and (8) policies and regulations.

Research in Africa

Research Practices

Africa has a heritage of indigenous knowledge that predates colonialism. Research practice in Africa dates to many centuries before Christ. Ancient African civilizations, such as those in Egypt and sub-Saharan Africa, contributed to mathematics, astronomy, medicine, and other scientific fields. Those early forms of knowledge production and communication laid the foundation for subsequent scholarly pursuits. This reflects the continent's rich intellectual heritage and its ancient evolution of knowledge production systems (Gerdes 1994; Akinyemi and Ogunniyi 2020).

The colonial era of Africa marked a significant shift in the continent's research practice. Colonial powers controlled the African academic landscape by imposing Eurocentric research agendas that often disregard indigenous knowledge and local needs. Research practice during this era often served the colonial interests and contributed to the processes of resource extraction and societal subjugation (Crawford *et al.* 2021).

After the independence movements in the mid-twentieth century, African nations began to build and reform their research practices and policies. The newly independent states started investing more in education and research, which contributed to the growth and development of local scholarship. Despite this progress, the African research landscape continued to face various challenges such as limited funding, inadequate infrastructure, and a brain drain. Efforts to address and solve these challenges came with collaborations, research networks, and initiatives aimed to strengthen the research practices and capacity on the continent (Ondari-Okemwa 2007).

Today, African societies are experiencing strong growth in terms of policymaking and investments in education, science, and technology. Initiatives such as the African Union's Agenda 2063 and the Partnership for Applied Science, Engineering and Technology (PASET) convene the continent's stakeholders to prioritize research and innovation as key drivers of Africa's development. The rapid increase in African

scholarly input into global research output reaffirms the continent's position as an important contributor to the global wealth of knowledge (World Bank 2014; African Union 2015).

Research Publishing

The rich history of knowledge sharing practices in Africa reflects the continent's long-standing traditions of research practice and knowledge dissemination. Different knowledge sharing systems thrived within African societies, ranging from simple systems – such as oral communication – to more complex systems – such as the sharing of manuscripts. Such forms of knowledge dissemination existed on the continent long before the introduction of printed research journals (Bgoya and Jay 2013). The evolution of research-publishing practices on the continent from ancient civilizations to modern days shows Africa's continuous attention to knowledge production and dissemination. It also demonstrates the impact of colonizers on Africa's scholarly landscape during and after the colonization era.

Ancient civilizations in the Nile Valley, western, and coastal eastern Africa engaged in scholarly pursuits as proved by the finding of written texts. The origins of research publishing in Africa can thus be traced back to the early civilizations that emerged on the continent. African societies were centres of scholarship, and their knowledge was documented on various mediums, including papyrus and manuscripts (Bgoya and Jay 2013).

However, with the beginning of colonialism in Africa, research publishing on the continent took a different turn. The colonial era brought significant changes to the research publishing landscape of Africa by imposing the colonizers' own agendas. Indigenous knowledge, languages, sharing traditions, and academic needs were often sidelined or suppressed during the colonial era (van den Bersselaar 2006).

The imposition of colonizers' languages as the medium of instruction and research had long-lasting consequences for African scholarly production and communication systems. Most of the indigenous African languages were marginalized, which compromised the process of knowledge dissemination among local populations. The common use of European languages in the publishing of research findings limited the knowledge accessibility for Africans (Ngobeni 2010). Through these linguistic constraints and others, the European colonizers controlled the landscape of knowledge-production and knowledge-dissemination systems, harnessing them to serve colonial interests (Bgoya and Jay 2013).

The mid-twentieth century witnessed an increase in African research practice and publishing as African nations began growing their citizens' literacy levels after independence. African scholars and intellectuals recognized the importance of documenting their own narratives and research findings. This era marked the establishment of academic journals and publishing houses dedicated to African research, particularly during the 1970s and early 1980s (Bgoya and Jay 2013).

In the late twentieth century, pan-African initiatives aimed to support research and foster collaboration among African scholars were being established. These

initiatives included The Council for the Development of Social Science Research in Africa (CODESRIA), which was established in Senegal in 1973. CODESRIA aims to contribute to the development of a scholarly publishing culture in the continent as well as to promote excellence in publishing (Bgoya and Jay 2013).

The legacy of colonialism continues to affect the research publishing landscape of Africa, influencing its accessibility practices, language choices, and research priorities. African scholars and publishing systems continue to grapple with the legacy of colonialism with the aim of reconstructing their scholarly publishing systems to meet their local needs and interests (Zegeye and Vambe 2006). Understanding this historical context is essential for the proper addressing of challenges and the promotion of a more inclusive and equitable research landscape on the continent.

Research Output

The recent increase in numbers of scientific research papers produced by African scholars is a good sign of progress on the continent. Between 2003 and 2012, the annual number of research papers published in scientific journals doubled in sub-Saharan Africa. The sub-Saharan African total share of global scholarly content has increased from 0.44% to 0.72%. In this increase, the regions of West and Central Africa recorded faster growth compared with the region of Southern Africa (World Bank 2014).

In the decade between 2003 and 2012, research in health sciences accounted for an average of 45.2% of sub-Saharan Africa's scholarly output, making it the most highly researched scientific area. For South Africa, physical sciences and STEM research comes as the main scientific area of focus, with 44.7% of the country's total research output, compared with only 25% in the other regions of sub-Saharan Africa (World Bank 2014).

The digitization of research publishing and the implementation of open access publishing contributed significantly to the increase of African research output. Digital platforms made it easier for African scholars to access global research, collaborate with international peers, and publish their research findings more widely. Open access initiatives and institutional repositories have also contributed to an enhancement of the visibility of African research outputs (Ngobeni 2010; Schemm 2013).

Infrastructures Supporting Digital Research Publishing

Digital research publishing requires the acquisition of supporting infrastructure that includes human, technical, and organizational components. Digital research publishing in Africa can benefit from the establishment of supporting infrastructures such as digital repositories and archives that serve as central platforms for the preservation and dissemination of scholarly content and datasets. Such platforms

help enhance the visibility and accessibility of African research outputs (Chiware and Becker 2018).

The incorporation of Digital Object Identifiers (DOIs) and other digital identifiers in the research-publishing systems of Africa can enhance the traceability and citability of research publications. Digital identifiers provide the published materials with unique and persistent alphanumeric strings to help identify and link readers with scholarly works (Paskin 2009). Furthermore, the use of effective content management systems such as WordPress and Drupal are essential for organizing and presenting research materials more effectively. This offers customization flexibilities to help meet the specific needs and requirements of digital research-publishing journals and platforms (Patel *et al*. 2011a, 2011b).

A number of initiatives and platforms were established to help bridge the gaps in research-publishing infrastructures in Africa. They support the growth of digital publishing cultures and enhance the visibility of African research outputs through the implementation of open access principles in research publishing. Such platforms include African Journals Online (AJOL), which offers a vast collection of African research journals, making them more visible and accessible to the global audience (Rotich 2011).

The collaboration with other African institutions and international entities is also integral to the advancement of research infrastructures in Africa. Regional research and education networks, such as the UbuntuNet Alliance, provide eastern and southern African research and academic institutions with high-speed internet connectivity as well as other services to facilitate collaborations in research and education (Ndebvu 2019).

Organizations, library consortia and developers of content management systems often support digital research publishing in Africa and beyond. Content management systems such as DSpace and EPrints are available as open software systems for free and open use by institutions everywhere. Organizations such as eIFL (Electronic Information for Libraries) work with a number of African countries to provide support and empower libraries across Africa to manage and disseminate digital content more openly and effectively (EIFL n.d.).

Capacity building is of significant importance to African digital research-publishing systems and infrastructures. Organizations such as the African Academy of Sciences (AAS) invest in developing programs to help enhance the research knowledge and skills of African scholars. This enhances scholars' abilities to produce and publish African scholarly content that contributes to the global wealth of knowledge (AAS n.d.).

Data management is also of significant importance in digital research publishing. Infrastructures supporting the collection, organization, dissemination, and preservation of data are largely needed across the continent. Initiatives such as the African Open Science Platform (AOSP) were established with the aim of enhancing research data management for African scholars. This helps in fostering more transparency and collaboration within the scientific research communities in Africa and worldwide (AOSP n.d.).

Challenges of Digital Research Publishing in Africa

Limited Funding

Despite the continent's recent increase of investments in research and development, the areas of research and development are still lacking sufficient funding and support in many African countries. As a result, digital research-publishing systems on the continent also lack sufficient funding. This lack of funding affects the ability of scholars and institutions to conduct research, cover publication costs, and promote positive publication practices. In addition, the absence of financial incentives for researchers to conduct research and participate in peer review processes lowers Africa's research output and discourages open publishing practices (Ondari-Okemwa 2007).

With the limited financial support and the expensive subscription fees of international journals and databases, many African scholars and research institutions find themselves unable to explore and disseminate research content. Limited access to research content can reduce the quality of African research output. Funding for research and research publication in Africa is often unevenly distributed across the institutions and regions. Significant disparities in academia are often seen between scholars and institutions with different access-to-funding and financial profiles (Rotich 2011).

The dependence on external funding sources to support research projects and publications threatens the sustainability of research practice and research publishing on the continent. External funding may impose mandates to follow research topics of limited relevance to African communities. It may also come with restrictions on certain publishing practices such as open access publishing and open research data sharing (Ngobeni 2010).

Gaining access to funding to cover the costs of research conduction and research publication is often a complicated and bureaucratic process. This results in administrative delay, which affects the research practice and the timely dissemination of research findings (Oppenheim *et al.* 2000). Moreover, the African continent is a youthful continent, and therefore the limited funding for research and research publication costs will mostly affect the early-career researchers who are struggling to find themselves a place in the scientific research communities.

Poor Infrastructure

Africa faces a range of challenges when it comes to the infrastructures needed to support research publishing in Africa. These challenges influence the dissemination of the continent's scholarly output and the development of robust research ecosystems. The multifaceted nature of the challenges of infrastructure in Africa make it a complicated area for effective diagnosis and intervention. The challenges include, in addition to the lack of funding, maintenance, development, expertise, and supporting policies. They contribute to the creation of gaps and disparities in research infrastructure across the continent.

The scholarly systems in Africa often suffer from inadequate infrastructures needed to support their scholarly output. Scholars and institutions on the continent often fail to acquire state-of-the-art equipment, maintain facilities, and support research projects effectively. Many research communities in Africa still grapple with issues related to internet connectivity, electricity, and Information and Communication Technology (ICT) infrastructures, which ultimately hampers research production, publication, and access to research content (Ondari-Okemwa 2007).

The poor living and working conditions caused by various factors in Africa and the better opportunities and incentives in other regions have led experts from different fields to migrate from Africa. This brain drain has affected the scholarly publishing systems on the continent, causing a lack in the number of experts in research, ICT infrastructures, and scholarly communication. This lack of expertise comes as a persisting challenge that can only be resolved by addressing the migration causes and by enhancing the living and working conditions on the continent (Ondari-Okemwa 2007).

The fragmentation of research institutions in Africa has also been a contributor to the poor research infrastructural conditions of the continent. Research institutions in Africa partake only in limited collaborations between them. This lack of collaboration stands in the way of rapid development of research infrastructures, interdisciplinary research, and knowledge-sharing systems in Africa. In addition, the limited access to international research collaborations and networks tends to isolate African researchers and research institutions from the global scientific discourse (Joseph 2015; Cerdeira *et al*. 2023).

Moreover, political instabilities, conflicts, and security concerns in some regions of Africa can disrupt the continent's research-publishing systems and threaten the safety of researchers and infrastructures. Support from African governments and stakeholders for scholarly publishing systems is often inadequate (Ondari-Okemwa 2007; Cerdeira *et al*. 2023).

Low Research Output

The low research output of Africa has been a concern for African scholars and research institutions for many years. Despite the continent's huge potential, Africa has not been able to match other regions in terms of research and innovation in the modern day. This leads to serious implications for the continent's medical, social, political, and economic development (Simpkin *et al*. 2019).

Despite the doubling of annual research output in sub-Saharan Africa, the region's contribution to the world's research output remains minor. According to a report examining the research enterprise in sub-Saharan Africa over a decade from 2003 to 2012, published by the World Bank, the region's research output accounts for less than 1% of the world's research output. Meanwhile, the region's population accounts for 12% of the global population (World Bank 2014).

The low research output of Africa can be linked to multiple causes. These include the lack of funding, lack of supporting infrastructures, lack of expertise, absence of governing policies, poor education, language barriers, and a brain drain. Efforts to expand research practice to increase the continent's research output are often under-prioritized by governments and stakeholders (Ondari-Okemwa 2007).

Language Barriers

Africa is celebrated for its racial and linguistic diversity. The continent has a remarkable number of languages – estimated to range from 1500 to 2000 languages (Tirosh 2021). Africa holds one third of the world's languages, with its population only accounting for less than a seventh of the world's population. Language diversity in Africa comes with opportunities in cultural richness and with challenges in education and communication. This reflects the need for linguistic research as well as infrastructures to support the use of local languages in scholarly publishing.

Research published in languages other than English, which is common in some African countries, often has limited options for publication channels, low visibility, and less accessibility. African scholars also face an increased probability of seeing their publications rejected due to weaknesses in English in their submitted manuscripts (Salager-Meyer 2008). Language barriers restrict the communication of African research output, resulting in a loss of opportunities for collaboration and knowledge exchange.

The dominance of the English language in research publishing contributes to building inequalities in knowledge production and dissemination. Native English scholars and scholars with good English language skills often enjoy more advantages in scholarly publishing. In addition, the translation of research papers written in a local African language for dissemination in research journals can diminish the quality and authenticity of the scholarly material (Ondari-Okemwa 2007; Salager-Meyer 2008).

Non-English language publications are less likely to be cited by other scholars, which leads to a reduction in the impact and recognition of African research by global academic communities. African scholars face challenges in the accessibility of, and the publication in, prestigious English-language journals due to their strict language requirements. Early-career researchers in Africa, who tend to be less fluent in English, may face more obstacles in publishing their research findings due to these language barriers (Ngobeni 2010).

Difficulties of Quality Assurance and Peer Review

The incorporation of quality assurance tools and practices into Africa's scholarly communication systems is vital to ensure the credibility and rigor of the scholarly content produced. The process of peer review plays an important role in quality assurance through the screening of research papers by colleagues from the same domain (Ocholla 2011). Many African research communities find it difficult to

sustain peer-review practices due to the lack of interest by qualified scholars to peer review. This can negatively affect the overall quality of research publications on the continent, resulting in citizens' mistrust in science.

Despite the advantages of peer review in quality assurance, peer review can also introduce some issues affecting the quality of the produced papers. Such issues include biases brought by the reviewers, whether conscious or unconscious. This renders the scholarly publishing systems more vulnerable to issues of fairness and justice. In addition, the process of peer review raises other concerns regarding the reviewers' acquisition of adequate knowledge about the submitted topics and their local contexts (Nentwich 2005; Ocholla 2011).

Language diversity in Africa introduces language-related challenges during peer-review processes, especially when manuscripts are submitted in non-English languages. This can potentially limit the pool of qualified reviewers and compromise the understanding of topics. Training opportunities in peer reviewing are lacking in many African countries, which hinders the development of a generation of skilled and diverse reviewers. The lack of institutional support and recognition for peer-review practices can discourage African scholars from participating in this necessary process (Ngobeni 2010).

Challenges in quality assurance and peer review may push some scholars and institutions to engage in predatory practices. Bypassing quality assurance practices and proper peer review to expedite publication can compromise the quality and integrity of Africa's research outputs. African journals and publishers often face a shortage of resources, which makes it challenging to implement robust quality assurance and peer review systems. Therefore, discussions around south–south collaborations and sustainable quality assurance tools should be prioritized.

Copyright and Intellectual Property Issues

Areas of copyright and intellectual property laws in scholarly publishing seem to be underdeveloped for most African countries. The challenges in copyright and intellectual property laws and regulations in Africa are often complex, as they are influenced by legal frameworks, cultural norms, and economic status. This lack in formal intellectual property laws and regulations affects not only the communication of newly produced research, but also the communication of already existing indigenous knowledge and cultural heritage.

Collaborative research projects involving African and international scholars may involve complex negotiations over intellectual property rights. This might affect the distribution of ownership in terms of research and data, leaving African scholars and institutions with fewer benefits, owing to the underdeveloped copyright and intellectual property systems in Africa. In addition, the establishment of preprint repositories and archives on the continent can help African scholars and readers overcome research ownership issues (Oppenheim *et al.* 2000).

Open access publishing continues to grow within African research communities, promoting better accessibility and visibility of African research outputs. The

implementation of open access publishing in Africa requires addressing the copyright and intellectual property related gaps on the continent. Digital publishing and the implementation of openness in scholarly publishing have the potential to accelerate the development of scholarly publishing systems in Africa and beyond (Oppenheim 2008; Shavell 2010).

Data Management

The political and financial circumstances of many African countries have imposed challenges related to data management in research production and digital publishing. These unique circumstances and limitations resulted in issues regarding data collection, organization, dissemination, and preservation. Data management issues can significantly affect the quality and accessibility of African research outputs (Lages *et al.* 2015). Determining data ownership and intellectual property rights, especially concerning indigenous knowledge and cultural heritage, is also a key issue on the continent.

Funding and support in research data management infrastructures and capacity building is often neglected in many African countries. Hence, many digital repositories and archives in Africa face serious sustainability issues that might threaten the long-term preservation of African research data. The fragmented efforts and lack of coordination among African countries and institutions hinder the development of effective data-management plans and strategies (Chiware and Becker 2018).

Sharing research data openly has numerous potentials for the advancement of research and publication in Africa and beyond. Despite its huge advantages, open data sharing raises concerns about data safety and the privacy of individuals. This brings a need for the creation of effective data management laws and regulations, which brings another layer of complexity to research data management in Africa. A culture of ethical research data sharing practices should be encouraged in Africa. Safeguarding research data from cybersecurity threats and ensuring the integrity of the data is also another growing concern in Africa (Kahn *et al.* 2014; Elisha and Mathe 2015).

Policies and Regulations

Digital research publishing in Africa often lacks supportive policies and regulations (Rotich 2011). The lack of understanding of digital research publishing and its needs in Africa from the local governments and policymakers has contributed to the neglect of support and investment in scholarly publishing in the continent. In addition, policies obstructing the advancement of African digital publishing systems are still in use, such as language-diversity-restrictive policies (Bgoya and Jay 2013).

Policies to support the development and advancement of digital research publishing infrastructures – such as institutional repositories and open access journals – are still insufficient across the continent. In addition, policies related to

funding and governmental and institutional support for digital research publishing are often neglected, hindering the success of initiatives and actions aimed toward improving the scholarly publishing systems and promoting research excellence (Tijssen and Kraemer-Mbula 2018).

The lack of policies and their uniformity and consistency among African research communities can lead to confusion and hinder collaborations. The absence or inconsistency of policies, guidelines, and ethical standards in research publication practices and quality assurance can affect the quality and credibility of African research output. Policies aimed toward improving the open sharing of research and research data are often missing in Africa. Many African governments and institutions have yet to invest in the development of policies and regulations to support research practice and digital research publishing (Gaillard 1992).

Conclusions

Research publishing is crucial for the acceleration of Africa's educational and socio-economic development. It will enable the dissemination of Africa's research output, which includes indigenous knowledge, cultural heritage, and innovative solutions for local challenges. The digitalization of research publishing in Africa offers numerous advantages that include enhanced visibility, accessibility, cost efficiency, and collaboration opportunities.

Research publishing in Africa has accomplished multiple milestones throughout history. Knowledge sharing practices varied according to the continent's circumstances and influences during ancient, colonial, and post-colonial eras. Africa's journey in the production of scholarly content has ranged from indigenous knowledge systems to pre-colonial scholarship and post-independence scholarly endeavours. Despite the many historical disruptions in Africa's scholarly systems, the continent has continued to stride forward with growing investments in education, science, research, and technology.

This article has addressed the major challenges faced by research publishing communities in Africa. The first challenge is limited funding. Research publishing in Africa is often under-funded. This affects the development and sustainability of the infrastructures needed to support publishing systems. In addition, limited funding contributes to the brain drain and affects the publishing system's accessibility to needed support and expertise.

The second challenge is the lack of infrastructures needed to support digital research publishing. Many African scholars and institutions face infrastructure-related issues, including electricity, internet connectivity, and ICT infrastructures.

The third challenge is the low research output of Africa. The continent doubled its annual research output in the decade between 2003 and 2012, but the overall percentage of Africa's research output to the global output is still minor. This often results in the marginalization of research publishing by stakeholders in the continent.

The fourth challenge is language barriers. African scholars still struggle with legacies of colonialism that include the suppression of the use of African indigenous languages in research practice and publication. Scholars on the continent are often left disadvantaged and with fewer opportunities for research access and dissemination.

The fifth challenge is quality assurance and peer review. African research publishing systems often struggle to implement and sustain quality assurance practices owing to their limited resources. Engaging African scholars in the peer review process is a concern due to limited incentives.

The sixth challenge is building proper copyright and intellectual property systems. Many African countries lack policies and regulations in the areas of copyright and intellectual property, which makes it challenging for the research-publishing systems to operate in such an environment.

The seventh challenge is effective data management. African scholars and institutions often lack the resources and expertise needed to build and maintain proper data-management systems.

The eighth challenge is the lack of policies and regulations needed to govern the funding, support, quality, copyright, and practice of research publishing in Africa.

Addressing these eight challenges is crucial for the enhancement of digital research publishing in Africa. Further research in digital research in Africa is needed to provide practical solutions and policy recommendations to support the governments, institutions, scholars, and publishers in their efforts to contribute to global knowledge and address local challenges.

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Digital Publishing and the New Academic Ecosystem: An ANT Approach to the Recent Disputes over a Chinese Journal Database Giant

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As digital publishing gains momentum globally, it presents unique challenges in different regions and cultures. To address these challenges, it is important to understand the specificities of each local context. In light of Actor Network Theory (ANT), which advocates an interdisciplinary approach through an association of related factors from different fields, this article examines problems of Chinese digital publishing, focusing on one giant database, called the Chinese National Knowledge Infrastructure (CNKI). The discussion falls into three parts. First, the self-positioning of CNKI. As the sole academic database giant, it encounters a dilemma between making profits and serving the public – it has been criticized for charging high subscription fees and for committing intellectual property infringements. Second, the scholars, while becoming more dependent on digital publishing and such a giant database as CNKI, are bewildered by the fact that they become less capable of protecting their academic autonomy as well as their intellectual copyright. Third, CNKI's near monopoly has damaged domestic academic justice, which becomes detrimental to the development of Chinese academic journals and the international transmission of Chinese scholarship. The article concludes with an inquiry into possible solutions for building a new academic ecosystem in the digital era, locally as well as globally.

Introduction

The Chinese National Knowledge Infrastructure (CNKI) is the country's largest academic database, providing services including online searches and downloads of most domestic academic journals, doctoral dissertations, and masters' theses. Since its debut in 1999, it has collected more than 280 million academic articles and over 9300 journals, serving over 200 million end-users, with over 16 million daily visits and over 2 billion full-text downloads. The core users of CNKI come from universities, research institutes, enterprises, and public libraries in China, plus over 1600 institutional customers overseas in 60 countries and regions. China Academic Journals Electronic Publishing House (CAJEPH), the company responsible for the construction of CNKI database, is a subsidiary of Tsinghua Tongfang Co., a state-owned software firm, whose legal representative is Mingliang Wang. CAJEPH is among the first batch of digital databases approved by the State Press and Publication Administration, supervised by the Ministry of Education, and sponsored by Tsinghua University. It is also the largest professional internet and electronic publishing organization with the longest history in China. It needs to be pointed out that CAJEPH is not a private company; instead, it is owned by the state-owned Assets Supervision and Administration Commission of the State Council.

> In recent years, disputes over CNKI have been rising, focusing especially on two events. In April 2022, the Chinese Academy of Sciences (CAS) accused CNKI of raising subscription fees at a fast pace every year: In 2022, the two sides had active discussions in terms of the fees and subscription models. But after many rounds of arduous negotiations, CNKI still insisted on a renewal fee close to 10 million yuan. (China News 2022)

The academic organization claimed that it could no longer afford such high fees and would stop using the database from then on. Another case concerns individual intellectual property, and the lawsuit lasted for years. Since 2013, Zhao Dexin, a retired professor at Zhongnan University of Economics and Law (ZUEL), started charging CNKI with intellectual infringement. CNKI added over 160 of his articles online to make profits without his authorization. Until the end of 2021, Zhao has won all 13 lawsuits and received compensation of about 700,000 yuan for his losses. Both are typical cases among many similar disputes, revealing CNKI's problems of high subscription fees and intellectual infringement during its rapid development.

In 2022, the copyright and market authorities started investigating CNKI, which claimed in public statements that it would cooperate and make necessary corrections accordingly. However, later that year, the ruling of the 13 lawsuits for copyright infringement filed by Shiji Chaoxing Information Technology Development Co. Ltd. against CNKI, which ordered CNKI to pay the plaintiff 196,000 yuan in compensation, suggested that CNKI did not rectify the situation (Jiupai News 2022). In recent years, CAJEPH has been involved in over 1000 lawsuits with a total value of several million yuan and was the defendant in over 800 of them, among

which 700 involved disputes over copyright ownership infringement and over information network dissemination rights infringement.

Similar disputes have occurred in some Western countries in recent years. For example, in 2021, the University of California (UC) and Elsevier, a leading academic publishing company specializing in scientific, technical, and medical research, reached an agreement after extended difficult negotiations. The latter would finally offer open access (OA) to UC at a reasonable price for the following four years of negotiations. From 2019 to 2021 when they reached the agreement, thousands of researchers and students were not able to access resources on Elsevier. In some other cases, negotiations did not lead to any agreement. For example, Elsevier cut off researchers in German institutions in 2018, and the impasse of negotiations has continued to this day (Else 2018).

While disputes and disagreements between databases and academic institutions happen worldwide, incidents involving CNKI need to be reconsidered with special attention to their particularities. Zhu Jian at Nanjing University finds that when it comes to academic communication, there are commonalities between CNKI and other international databases, but the former 'is endowed with more Chinese characteristics' (Zhu 2022: 27). The first distinction between the two is that, lacking any journals of its own, CNKI merely enables literature reading, without including publishing services as Elsevier does. Secondly, CNKI is a state-invested database, which leads to its near-monopoly status. Domestic users have no alternative. Theoretically, CNKI is obliged to serve the public, though it also needs to make profits. Third, Chinese academic journals are unable to rely on publishers, who are usually granted limited serial numbers (Wang 2019), whereas their Western counterparts can publish an unlimited number of journals. Thus, Chinese journals possess little power to gain independence from a digitalized platform such as CNKI, which is detrimental to their potential development.

Thus, we should ask: is it possible for the database to strike a balance between public service and profit making? Does digital publishing affect scholars' autonomy? How does it exert influence, not only on the scholars but on the whole academic ecosystem? By employing Actor Network Theory (ANT), this article will place CNKI as one of the central actors in a lively network of Chinese academic ecology (in line with other actors such as research institutes, researchers, and journals), following its positions in relation to other actors, and in forging different kinds of associations in response to new changes in the academic world. This article attempts to address three major issues, namely, the self-positioning of CNKI as an academic database, the attitudes of researchers in the face of digital challenges, and the optimization of the academic ecosystem in the digital era.

The Self-positioning of the Academic Database

From the ANT perspective, the interactions among related actors from different fields or even disciplines are highlighted in the process of careful analysis. Within this

vibrant network, non-human elements such as ideas, processes, and objects are also actors, as long as they 'transform, translate, distort, and modify the meaning or the elements they are supposed to carry' (Latour 2006: 39) and thus become 'mediators'. ANT provides a new perspective for comprehensively understanding a thing, event, or concept by rechecking its connection with other actors and the unexplored assumptions underlying it.

In the case of CNKI, the database has changed the traditional relationship among authors, readers, and journals and thus should be regarded as one central actor in bringing forth a new academic ecosystem in the digital era. The task of publishing in Chinese academia is divided between the journal and the database, usually with the former responsible for the paper version and the latter for the digital one. Therefore, CNKI exerts a unique influence on academic publishing and dissemination in China. Given its state-owned and near-monopoly position, the database has contributed significantly to the evolution of a domestic academic system different from that in Western academia. In a domestic situation where the journals are dispersed and the government calls for centralized management, CNKI seized the opportunity to meet the official need to improve supervision efficiency. However, it has brought risks in the long run, 'monopolizing digital publishing and communication' (Zhu 2022: 31), breaching the principle of equity and thus hindering a fair, healthy academic ecosystem, especially on its mode of internationalization. Nowadays, CNKI has been 'deeply embedded in a complex network of relationships marked by academic research, evaluation and research management', making its self-positioning within this network one of the most pressing issues to pin down. Several related knots in the network include journals, scholars (authors and readers), research institutes, government, and policies. By locating the database at the centre of the analysis and tracing its connections with each of these knots, CNKI's distinct modus operandi (method of operation) will reveal itself.

Given its monopoly status, CNKI's relationship with the government should be assigned a prominent position in our inquiry. What role does the government play in the network? Is it one of the many collaborators of CNKI or the de facto authority? From the academic standpoint, CNKI enjoys the right of academic appraisal, while the government serves as a co-agent that offers policy and financial support. However, when evaluated from a political angle, the government must be the regulator and real power holder. Following the disputes surrounding CNKI in 2022, the State Administration for Market Supervision launched an antitrust investigation into CNKI. The investigation reached a verdict at the end of the year and imposed a fine of 87.6 million yuan (5% of its domestic sales of 1.75 billion yuan) on CNKI for its monopolistic behaviour: first, selling database services at unfairly high prices; second, prohibiting academic journals, publishing units, and institutions from authorizing any third party to use academic literature data to ensure exclusive cooperation implementation. According to the page on the SAMR website, CNKI has excluded and restricted competition in the Chinese academic literature network database service market, infringed on the legitimate rights and interests of users, and disrupted the innovation and development of relevant markets and academic

exchanges and dissemination (SAMR 2022). Following the investigation verdict, CNKI pledged to lower its subscription fees by 30% within the next three years and improve its payroll system for authors (Chengdu 2022). The investigations and judgments on CNKI indicate that the government, with the ultimate authority over academic databases, serves as the regulator to balance each power and protect the rights of researchers and institutions.

As for academic journals, what is their relationship with the database? Is collaborating with CNKI beneficial for them? If not, why would they agree to it in the first place? Most Chinese academic journals are dependent on small-scale paper publishing and do not usually run digitalization on their own. According to an interview done by Sixthtone, an employee of a public library in Shanghai stated that the 'scale of domestic journal publishers is too small, allowing aggregators to seize the (business) opportunity' (Wang 2019). Therefore, journals trade their resources with CNKI by buying out the authors' rights to their articles all at once, transferring the rights and the academic resources to the database, and relying on the latter for digital publishing and transmission. This arrangement has brought them convenience but at the same time created difficult problems. The database now monopolizes academic resources, publishing rights, and digital publicity, leaving little autonomy for the journals. The journals are trapped in a vicious circle of being more exploited and less centralized, thereby bringing harm to the whole academic ecosystem and preventing Chinese scholarship from going global.

Apart from providing this ostensible convenience to the journals on the road to digitalization, CNKI also obscures their more inherent problems. Operating on a small scale and with little academic influence, many journals publish in largely homogeneous disciplines, which renders the whole system scattered and chaotic. In his article, Zhu points out that academic journals aggregated by CNKI 'cannot catch up with the need of disciplinary development because of their inappropriate structures and layouts, as well as the disintegration between the editorial and academic community' (Zhu 2022: 41). When CNKI aggregates these journals and re-publishes them on the database, it dismembers them into individual articles, thus tempering and concealing the deficiencies. However, covering up the problems numbs the crisis awareness of journals, prevents them from upgrading their professionalism, and, in turn, jeopardizes the academic ecology in China.

Universities and research institutes have yet more problems with CNKI. According to Zhu (2022: 32), 'universities and research institutes generally purchase a package library from CNKI (the periodical database is, of course, a must buy)'. From the perspective of the database, they are its major customers, who purchase open access and other services, such as providing a duplicate check and citation rate. However, from the standpoint of universities and institutes, their academic contributions are not adequately acknowledged, let alone rewarded. Being producers, providers and purchasers of academic resources in their relationship with CNKI, universities and institutes do not seem to hold as much power as they would like to.

The monopolistic position of CNKI in the market of academic data gives universities and institutions little space for negotiating the prices and terms of cooperation. Tao Xinliang, a professor at Shanghai University, states that CNKI's role as the dominant source of academic data gives it 'absolute power'. Not only do institutions have to shoulder the heavy load of subscription fees, but also, as part of their agreement with CNKI, they often have to 'demand their students turn over the digital copyright of their theses as a condition for graduation' (Wang 2019). These monopolistic practices of CNKI have not gone without confrontation and opposition. Between 2016 and 2018, Peking University, Wuhan University of Technology, and Taiyuan University of Technology voiced their discontent with the surging prices in different measures, but all disputes culminated in the renewal of their contracts with CNKI. These events, as well as the most recent and prominent complaint from CAS, suggest that although little has been done to fundamentally challenge CNKI's power, its method of operation can no longer meet the demands of the universities and institutions, whose brewing discontent threatens CNKI's credibility and even existence.

Researchers may be the most vulnerable nexus in this academic network. On the one hand, their research requires a vast amount of academic data, provided mainly (sometimes solely) by CNKI; on the other hand, their works need a platform to be stored and transmitted. Because CNKI effectively meets these needs, particularly as it 'gradually monopolizes the digital publishing and dissemination of academic journals' (Zhu 2022: 29), researchers dare not voice their discontent when their rights are infringed:

> Individual scholars enjoy free downloads on CNKI after logging in to the intranet, as the universities and institutes have already paid the bill, usually in the form of a library package, but their yearly downloads will be the yardstick of CNKI's quotation for the next year.

As for individual users, downloading a journal article or conference paper on CNKI costs 0.5 yuan per page, while masters' theses and doctoral dissertations are 7.5 and 9.5 yuan per copy, respectively. For scholars whose articles are included in the database without their permission, have they been paid? If not, would they feel treated unfairly and exploited? For users who pay for paper downloads, is this charge reasonable? Would it be a burden for some users or affect their academic work?

As a central actor in the network, CNKI should seriously reconsider its role in the academic world, making its self-positioning clear. As a state-funded academic database, it has the responsibility to spread knowledge and serve the public. Tongfang Knowledge Network Technology Co., Ltd. (Beijing) said in a statement posted on its official WeChat account that it would fully cooperate with the government's investigation. It said: 'We will deeply reflect on ourselves [...] and take the social responsibility as a knowledge infrastructure'. The goal of a company should and always will be to make profits, but it also needs to balance its different roles in society. As an old Chinese saying goes, 'A gentleman makes money in the

right way'. It is expected that the database should promote the flow and sharing of knowledge and information, but it has failed to do so.

CNKI needs to re-evaluate its present charging standards. Is it reasonable to charge the download of all works in its database? Should the charge vary with different types of work? Is overcharging an issue to be taken care of seriously? Will it impose a burden on the parties concerned? Will it lead to a monopoly in the domestic academic industry? Shen Teng, director of Harmony Partners Law Firm (Beijing), claimed that to determine whether a company is guilty of industrial monopoly, there are usually three steps: to delineate the relevant market, to inquire whether a certain company has taken a dominant position in the market, and to determine whether the company has abused this position. According to the regulations of antitrust law, only anti-monopoly law enforcement agencies or judicial organs have the power to determine whether a company constitutes a monopoly. Shen believes that the company's dominant market position is not illegal, as the real target of the antitrust law is the 'abuse of one's market dominant position'. Therefore, in the case of CNKI, it all depends on whether its high subscription fee constitutes some kind of 'abuse' of its monopoly status.

In the current Chinese academic ecosystem where databases occupy a strong position, all parties have had to interact with CNKI, despite the irreconcilable discords within each of these relations. The unique position of CNKI brings the database lots of profits but hinders the long-term progress of the domestic academic ecosystem, which has consequences on journal reform, academic equity, and internationalization. What are some of the difficulties that researchers have faced and are facing under the impact of such a database as CNKI?

The Perplexity of Researchers: Digital Publishing and Academic Autonomy

As mentioned above, Chinese researchers rely heavily on CNKI for its vast resources and its academic impact. In the digital age, researchers access research literature primarily through databases rather than traditional print journals. The database, which is more convenient and efficient, provides digitized versions of academic papers and can track the impact of articles through numbers of downloads and click rates. By these means, researchers are able to know the impact of their research articles, and academic organizations can evaluate the academic performances of individuals and institutions for the sake of efficient administration. It is now understandable why CNKI, though it has turned out to be controversial time and again, is invaluable and indispensable in the academic world. However, the business model of CNKI poses a series of problems for researchers' work, and they have become aggravated and more readily apparent in recent years. These problems exist in the researcher/author/reader's relationship with journals, research institutions, and the government, under the influence of the academic database.

The medium of CNKI has changed the journal's relationship with the researcher, both as the reader and as the author. On the one hand, as authors who aspire to publish, researchers (sometimes without being aware) authorize their copyrights to the journals, which includes the right of information network transmission and the right to have the work published in other formats and venues. The journals, falling behind and lacking ambition and resources in digital publishing, often hand over these rights, along with the autonomy and agency as the publishing entity, to CNKI to reassign the duty. In this way, the authors are distanced from their own articles, losing their publishing autonomy with the journals. Over time, 'the journals and the authors stay blocked from digital publishing and communication' (Zhu 2022: 29). Also, even though authors have signed the agreement, with or without knowing it, CNKI's re-publishing their articles without paying them still violates the Copyright Law of the People's Republic of China (The Standing Committee of The National People's Congress of PRC 2020), which orders that remuneration should be paid to the author.[a] This is also the reason why Professor Zhao won the lawsuits against CNKI.

CNKI's copyright infringement may be even more egregious and blatant when it comes to the inclusion of masters' and doctoral theses. The large number of theses is one of CNKI's vaunted features and improves its plagiarism-checking service sold to the universities. However, the theses are published on the platform without agreement or payment. According to a report by Sixthtone, many Chinese students expressed their discontent over the exploitation by CNKI of their work. Some universities, such as Dalian University of Technology, 'demand students sign a letter agreeing to give their authorization of digital copyright to CNKI', the refusal of which would jeopardize their prospect of graduation (Wang 2019). This means that the students' ownership of their copyrights is completely at the mercy of their universities, which have signed agreements with CNKI to publish their students' theses. This exploitative mechanism can be very disheartening for the students, especially those who aspire to become professional scholars.

On the other hand, as readers, the researchers have switched from reading journals to reading individual articles re-published on the database. By disassembling the journals to individual articles aggregated on the database, CNKI has certainly provided convenience for researchers to search and read articles. However, this convenience comes at a price. The researchers are no longer concerned with the history and features of the journals, further discouraging the latter from upgrading, digitalizing, and clustering.

Different parties' reliance on CNKI creates an awkward problem for the researchers: double dipping. The researchers and their institutions have to pay double fees to the database, one to have their articles included in CNKI and the other to access the resources included. This has resulted in the authors paying to access their own articles online. CNKI interposes a toll both along the route of the researchers' access to academic journals *from* the database and of the publication of the researchers' works *onto* the database. Although universities and institutes purchase open access to the database, authors still need to pay for downloading some

of their own articles, especially when they cannot have access to their university digital library website. For individuals, especially young scholars, the problem of double dipping can have a serious negative effect on the development of their research work owing to the increase of unnecessary research cost.

However, researchers cannot confront such a giant enemy as CNKI, nor can they resist its monopoly, because their academic activities are already fully reliant on CNKI. In a digital age when certain academic journal databases are well on their way to monopolization, scholars do not usually take legal action against them, because they are worried that the databases might remove their articles, which would affect their transmission. For example, Professor Zhao's articles were immediately removed from the platform after the lawsuits. In an interview with *The Paper*, he explains the reason why no one acts against CNKI's monopolistic behaviours: the scholars fear that CNKI will take their papers offline, since CNKI is now the most acknowledged 'publication' in Chinese academia, largely determining the articles' number of citations. He also points out the 'unreasonable protocols' of some institutions, who refuse to acknowledge journal articles unless they are published on CNKI.

Suing CNKI might cause even worse ramifications for scholars. With a strong influence in Chinese academia, CNKI may put pressure on journals to discourage authors from suing, or even ask journals to turn down the authors' articles. Zhao recalls in the interview his experience of receiving a phone call from a chief editor of a journal asking him not to pursue his lawsuit. In conclusion, due to its monopolism and copyright infringement, CNKI creates an academic ecosystem that disempowers the author and stultifies the effort of rectification.

The recent disputes and complaints highlight the urgent need for CNKI to reflect on its mode of operation and strengthen the construction of its copyright credit system. Tao Xinliang, a professor of law at Shanghai University, emphasized that it is not only crucial 'to regulate CNKI, but also to construct principles for the whole system [. . .] to get rid of historical influence and reconstruct the rules' (Wang 2019). Fang Xingdong, a distinguished professor at Zhejiang University, emphasized the complexity of the issue, and proposed system innovations and new governance mechanisms for its solution (Fang 2022). As the problem of CNKI encompasses many parties and relations inside the Chinese academic network, the solutions should also be considered with regard to the specificities of each relationship.

Optimizing the Academic Ecosystem

In response to the challenges in digital publishing, different parties, including governments, universities, research institutes, researchers, and databases, need to take action for the construction of a better academic ecosystem. In this age, when the local and the global become more and more entwined, what happens in the Chinese academic world cannot be separated from the European or the American academic

world(s) or any other. In addition, the optimization of the Chinese academic ecosystem would be better studied with reference to the factors outside of China.

As concerns governance, a series of measures have been discussed and proposed by scholars in different fields to optimize the operating mechanism of CNKI. First, a competitive mechanism should be introduced into the academic field to foster and support multiple databases and help promote the digitization of journals in large publishing groups. As Zhao advises, 'the state should support the construction of different digital academic platforms to co-exist and compete with CNKI' (Chen 2021). In addition, with the emergence of more platforms, government should play a better role in maintaining a balance among the different parties involved, providing strong support for researchers. In the international academic arena, various digital publishing companies have formed a competitive, supplementary, and relatively comprehensive network, which has greatly facilitated the work of researchers.

Second, the legislative authorities should introduce relevant laws as soon as possible to better protect scholars' copyrights and other publishing rights. Li Shunde, a researcher at the Institute of Law of the Chinese Academy of Social Sciences, believes that the discussion of CNKI should not be limited to the issue of monopoly but should consider the social, historical, and legal aspects of the copyright protection system to delve into the essential problems of CNKI (Li 2022). Although CNKI is the most high-profile offender in digital academic copyright infringement in China, it is certainly not the only one. As Zhao tells *The Paper*, the smaller outlets, such as CQVIP or Wanfang Data, CNKI's major rivals, do not pay authors either (Chen 2021). This universal phenomenon reveals a big loophole in copyright laws and their implementations. Li Junhui, Director of the Innovation Research Department of the China Judicial Big Data Research Institute and a researcher at the Intellectual Property Research Center of the China University of Political Science and Law, believes that CNKI should make adjustments to its own business model based on the court's judgment in the copyright disputes, including obtaining authorization from the author and paying the corresponding amount to the author. The remuneration standard should be agreed with authors, and the national copyright management department can also refer to other licensing fee standards to formulate corresponding standards (Ke 2021). Feng Xiaoqing, a doctoral supervisor at China University of Political Science and Law and Vice-President of the China Intellectual Property Law Research Association, stated that the formatted agreement (contract) of the magazine deprives the author of the property rights for the works, and even the right of inheritance (Yue 2022). Feng believes that the key to solving this problem lies in reforming the model contracts signed between journal publishers and authors, which should be regulated by the National Copyright Administration. Zhang (2022: 11) proposes that the supervision departments of copyright, press, and education should conduct copyright law enforcement inspections on knowledge resource platforms, periodicals, and graduate schools to standardize the cooperation between platforms, journals, and schools. The departments, journals, and schools should also formulate standardized formats of submission agreements. When the authors sign up with the journals for publication,

there should be clearer regulations concerning the rights they sign over. Strengthening the protection of intellectual property rights on knowledge resource platforms, periodicals, and graduate training institutions requires a joint effort of multiple departments.

Third, as a knowledge resource platform, CNKI should not make capital its sole motivator. For example, Hu Gang, a member of the Lawyer Team of the China Consumers Association, propounds that Tsinghua Tongfang Company should divest its business from CNKI 'to prevent the vicious erosion of knowledge aggregators by excessive capital-driven thinking' (Ke 2022). Fang Xingdong, Professor of Zhejiang University, believes that since CNKI is invested in multiple interests, the database should not be a profit-making entity governed by a single capital-driven company but should become a non-profit organization regulated collaboratively by different parties (Ke and Li 2021). These remarks resonate with the theoretical premise of this article, that is, CNKI is entangled with different players and powers, and hence the solution to its problems should be based on the comprehensive view of its position in the academic ecosystem.

One of the major reasons for which CNKI is involved in incessant disputes is that it does not have its own publication, but rather re-publishes articles from already-existing journals. Zhu rightfully points out that 'the primary characteristic of CNKI's business model is the co-existence of two publishing entities' (Zhu 2022: 38), and that this business model is the origin of its copyright crisis. Although the journals and CNKI reached a tacit agreement to split the profit, neither of the publishing processes is complete: while journals lack the technology of digital publishing and transmission, CNKI lacks the most basic steps of manuscript screening, reviewing, and editing. The best solution to this problem is for CNKI and other databases to establish their own integrated journal system in collaboration with the already-existing journals.

Efforts have been made in this direction in the last 12 years to establish closer collaborations between academic databases and journals to provide a better platform for digital publishing and transmission. *Specialized Series of University Journals in China* was established collaboratively by university journals and CNKI. According to its website, this specialized series aims to 'break the boundaries of universities, aggregate the expertise of each university, and realize the professional transformation of academic journals on the digital platform' (Specialized Series of University Journals in China 2013). In May 2021, the China Association for Science and Technology, the Publicity Department of CCP Central Committee, the Ministry of Education, and the Ministry of Science and Technology issued 'Opinions on Promoting the Development of Academic Journals', which promotes the construction of 'integrated development platforms' and 'publication clusters and conglomerates', as well as the digitalization of academic journals (Publicity Department of CCP Central Committee, Ministry of Education and Ministry of Science and Technology 2021). The establishment of the joint journal series is an outstanding role model for realizing those goals. Another example is the initiation of the Journal Excellence Action Plan, which aims to optimize the scientific academic journals in

various aspects, the most prioritized of which are professionalism, digitalization, clustering, and internationalization (Ke Dao 2019).

By introducing an *OA system* and charging authors for publishing their articles, the Chinese databases, such as CNKI, can obtain a stable source of funding without charging institutions exorbitant subscription fees. The subscription fees for many Chinese international academic journals have met with objections from foreign institutions, whose efforts to transform the paywall system to an open access system constitute a plausible reference for Chinese academic institutions, journals, and databases. The most common fee models of OA journals are hybrid OA and gold OA. Hybrid OA journals use the paywall/subscription system but allow for authors to publish their articles open access with an article processing charge (APC). Gold OA (Gold Open Access) journals publish all articles open access, and in return producers (authors) are charged processing fees. The University of California (UC) deal with Elsevier serves to make all publications on the database open access to UC and all UC publications on Elsevier open access to the public, which means the new fee model replaces the subscription fees with APC, saving subscription costs while benefiting public education.

The open access movement, for which the UC's deal with Elsevier is a great inspiration, strives to replace the subscription fee with fees paid to open the access to each article. In this way, the result of academic research becomes fully accessible to the public. UC Berkeley's University Librarian, economics professor, and co-chair of UC's publisher negotiation team, Jeffrey MacKie-Mason emphasized that open access is 'fundamental' to the mission of 'a public research university [whose] research is largely funded by public dollars' (Kell 2021). MacKie-Mason also pointed out that research universities and institutions around the world are trying to move in the direction of open access.

UC's success is part of the OA 2020 Initiative established at the 12th Berlin Open Access conference in 2015. Another ground-breaking success in line with the Initiative was achieved by the German project DEAL, a consortium aimed at negotiating 'nationwide transformative "Publish and Read" agreements with the largest commercial publishers of scholarly journals on behalf of German research institutions' (DEAL Konsortium, 2023a). In 2019 and 2020, DEAL secured agreements with Springer Nature and Wiley, allowing authors affiliated with more than 900 German institutions to publish their articles open access, whose publishing fees are covered by 'repurposing former subscription fees via DEAL's transitional cost model of "publish and read"'. In the meantime, institutions have 'unlimited perpetual access for their readers' of more than 4000 hybrid journals fully accessible across the Springer Nature and Wiley portfolio (DEAL Konsortium, 2023b).

Applying the US and European institutions' experience to the Chinese situation, a problem quickly emerges. CNKI does not have its own journals, which are usually affiliated with teaching and research institutes and published by academic presses, and it cannot charge the producers any money for publishing their works. Some Chinese scholars such as Zhu and Li (2022: 81) have identified this issue and proposed an alternative approach to the retrofitting of Chinese journal databases:

providing enhanced and more diverse service to make up for the lost revenue in subscription fees. However, this approach is still in its infancy and faces an uncertain future. The road ahead for Chinese academic journals and databases to go professional and global is still rough, and there will still be many inequities and limitations for scholars to disseminate their scholarship, particularly in the international arena.

In the face of these challenges, Chinese academic journals need to revitalize their strength, avoid unfair practices, and strive for expansion into digital publishing, all while acting in line with international academic conventions. Chinese journals need to form new kinds of collaborations with databases such as CNKI to become an active part of the digitalization process, which will benefit long-term development of the journals and their internationalization. On the other hand, CNKI should also foster new ties with journals, providing better support for them to become professional and international. Recently, the CNKI platform developed an English–Chinese translation service for words, phrases, and even academic articles, based on its large volume of academic bilingual corpora, with the aim of disseminating Chinese scholarship abroad and accelerating mutual communication. The technology has been used in creating the English version of China's Economic and Social Big Data Analysis Platform, *China Data Insights*, which facilitates research on Chinese economic and social development for foreign researchers.

There have been clear indications that efforts have been made by different parties to improve the academic ecosystem in China. Xu et al. (2019) found in their research that 'there has been rapid growth in CELJs (Chinese English Language Journals) between 2006 and 2011 but mostly in the science, technology and medicine disciplines' (Xu et al. 2019: 113). They summarized three approaches to the successful creation of international CELJs: increased visibility, good editorial boards, and international publishing partnerships (Xu et al. 2019: 122–123). These approaches have been embodied by China's 'Journal Excellence Action Plan'. One of the major goals of this plan is to improve the journals' level of internationalization, as a news piece of the *South China Morning Pos*t vividly describes, 'to raise the profile and influence of domestic scientific research' (Feng 2022). It is only through internationalization that experiences of improving academic equity and accessibility of academic resources can be shared and that the global academic community can form a sustainable ecosystem to benefit the production and sharing of knowledge.

Conclusion

As Zhu (2022: 45) bravely calls for 'stepping out the CNKI model to win the academic future', it is of great necessity and urgency to reconsider and revitalize the academic ecosystem, viewing it as a network where all relevant parties are actors exerting influence on each other and on the system as a whole. Thus, they all must take action to make progress in academic publication, dissemination, and evaluation. The future of Chinese scholarship is largely dependent on the progress

of Chinese journals and databases, as well as on the services provided by international academic journals and databases. Currently, with more and more Chinese scholars publishing in international academic journals, along with international journals' shift to OA and publication fees paid by authors, Chinese scholars will be required to pay higher publication fees, which could trigger a series of new problems. Additionally, it is foreseeable that there will be both cooperation and competition between the Chinese and international databases, so it remains to be seen what impact this will have on authors, especially in China.

For service-oriented databases to expand, they should first balance the seemingly paradoxical nature of public service with profitability. For scholars to obtain copyright security and for users to get open access to database resources would require government intervention and legal protection. When it comes to CNKI, it should serve the public and protect intellectual property rights. However, it is not yet quite clear to Chinese scholars what measures CNKI will take to improve its services and to upgrade its business model in the near future. Our expectations will be that academic databases, including CNKI, and digital publishing, which are inevitable, and in many ways very helpful, can be conducive to a better future of a new academic ecosystem for all of us.

Notes

a. Article 27 of Copyright Law of People's Republic of China regulates:

> The rates of remuneration for the exploitation of a work may be agreed upon by the parties and may also be paid in accordance with the rates fixed by the administrative department for copyright under the State Council in conjunction with the other departments concerned. In the absence of an explicit agreement in the contract, the remuneration shall be paid in accordance with the rates fixed by the said department under the State Council in conjunction with the other departments concerned.

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Multilingualism in Scientific Literature Communicated by Journals from the SciELO Brazil Collection

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This article describes the internationalization of the Scientific Electronic Library Online (SciELO), an open-science programme aimed at the development of capacities and infrastructure in research communication. It manages open-access collections of preprints, articles, research data, books, and book chapters, with a focus on national collections of non-profit peer-reviewed journals published by research communities of academic institutions, scientific societies, and associations. Celebrating 25 years of regular operation, SciELO improves research communication through professionalization, internationalization and sustainability of the indexed journals, maximizing their visibility and impact. In Brazil, the internationalization efforts by SciELO are aligned with national research policies, especially the internationalization of graduate programmes. The SciELO Brazil collection of journals evolves by adopting English solely or with Portuguese to improve the contribution of multilingualism to performing research by subject field. This article covers two decades of scientific literature in SciELO Brazil from 2003 to 2022. During this time, articles written in English or simultaneously in Portuguese and English increased significantly, resulting in a corresponding rise in access and citations received. The progress of the internationalization of the journals in the SciELO Brazil collection through multilingualism has been challenging both operationally and programmatically.

Introduction

Scientific literature consists of collections of texts such as articles, books, and other documents that record and convey knowledge resulting from research, essays, and

other intellectual exercises by researchers from yesterday, today, and tomorrow. It may span all geographies and thematic areas (Zilsel 1945). A project to achieve this is the SciELO Brazil collection, which, after 25 years of development and regular operation, brings together, as of 2024, more than 300 open-access journals from different disciplines and thematic areas, with a cumulative repository of 500,000 documents. This repository is updated annually with around 22,000 new documents. Over 180 academic institutions own the non-profit journals. The collection operates with a publication model adopted by Brazil and 16 other countries, forming the SciELO Network of national collections of journals with increasing quality. The conceptual framework governing the network and its collections is the SciELO Program (SciELO 2023a). As a public policy, SciELO Brazil is funded by the Coordination for the Improvement of Higher Education Personnel (CAPES) of the Ministry of Education, the National Council for Scientific and Technological Development (CNPq) of the Ministry of Science and Technology, and the São Paulo Research Foundation (FAPESP) of the State of São Paulo.

The collection is based on two documents adapted to the national specificities of each country. The first describes the policies, procedures, and indexing criteria applied in the evaluation of the entry and permanence of journals. It is periodically updated by a scientific committee formed by researchers representing the country's research community (SciELO Brazil 2022). The second document describes the priority actions for professionalization, internationalization, and operational and financial sustainability. It is updated every five years during the in-person meeting of the national coordinators of the SciELO Network (SciELO 2023b).

The content of the SciELO Brazil collection is scientific literature. The concept of scientific literature is used recursively and expresses the nature of science to continually update itself and accumulate new knowledge. In fact, the research of new knowledge, whose reports will feed the scientific literature, always presupposes the review and analysis of what is already known. Thus, the dynamism of information flows originated by new texts and references between texts that inform minds, new research, public policies, education systems, professionals, and society is inherent in the concept of scientific literature.

The temporal, geographical, thematic, and medium universality that characterizes scientific literature is also expressed in the different languages of the texts used throughout the scientific history of humanity. There have been periods of predominance of a language, such as Latin and French, the coexistence of two or more, as with German, French, and English in the early twentieth century, soon surpassed by the progressive dominance of English that emerged as the lingua franca of contemporary scientific communication (Ortiz 2004).

This article analyses the evolution of the adoption of English and Spanish by the journals in the SciELO Brazil collection because of the implementation of its internationalization policy aimed at maximizing the visibility and impact of the communicated research. The data used and produced in the articles are available for public access. The scientific literature referenced in this article is, whenever possible, self-referenced from the SciELO collection itself as an expression of its relevance.

Multilingualism vs. Lingua Franca

Despite the hegemonic force that the lingua franca globally exerts on research communication and exchange between researchers, multilingualism has always been present in scientific literature. This has been the fact notwithstanding the difficulty or impossibility of measuring its precise occurrence due to the limitations that libraries and bibliographic control systems have in identifying and encompassing a universal and comprehensive scientific literature. These limitations have been progressively overcome with the predominance of the digital format of new texts and the digitization of texts originally on paper. The web, through the network of digital collections, has made the dream of humanity to create a universal library of all texts a reality. In fact, one of the significant contributions of this networked universal library was to overcome the phenomenon of 'lost science in the third world' (Gibbs 1995). This concept found pioneering implementation in the Scientific Electronic Library Online (SciELO) with an open-access online publishing model for nationally published journal collections. It was launched in São Paulo four years before this publishing modality was proposed and formalized in the Budapest Declaration (Packer and Meneghini 2015).

However, a significant portion of contemporary bibliographic services for scientific literature has its policies, methodologies, criteria, procedures, and coverage technologies conditioned by the hegemony of the English language, dominant in their geographic origin (Salatino 2023). In fact, the commercial bibliographic indexes of international reference – such as Scopus and Web of Science – used for the past 20 and 50 years, respectively, to measure the scientific production in countries, institutions, thematic areas, and researchers, have exacerbated the dominance of English in global production with about 95% of journal article records in recent years. Meanwhile, the more exhaustive OpenAlex index presents a proportion of 72% of articles in English. National bibliographic indexes, such as those of the SciELO Network in 17 Ibero-American countries and South Africa, have more records in Portuguese and Spanish than in English. Several comprehensive indexes cover all journals in the SciELO Brazil database, such as Google Scholar (which covers the web), OpenAlex and others that have the Crossref DOI registration platform as their main source of articles. SciELO Network collections are indexed in the WoS platform within the All Databases collection under the name of SciELO Citation Index, which is a source to follow up the citation performance of the collections, journals and articles.

The SciELO publication model, as a means of overcoming the 'lost science of the third world' phenomenon, emerges as a determinant force striving to secure a place in the sun for non-commercial journals published nationally, previously excluded from bibliographic indexes. These journals were traditionally printed on paper with limited distribution, communicating predominantly in Portuguese in Brazil and Spanish in Hispanic-American countries. Moving the publication to the web in an appropriate model brought extraordinary visibility to the journals and the research they communicated, giving strength and feedback to SciELO's geographic, thematic,

and language diversity and inclusion. Thus, SciELO, deployed as an integral part of the global flow of research communication, organized a network of national collections of scientific literature. While produced progressively according to state-of-the-art editorial practices, it possessed national historical and cultural characteristics and was driven by national conditions and priorities (Packer 2001). Over the last four decades, the SciELO model was developed within a Latin American and Caribbean environment of open-access related capacities and infrastructures, involving policies, methodologies, technologies, systems, products, and services of scholarly communication. It highlights systems such as the Latin American Population Documentation System (DOCPAL/CELADE), Latin American and Caribbean Health Sciences Literature (LILACS), the Scientific Information System Redalyc, the Regional Cooperative Online Information System for Scholarly Journals from Latin America, the Caribbean, Spain, and Portugal (Latindex) and the Federated Network of Institutional Repositories of Scientific Publications (LA Referencia) (Beigel *et al*. 2024). After 25 years of continuous development, SciELO is asserting itself as an open-science communication programme as part of the global flow with unique characteristics expressed by the motto 'SciELO Open Science with IDEIA – Impact, Diversity, Equity, Inclusion and Accessibility' – that serves as an experience and model for national research systems (SciELO 2023c).

The SciELO Brazil collection quickly became the reference index for quality journals of Brazil, serving the function of communicating nationally scoped and relevant research largely in the Portuguese language. The same happened with the other collections of the SciELO Network, contextualized by national conditions and priorities with a predominance of the Spanish language in Hispanic-American countries, Portuguese in Portugal, and English in South Africa and the West Indies. One noteworthy feature of SciELO as a bibliographic index and meta-publishing web space is its native ability to index articles made available in two or more languages simultaneously. Among international indexes, only Google Scholar has this capability. Full text articles are structured in XML according to a JATS compatible schema, which helps web dissemination, exchange and interoperability. Documents in Portuguese or Spanish have their title, abstract and keywords also available in English.

In the Brazil context, the goal of maximizing the visibility and impact of journals and the research they communicate required overcoming their endemism determined by two concurrent factors. First, the origin of the journals aimed at facilitating national scientific production and communication, mainly generated by graduate programmes since the 1950s. In fact, half of the journals in the SciELO Brazil collection were created after 1995. Second, the national Portuguese language limits international collaboration and the submission of articles from abroad, a condition that is less restrictive to SciELO journals in Hispanic-American countries, which communicate a high proportion of research from other countries (Beigel *et al*. 2024; Salatino 2023). Thus, in the year 2006, a total of 200 journals of SciELO Brazil published 71% of their articles in Portuguese.

Internationalization emerged as a solution to provide more access and obtain more citations. Therefore, the collection's leadership established, in the indexing criteria from 2014 onwards, an expected proportion of articles in English, the international affiliation of authors, and foreign researchers in the editorial management bodies according to thematic areas (SciELO Brazil 2014; SciELO Brazil 2022). The adoption of English was in the short term the most viable policy and operationally feasible line of action for internationalization implemented by the journals. An inherent solution in the methodological and technological platform of SciELO is to publish simultaneously in two or more languages, an option that we suggested in response to the question 'Is there science beyond English?' (Meneghini and Packer 2007). Furthermore, the indexing criteria of SciELO Brazil were reinforced by the internationalization policy of Brazil's graduate education promoted by the Ministry of Education through the Coordination for the Improvement of Higher Education Personnel (CAPES), responsible for approving and evaluating graduate programmes (Ramos 2017; Feijó and Andrade 2021).

Characteristics of the SciELO Brazil Collection

Geographic Origin and Institutional Affiliation of Journals

At the end of 2022, the SciELO Brazil collection indexed and published 314 active journals primarily focused on national research communities. These journals are published by 182 different institutions, of which 153 have only one indexed journal. Approximately 62% of the journals are published by educational and research institutions – universities through their faculties, departments, and graduate programmes, research institutes, museums, and institutions linked to ministries – while 37% are published by scientific and professional societies and associations. Commercial publishers only put out five of the journals.

All five regions of Brazil, comprising the 27 federative units, are represented in the collection, with a high concentration in the Southeast region (73%) and the South region (15%), followed by the Central-West (7%), Northeast (4%), and North (1%) regions. Among the 27 federative units, 17 (63%) have indexed journals. The distribution of journals in the collection broadly mirrors the distribution of Brazil's infrastructure and scientific production across federative units.

Thematic Areas of Journals and Author Affiliation

The SciELO collection classifies journals into thematic areas defined by CAPES in three hierarchical levels. The first level comprises (1) Life Sciences, (2) Exact, Technical, and Multidisciplinary Sciences (hereafter referred to as Physical Sciences), and (3) Social Sciences and Humanities. At the second level, the Life Sciences journals include those in (1a) Health Sciences, (1b) Agricultural Sciences, and (1c) Biological Sciences, while the Physical Sciences, include (2a) Engineering, (2b) Exact and Earth Sciences, and (2c) Multidisciplinary journals. The Social Sciences and

Table 1. Distribution of journals and articles in the SciELO Brazil collection by thematic areas, years 2020–2022.

Field	Journals (%)	Articles (%)	Scopus (%)
Life Sciences	*45*	*60*	*58*
Health Sciences	63	69	–
Agricultural Sciences	24	19	–
Biological Sciences	13	12	–
Physical Sciences	*9*	*11*	*42*
Engineering	57	49	–
Exact and Earth Sciences	27	23	–
Multidisciplinary	17	28	–
Social Sciences and Humanities	*46*	*29*	*18*
Humanities	61	67	–
Applied Social Sciences	28	25	–
Linguistics, Letters and Arts	11	9	–

Note: A few journals in the Life Sciences and the Social Sciences and the Humanities are attributed to two or more thematic areas. When in three or more areas they are named multidisciplinary. Thus, the table shows weighted percentages of journals and articles in SciELO Brazil collection.

Humanities for their part include journals in (3a) Humanities, (3b) Applied Social Sciences, and (3c) Linguistics, Letters, and Arts. Table 1 presents the distribution of journals by thematic areas and the articles they published in the years 2020–2022. It shows that the journals in the Life Sciences and the Social Sciences and Humanities each comprise 45% and 46%, respectively, of the journals, while those in the Physical Sciences constitute a minority with 9%. However, in terms of the number of articles, those published by the Life Sciences journals constitute 60% of the collection, while the Social Sciences, and the Humanities contribute less than a third at 29%, and the Physical Sciences only 11%. In contrast, the production of articles from Brazil for the years 2020–2022 indexed in Scopus is distributed with 58% in the Life Sciences, 42% in the Physical Sciences and 18% in the Social Sciences and the Humanities.

Among the Life Sciences journals, the Health Sciences predominate, constituting 63% of the journals and contributing to 69% of the articles, while Engineering dominates within the Physical Sciences with 57% of the journals and 49% of the articles. Among the Social Sciences and Humanities journals, those in the Humanities predominate with 61% of the journals and 67% of the articles.

With respect to author affiliation, it is clear that the journals in the SciELO Brazil collection were predominantly created to disseminate research conducted by communities involving mainly Brazilian researchers. With the promotion of internationalization led by SciELO, research agencies and evaluation programs, there has been an average annual growth of 4% over the last ten years, increasing from 17% of foreign affiliation in 2013 to 30% in 2022. Of the three major fields, the journals in the Life Sciences and the Physical Sciences had 32% of their articles by foreign authors and 9% of articles in collaboration between Brazilians and foreigners. As expected, the Social Sciences and the Humanities journals published a

Table 2. Minimum limits for articles in English in the SciELO Brazil collection by thematic area and criteria years.

Field	2014	2022
Life Sciences		
Health Sciences	80%	90%
Agricultural Sciences	50%	95%
Biological Sciences	85%	95%
Physical Sciences		
Engineering	70%	75%
Exact and Earth Sciences	70%	75%
Multidisciplinary	85%	100%
Social Sciences and Humanities		
Humanities	25%	35%
Applied Social Sciences	25%	50%
Linguistics, Letters and Arts	20%	32%
Total	*60%*	*76%*

smaller proportion of articles with foreign authors (23%), and collaborations between Brazilians and foreigners (6%). The majority of foreign authors came from Asia (22%), Latin America and Caribbean countries (18%), Spain or Portugal (16%), North America (14%) the Middle East (14%), Western Europe except Iberia (5%) and Africa (4%).

Evolution of Multilingualism in Portuguese, English and Spanish Publication

In the last 20 years (2003 to 2022), the journals in the SciELO Brazil collection have shown a notable and systematic evolution towards multilingualism, with the progressive adoption of English as the sole language or simultaneously with Portuguese as a strategy for the internationalization of research communication. On a smaller scale, Spanish is relevant in specific groups of journals. As shown in Table 2, the minimum indexing criteria of the SciELO Brazil collection for the proportion of articles in English – the total number of articles in English divided by the total number of articles in the area – were raised between 2014 and 2022 for the journals in different thematic areas. In the Life Sciences to 90% and above, in the Physical Sciences to 75% for Engineering, Exact Sciences and Earth Sciences, and to 100% for Multidisciplinary research. For the Social Sciences and the Humanities, the proportions were between one third and one half. The criterion applied by thematic area thus allows for flexibility in the proportions of articles in English and Spanish for individual journals, providing some leeway for compliance, including allowing journals that publish only in Portuguese. While translation from Portuguese to English became common, very few journals have chosen to translate articles submitted in Portuguese into Spanish.

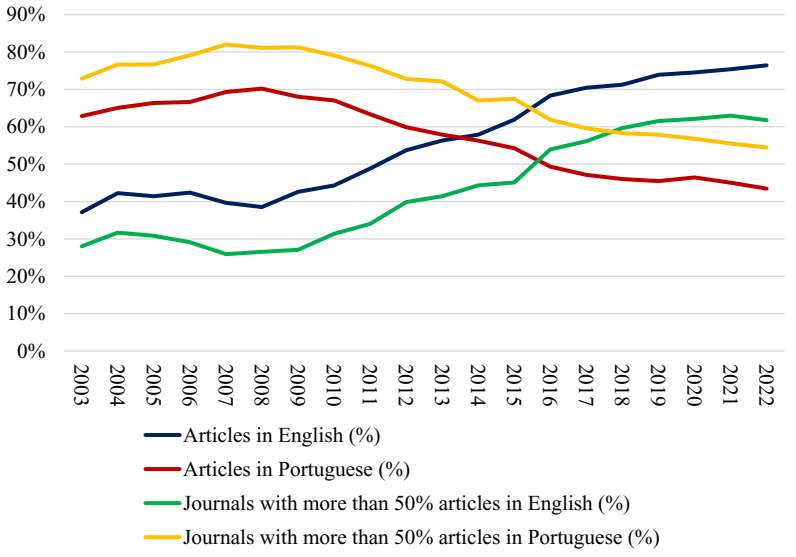

Figure 1. Evolution of the proportion of articles and journals in English and Portuguese.

Although limits for the Life Sciences and the Physical Sciences were already relatively high in 2014, they were raised in 2022. At that time, only a small portion of articles authored in Portuguese and rarely in other languages than English were permitted in the Life Sciences, about a quarter in the Physical Sciences, whereas the limits were considerably less restrictive in the Humanities and the Social Sciences.

An unequivocal expression of the multilingualism of the SciELO Brazil collection is the fact that, as stated in the instructions to authors, 52% of all journals, 83% of those in the Social Sciences and the Humanities, 29% in the Life Sciences, and 21% in the Physical Sciences accept manuscripts in any of the languages English, Spanish, or Portuguese. The greatest restriction comes from 31% of the journals that accept only manuscripts in English, predominantly among those in the Life Sciences (42%) and the Physical Sciences (72%). Journals in the Social Sciences and the Humanities are the most inclusive, with 97% accepting manuscripts in English, 96% in Portuguese, and 84% in Spanish.

The evolution of the proportion of articles in English varies with the adoption of English by journals that previously published in Portuguese and with the entry of new journals where the proportion of English is a key indexing criterion, especially from 2014, when minimum requirements were defined by thematic area. Spanish was also adopted in the wake of internationalization, especially among the journals in Social Sciences and Humanities. The evolution of international author affiliations also contributes, with articles in Spanish from Hispanic-Americans and in English from those outside Ibero-America.

As demonstrated in Figure 1, there has been a steady increase between 2003 and 2022 in the share of articles published in English (from 37% to 76%) and the share of

journals publishing more than 50% of their articles in English (from 28% to 62%). At the same time, there has been a decline in the share of articles published in Portuguese (from 63% to 43%) and the share of journals publishing more than 50% of their articles in Portuguese (from 73% to 54%). In 2018, the number of journals publishing more than 50% of articles in English surpassed those publishing 50% or more in Portuguese.

A closer look at the development clearly reveals three periods in the evolution of plurilingualism and multilingualism between 2003 and 2022: 2003–2009, 2010–2015 and 2016–2022 (Table 3).

2003–2009

The number of journals increased at an annual average rate (AAGR) of 11% from 107 to 203 and articles at 13% from 8,080 to 17,028, with a steady distribution of the annual percentage of articles in English and in Portuguese of around 40% and 67%, respectively. The share of journals with more than 50% of articles in English and Portuguese averaged 28% and 77%, respectively. The share of articles in Spanish increased from less than 2% to 4%, and the share of journals with more than 15% of articles in Spanish increased from 2% to 5%.

2010–2015

The number of journals increased at an annual average of 6% from 220 to 286 and articles at 2% from 18,078 to 19,599, with the percentage of English articles increasing at an annual average rate of 6% from 44% to 62%, while the Portuguese articles decreased at an annual average rate of 4% from 67% to 54%. The number of journals in 2015 with more than 50% articles in English and in Portuguese reached 45% and 67%, respectively. Articles in Spanish remained around 4%. The share of journals with more than 15% articles in Spanish increased from 4% to 7%.

2016–2022

The number of journals and of articles increased steadily in the SciELO Brazil core collection at an annual average of 1% from 291 to 314 and from 19,939 to 21,250, respectively. The share of English articles increased at an annual average of 4% from 68% to 76%, while Portuguese articles decreased at an annual average rate of 3% from 49% to 43%. The share of journals with more than 50% articles in English increased from 54% to stabilize around 62% in the last four years, while the publishing in Portuguese went in the opposite direction: from 62% to 54%. In 2018, the number of journals publishing more than 50% of articles in English surpassed those publishing 50% or more in Portuguese. Articles in Spanish stabilized just above 4%, and journals publishing more than 15% of articles in Spanish increased at annual average of 11% from 7% to 12%.

Further evidence of the development is the fact that those journals publishing only in Portuguese decreased from 14% to 1%, after a peak of 17% in 2006. At the same time, journals with more than 50% of articles in English increased from 28% in 2003

Table 3. Number of journals, number of articles and publishing languages 2003–2009, 2010–2015 and 2016–2022 with annual average growth rates (AAGR) in the SciELO Brazil collection

Period	2003–2009			2010–2015			2016–2022		
Years	2003	2009	AAGR	2010	2015	AAGR	2016	2022	AAGR
Number of journals	107	203	11%	220	286	6%	291	314	1%
Number of articles	8,080	17,028	13%	18,078	19,599	2%	19,939	21,250	1%
Articles in English	37%	43%	3%	44%	62%	6%	68%	76%	4%
Articles in Portuguese	63%	68%	1%	67%	54%	–4%	49%	43%	–3%
Journals with more than 50% articles in English	28%	27%	0%	31%	45%	9%	54%	62%	5%
Journals with more than 50% articles in Portuguese	73%	81%	2%	79%	67%	–3%	62%	54%	–3%
Articles in Spanish	2%	4%	19%	4%	4%	1%	4%	4%	2%
Journals with more than 15% in Spanish	2%	5%	21%	4%	7%	12%	7%	12%	11%

Note: As percentages of languages are calculated independently, they sum above 100% due to the simultaneous publication in two or more languages.

to 62% in 2022, those with more than 90% from 22% to 56% and those with English only from 17% to 41%. A particular aspect of this evolution was the maintaining of communication in Portuguese for a significant set of journals. In fact, simultaneous publication in Portuguese and English advanced: the share of the journals publishing 25% or more of the articles in English and Portuguese increased from 5% to 24%. Those publishing more than 90% in English and Portuguese now constituted 11%. The number of journals publishing more than 15% of articles in Spanish increased systematically, moving from less than 2% in 2003 to 12% in 2022.

The practice of multilingualism varies among thematic areas. In the Life Sciences in 2003, 10% of the journals published only in Portuguese, but this had ceased in 2020. In the Physical Sciences, the two journals that only published in Portuguese stopped doing so in 2017. Even in the Social Sciences and Humanities, journals that published only in Portuguese declined, from 30% to 1%. At the same time, the proportion of journals with more than 90% of articles in English increased: from 22% to 56% for the fields in total, from 27% to 84% in the Life Sciences journals, from 39% to 76% in the Physical Sciences and from 0% to 23% in Social Sciences and Humanities. In the same period, the proportion of journals with more than 15% of articles in Spanish contributed to multilingualism in the Health Sciences and the Social Sciences and the Humanities, reaching 6% and 24%, respectively, in 2022.

The adoption of English through simultaneous publication in Portuguese and English was more significant among journals in the Life Sciences, and the Social Sciences and the Humanities, something which has stabilized in recent years at around 25% and 17% of journals with 50% or more multilingual articles, and 14% and 9% with 90% or more articles in English and Portuguese, respectively. The Physical Sciences journals, in contrast, did not commonly engage in multilingual publication, and only one journal published in Portuguese and English in the last two years. Articles in Spanish with simultaneous publication in Portuguese or English or both in more than 15% of the articles has limited occurrence, with only 5% and 3%, respectively, in the Health Sciences and the Social Sciences and the Humanities journals.

The progressive adoption of English, and to a minor degree Spanish, as a means to contribute to the internationalization of the research communicated by SciELO Brazil journals, whether alongside or abandoning Portuguese, has simultaneously altered the composition of the collection of articles. Table 4 illustrates the evolution of the proportion of articles in English, Portuguese and Spanish in the three periods selected.

In the Life Sciences, the share of 38% in 2003 had risen to 92% in 2022, in the Physical Sciences from 60% to 82% and in the Social Sciences and the Humanities from 6% to 40%. Overall, the share of English articles increased from 37% to 76%. At the same time, publishing in both English and Portuguese increased from 2% to 27% in the Life Sciences, from 1% to 23% the Social Sciences and the Humanities, and from 2% to 22% as a whole. In the Social Sciences and Humanities, the share of articles in Portuguese in the same period dropped from 89% to 75% and from 63% to 43% in total. The proportion of articles in Spanish stabilized in 2015 at 4%.

Table 4. Evolution of article multilingualism in English, Portuguese and Spanish by major subject areas 2003–2009, 2010–2015 and 2016–2022 in the SciELO Brazil collection.

Language	Scientific field	Period					
		2003	2009	2010	2015	2016	2022
English	Life Sciences	38%	49%	51%	74%	82%	92%
	Physical Sciences	60%	54%	56%	71%	75%	82%
	Social Sciences and Humanities	6%	6%	11%	20%	28%	40%
	Total	37%	43%	44%	62%	68%	76%
English and Portuguese	Life Sciences	2%	12%	19%	2%	26%	27%
	Social Sciences and Humanities	1%	3%	4%	2%	12%	23%
	Total	2%	9%	14%	2%	20%	22%
Portuguese	Social Sciences and Humanities	89%	92%	89%	82%	77%	75%
	Total	63%	68%	67%	54%	49%	43%
Spanish	Total	2%	2%	4%	4%	4%	4%

Note: Owing to simultaneous publication, the percentages may sum to a total above 100%.

Language and Performance of Journals in Communicating Research

The promotion of multilingualism with the adoption of Portuguese and English as the main languages in the SciELO Brazil collection, and Spanish to a minor degree, specifically aims to enhance the visibility and impact of journals and the research they communicate. This can be verified by bibliometric indicators of visibility and impact based on the evolution of the number of accesses and citations received, filtered by document languages.

Table 5 presents the total number of unique accesses per document from 2019 to 2022 for documents published from 2016 to 2018, categorized by document language and major subject areas. The measurements use the COUNTER release 5 methodology, which eliminates robots and counts only one possible access to the same document during a session. The numbers of all versions of documents – articles, reviews, editorials, etc. – accessed in 2016, 2017 and 2018 were 22,235, 22,753 and 23,377, respectively. From 2019 to 2022, they received a total of 60.9, 66.7 and 71.6 million accesses, respectively. The tabulated data show that documents accessed most are those simultaneously published in Portuguese and English (row 4 in Table 5) followed by those in Spanish (row 5), Portuguese (row 3), and English (row 2). Documents of the Social Sciences and the Humanities journals (column 5) are more accessed followed by the Life Sciences (column 3) and lastly the Physical Sciences (column 4). The total access to 2016 documents is lower than to 2018 documents, signalling that recent documents tend to be more looked for, especially in the Life and Physical Sciences.

In terms of citations, the H5 indicator from Google Scholar (h-index in five years) and the CiteScore indicator applied to SciELO Citation Index of the Web of Science All Databases, both covering all SciELO Brazil journals, provide a comprehensive citation metric to follow up the evolution of the performance of the collection. The

Table 5. Accesses/document from 2019 to 2022 to documents from 2016 to 2018 by language and subject area in the SciELO Brazil collection.

Language (1)	Year (2)	Life Sciences (3)	Physical Sciences (4)	Social Sciences and Humanities (5)	Total (6)
English (2)	2016	1,538	1,503	1,821	1,547
	2017	1,700	1,550	1,859	1,698
	2018	1,712	1,649	1,673	1,704
Portuguese (3)	2016	2,924	2,379	3,508	3,051
	2017	3,142	2,487	3,691	3,321
	2018	3,514	2,505	3,630	3,568
English and Portuguese > 50% (4)	2016	4,834	4,313	5,161	4,666
	2017	5,266	5563	4,209	5,126
	2018	5,374	3,591	4,520	5,146
Spanish (5)	2016	2,630	1,721	4,254	3,461
	2017	1,908	1,808	3,901	3,173
	2018	2,082	1,707	5,085	3,813
Total (6)	2016	2,657	1,868	3,608	2,740
	2017	2,815	1,903	3,778	2,933
	2018	2,929	1,928	3,851	3,066

upper part of Table 6 presents the evolution of the median value of the H5 indicator between 2013 and 2022 for all journals and by major subject areas, alongside the evolution of the proportion of documents published in English. The H5 indicator has a broad coverage of journals, surpassing the limitations of indexing in traditional indices commonly used to measure the impact of journals, especially those in the Social Sciences and Humanities and published in languages other than English. It is therefore a key indicator for measuring the impact of journals in the SciELO Brazil collection. In the series from 2013 to 2022, the H5 operates as a five-year moving indicator of year-to-year evolution. For all disciplinary areas, there is an annual average growth rate (AAGR) ranging from 6% for the Life Sciences to 9% for the Social Sciences and the Humanities. This growth is highly correlated in all areas to the growth of the proportion of English (middle part of Table 6), with a particular emphasis on journals in the Social Sciences and Humanities (0.96).

Similarly, the bottom part of Table 6 presents the evolution of the median value of the Scopus CiteScore indicator between 2013 and 2022 for all journals and by major subject areas, parallel to the evolution of the proportion of documents published in English. The indicator was applied to journals in the SciELO Citation Index operating on the Web Science platform as part of the ALL Databases collection. The CiteScore indicator is similar to that applied to journals in the Scopus index, calculating the average number of citations received by journal documents over four-year periods. In the years between 2013 and 2022, it operates as a four-year moving average. As with the H5, there is a high correlation between the growth of the proportion of English and the CiteScore indicator in all areas, with a particular emphasis on journals in the Social Sciences and Humanities (0.93).

Table 6. Evolution of the median values of the H5 indicator from Google Scholar, the average of the journal's percentage of articles in English from 2013 to 2022, by subject area, and the CiteScore indicator in the Web of Science with respective average annual growth rates and correlations.

Indicator	Field	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	AAGR	*r*	*p*
H5	Life Sciences	13	14	14	14	15	16	17	19	21	21	6%	0.83	0.003
	Physical Sciences	9	10	11	11	13	12	14.5	16	17	17	8%	0.86	0.001
	Social Sciences and Humanities	7	9	9	10	11	12	14	15	15	15	9%	0.96	<0.001
	All	10	12	12	12	13	13	15	17	18	17	6%	0.85	0.002
English (%)	Life Sciences	70%	73%	76%	82%	85%	88%	90%	90%	91%	91%	3%		
	Physical Sciences	61%	70%	68%	73%	81%	82%	83%	81%	84%	85%	4%		
	Social Sciences and Humanities	26%	29%	28%	35%	36%	39%	42%	41%	43%	41%	5%		
	All	57%	60%	59%	64%	66%	69%	70%	69%	71%	69%	2%		
CiteScore	Life Sciences	0.75	0.87	0.90	0.96	0.95	1.06	1.18	1.37	1.47	1.51	8%	0.86	0.001
	Physical Sciences	0.41	0.43	0.44	0.50	0.54	0.87	0.97	0.98	1.19	1.19	14%	0.85	0.002
	Social Sciences and Humanities	0.20	0.25	0.29	0.31	0.31	0.38	0.44	0.49	0.53	0.45	10%	0.93	<0.001
	All	0.39	0.43	0.48	0.53	0.56	0.66	0.77	0.87	0.88	0.86	9%	0.91	<0.001

Discussion

The internationalization of scientific literature processed and communicated by journals across different subject areas in the SciELO Brazil collection over the past two decades has been successful, primarily due to the systematic adoption of the English language in most of the journals and of the Spanish language among the Humanities journals. Since 2016, more than 50% of all journals in the collection have been publishing over 50% of their articles in English, primarily the Life Sciences and the Physical Sciences journals. In fact, since 2018, the percentage of journals publishing more than 50% in English surpassed those publishing more than 50% in Portuguese. Between 2015 and 2022, there was an average annual growth of 4% in the share of English-language articles, with a notable 14% growth for journals in the Social Sciences and Humanities. Hence, in the same period, the proportion of Portuguese-language articles declined at an annual average rate of 3% from 54% to 43%, while the Social Sciences and Humanities declined only 1%. A key aspect of SciELO Brazil internationalization by language is the bilingual publication in Portuguese and English, accounting for a remarkable 22% of total articles in 2022. This practice is predominantly adopted by journals in the Life Sciences, and the Social Sciences and the Humanities, with shares in 2022 of 27% and 23%, respectively. The affiliation of foreign authors, as a second measure of internationalization, has also been steadily increasing at an average annual rate of 4% over the last decade, reaching 30% of articles in 2022, further contributing to the rise in the proportion of articles in English and Spanish.

The internationalization that has enhanced the visibility and impact of journals and communicated research, as measured by accesses and citations received, was practically induced by the indexing criteria of the SciELO Brazil collection. These criteria are aligned with Brazilian research internationalization policies, emphasizing graduate programmes whose scientific production is assessed by CAPES through journal rankings primarily based on bibliometric citation indicators. The performance of all journals grew at an annual average of 6% in the Google Scholar H5 indicator and 9% in the CiteScore indicator in the SciELO Citation Index of All Databases collection of the Web of Science platform. There is a correlation above 0.84 between these indicators and the proportion of articles in English. However, access per article to Portuguese-language articles is significantly higher than to English-language articles, justifying the practice of bilingual publication to cater to both national and international audiences. Thus, the adoption of English as the sole language for articles – while contributing to increased citations and international access – may reduce national access.

The challenge in managing the future development of the SciELO Brazil collection lies in striking an ideal balance between the proportions of publications in Portuguese and English for all journals as well as Spanish for the Humanities and the performance growth of access and received citations. This balance has been adjusted by subject areas, meeting indexing criteria, with the limits of English-language articles being reached in all subject areas. However, the adoption of English as the

only language in many cases and particularly with Portuguese, strains the pursuit of balance in the multilingual composition of the SciELO Brazil collection in two critical competing operational aspects: first, the high cost involved, leading many journals to adopt publication fees to cover translations and editing, and second the limitation of global bibliographic indexes, except for Google Scholar, to cover all versions.

The evolution of multilingualism in the SciELO Brazil collection as a national policy occurs in a global context where indexed scientific literature is dominated by English by over 90% in Scopus and Web of Science. However, there are significant global, regional, and national stances on the relevance of multilingualism that conceptually support the policy of the SciELO Brazil collection. However, these stances often tend to unilaterally defend or promote national and regional languages other than English, contrasting with the promotion of English by the SciELO Brazil collection as a critical dimension of multilingualism to balance the endemism of scientific literature that emerged from Portuguese predominance. This discrepancy usually arises from the perspective with which the visibility and impact of research are assessed, often due to the simplistic use of bibliometric indicators produced by platforms such as Scopus and Web of Science, which favour English and limit the indexing of nationally edited journals. Most analyses ignore that, besides the inclusiveness of national regional indexes, indexers such as Google Scholar index articles regardless of language. Recently, the popularization of search systems based on language models with high natural language processing capabilities contributes to the exhaustive indexing of scientific literature available on the web regardless of language.

Globally, SciELO Brazil's adoption of publication in English, Portuguese and Spanish in proportions adjusted by thematic areas aligns with the promotion of multilingualism as an international policy, which has historically been led by UNESCO and reaffirmed in its recent Recommendation on Open Science by '[e]ncouraging multilingualism in the practice of science, in scientific publications and in academic communications' (UNESCO 2022). In the international research and scientific communication community, the Helsinki Initiative on Multilingualism in Scholarly Communication (2019), whose recommendations gained global adherence, plays a significant role in supporting the protection of 'national infrastructures for publishing locally relevant research' and the promotion of 'language diversity in research assessment, evaluation, and funding systems'. This underpins the essence of the SciELO publication model, which also includes the publishing of internationally relevant research. In the Ibero-American context, three stances systematically promote multilingualism in favour of Spanish and Portuguese. The Ibero-American General Secretariat (SEGIB), which supports the development of the Ibero-American community reaffirms in its 2023–2026 strategic plan the bilingualism of Portuguese and Spanish as 'a distinctive characteristic of the identity and common heritage of the Ibero-American Community' and as languages of scientific communication (SEGIB, 2023). The Ibero-American Program on

Multilingualism and the Promotion of the Portuguese and Spanish Languages of the Organization of Ibero-American States for Education, Science, and Culture (OEI) stands out. In 2022, it organized the CILPE International Conference on the Portuguese and Spanish Languages, Languages, Culture, Science, and Innovation with a section dedicated to 'Plurilingual Science: Portuguese and Spanish in Science' whose analysis is permeated by the recognition of the strength of the regional research communication multilingual infrastructure (OEI 2023). Since 2019, the Latin American Forum on Research Assessment of the Latin American Council of Social Sciences (FOLEC/CLACSO) advances a common agenda on research assessment policies in the region and has stated that multilingualism 'favours the development of socially relevant research and contributes to sustaining cultural diversity' as one of its principles (FOLEC/CLACSO 2022). Its intention is 'to show the potential of Latin America and the Caribbean to promote a more diverse dissemination of knowledge in terms of format and language, with a quality seal that strikes a better balance between global standards and local or national needs' (FOLEC/CLACSO 2021).

Certainly, SciELO Brazil faces, in many senses, unique challenges, both operationally and programmatically, in seeking properly balanced multilingualism as a well-established indexing and publishing policy that ensures, primarily, the communication of nationally relevant research, but also international research, maximizing their presence in the global flow of scientific information. This is achieved, first, with the adoption of English, and, second, by contributing to the process of internationalization of Portuguese as a scientific language (Oliveira 2013). It is in many senses a unique configuration globally, but particularly in comparison with the Ibero-American collections of the SciELO Network, which published a steady yearly average of 75% or more of all articles in Spanish in the last ten years.

Operationally, the main challenges lie in maximizing the cost-effectiveness of internationalization in general but specifically related to English translation and editing costs and the benefits in terms of visibility and impact. Strategically, the main gain is the successful development of capacities and infrastructures in Brazil, through journals, private service providers and the SciELO platform, to regularly operate multilingualism with high complexity involved in structuring full texts in XML, HTML, and PDF formats, and metadata following FAIR principles. Collateral negative effects include the sharing of translation costs with authors, which has forced many journals to abandon the traditional pure diamond open-access model. Another operational challenge is to overcome the inability of classic bibliographic indexes, except for Google Scholar and SciELO itself, to adequately manage articles published simultaneously in two or more languages. They either manage only one version at the expense of others or all versions as separate records, artificially inflating scientific production and the denominator in bibliometric calculations.

Programmatically, considering that multilingualism is a critical foundation of SciELO, the main common questionings of the SciELO Brazil policies rely on the required adoption of English by native Portuguese authors communicating research

on problems that are of local, national or regional interest. Considering that these questionings apply mainly to the Social Sciences and Humanities articles, it is worth noting that 40% and 75% of articles in English and Portuguese in 2022 in the Social Sciences and Humanities journals are compatible with the research output of 37.5% English and 57.2% in local languages of seven Northern and Western European countries between 2013–2015 (Kulczycki *et al.* 2020).

The questioning in the SciELO Brazil literature of why native Portuguese-speaking Brazilians choose or are called to publish in English is grounded, on the one hand, in the premise of a loss of their full communication capacity or the limitations of translations that could ultimately impact the performance of texts, as well as the negative impact on the training of students, the continuous education of professionals, and the dissemination of reliable information to society. There is also concern about the negative impact on the development of the ability of the Portuguese language to express the state of the art in scientific knowledge and the advancement of national culture. On the other hand, there is a questioning about the type of internationalization based simply on the adoption of English, which would indicate submission to the dominance of the mainstream scholarly communication by central capitalist countries expressed in prestigious journals published by commercial publishers or large scientific societies that profit from scientific communication. It also has the side effect of Brazilians reading articles in English on national research topics authored by Brazilian colleagues (Beigel and Digiampietri 2023, Carvalho and Sasseron 2014, Diniz 2017).

Nevertheless, these questionings also suggest paths for improving existing policies and establishing new ones for the enrichment of multilingualism as an essential condition for the development with diversity, equity, and inclusion of the SciELO Brazil collection as a whole, but especially for each of the journals it indexes and publishes. The central focus is on recognizing the relevance of the communicated research and maximizing its visibility and impact. Therefore, the most immediate and promising path lies in refining the management of publication in Portuguese or English or both simultaneously with the help of indicators measuring the gains in the cost–benefit relationship. A similar practice should be promoted for simultaneous publication in Portuguese and Spanish in specific areas covering converging research communities from different Ibero-American countries.

Regarding the broader internationalization of journals beyond simple English publication, the challenge is to enhance mechanisms that contribute to increasing the active presence of foreign researchers in journal management roles as editors, reviewers, and authors. This is aimed at improving the quality and international positioning of the journals (Ferreira *et al.*, 2019). In terms of disseminating research to society at large, SciELO should improve current practices of research press releases and its partnership with the Bori Agency dedicated to public science dissemination through a network of journalists (Righetti *et al.* 2022).

Looking to tomorrow's scientific literature, the new direction that should guide SciELO's multilingualism is the use of language models across different disciplines

and journals to minimize losses in the transition between languages, with the perspective that both Portuguese and Spanish also acquire the status of scientific lingua franca.

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