The SciELO Open Access: A Gold Way from the South

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ABSTRACT

Open access has long emphasized access to scholarly materials. However, open access can also mean access to the means of producing visible and recognized journals. This issue is particularly important in developing and emergent countries. The SciELO (Scientific Electronic Library On-line) project, first started in Brazil and, shortly afterward, in Chile, offers a prime example of how this form of access to publishing was achieved and how open access in the traditional sense was incorporated within it. Open access has allowed more visibility, transparency, and credibility for the SciELO journals that now span over a dozen countries, three continents, and more than 600 titles. Conversely, SciELO incarnates the most successful and impressive example of "gold OA," that is, open access based on publishing rather than self-archiving; at the same time, its database acts like an open-access depository.

RÉSUMÉ

LL'accès aux documents de recherche a constitué l'essentiel de ce que l'on appelle communément l'accès libre (AL). Pour autant, AL peut également incorporer le souci de l'accès aux moyens de publier des revues savantes visibles et reconnues. Cette question est particulièrement importante pour des pays émergents ou en développement. Le projet SciELO, lancé initialement au Brésil, rapidement suivi par le Chili, offre un exemple significatif démontrant comment cet accès à la publication fut réalisé. Il montre également comment l'AL, au sens classique du

terme, a été incorporé dans cette stratégie générale. En offrant aux revues SciELO plus de visibilité, plus de transparence et plus de crédibilité, l'AL a trouvé sa place naturelle au sein des revues SciELO, qui se trouvent dans plus d'une douzaine de pays, sur trois continents et ayant plus de six cents titres. De la même manière, SciELO offre désormais l'exemple le plus réussi de ce que l'on appelle la voie d'or dans la langue de l'accès libre, c'est-a-dire l'accès libre obtenu par la publication de revues en accès libre plutôt que par l'auto-archivage d'articles dans des dépôts ouverts. Cela dit, les archives de SciELO fonctionne exactement comme un dépôt ouvert.

INTRODUCTION

In July 2009, 11 years after being launched, the Scientific Electronic Library On-line (SciELO) comprised a network of 15 national and 2 thematic open-access journal collections that are regularly published on the Web and included more than 600 titles, about 200,000 articles, and some 4 million granted citations.

The SciELO collections are intended to index and publish the best journals from the most research-productive countries from Latin America and the Caribbean region, in addition to Portugal and Spain. In 2009, South Africa joined the network, signalling a real possibility for the network's expansion into Africa. Its 2009 average of more than 12 million articles accessed per month positions the collections among the top-accessed, research-related websites in Ibero-America. Also, more than 85% of the journals within the SciELO collections saw their impact factor increase in 2006 and 2007, while from 1997 to 2008, the nine Brazilian journals indexed in both SciELO and Web of Science (WoS) saw their journal citation reports (JCR) impact factor increase by more than 240%. In the last three years, and for the first time, four journals from Brazil fulfilled an old dream as they reached a JCR impact factor greater than 1.0. All of these journals are published through SciELO, and its citation metrics are being used for ranking journals in several research-program evaluations. Most of the major international and regional bibliographic indices (including Web of Science, Scopus, CROSSREF, Google Scholar, PubMed, LILACS, AGRIS, DOAJ, and DOAR) maintain up-to-date links to the SciELO journals.

A critical and distinguishing feature of SciELO is its central focus on a well-known and recurrent issue: scientific journals from developing countries have a difficult time finding a place in the sun. This issue is not new and has been documented in many publications. For example, a 1995 article by Gibbs, published in *Scientific American*, gave purchase to the expression "Lost science in the Third World" and captured the main dimensions of the phenomenon. Gibb's article also inspired many, and in particular the project that led to the creation of SciELO.

Another critical event that contributed to the emergence of SciELO was the 1996 polemic around the applicability of the ISI Science Citation Index (SCI)

to Latin American and Caribbean research. A critical article penned by Ernesto Spinak and published in the *Bulletin of the Pan-American Health Organization* led Eugene Garfield to respond by proposing a Latin American SCI (Garfield, 1995; Spinak, 1995).

In a recently published editorial in *Science* on the globalizing of science, Wieland Gevers addressed anew the issue of how to overcome the lost-science phenomenon, identifying this issue as a challenge for contemporary Africa and other developing countries. The answer to this challenge, he points out, must include "boosting the quality and quantity of work that is locally published" (p. 920). To achieve this objective, measures aimed at optimizing the "global reach and potential impact of scientific research in Africa" (p. 920 must be instigated, including measures such as the establishment of a national SciELO-like publishing project (Gevers, 2009).

How SciELO successfully overcame the obstacles leading to lost science in the developing world is the point of this article. The constraints under which the project has toiled from its inception in 1998 are examined, and the ways in which it has successfully met some of the challenges of Third-World publications, in particular the question of how to globalize scientific publications coming from the Third World, are detailed.

A GLOBAL PERSPECTIVE FROM THE SOUTH

The Importance of Sponsorship

SciELO started modestly in 1997, as a one-year pilot project funded by FAPESP (the State of São Paulo Research Foundation) to evaluate the feasibility of improving both the quality and impact of the best journals published in Brazil (Meneghini, 2003; Packer et al., 1998). It also explored strategies to attract local authors who, for reasons of visibility and prestige, tended not to submit their articles to regional or national journals (Packer, 2001). However, SciELO's first priority was to move journals online, which was quickly completed, based on the vision that open access was the right way to go. To ensure greater sustainability for these two transformative processes, SciELO was organized as a collaborative effort that involved both editors and publishers. These points appear obvious today, but it was not the case in 1997 and the project did meet some resistance. As its second priority, SciELO began developing a bibliographic index associated with a database in which usage and citations of the full texts would be tracked. In this manner, an integrated monitoring of journal performance, as measured by downloads and citations, was developed. The pilot project was a success, and the first SciELO collection of 10 journals was launched at a public workshop in 2008 in São Paulo (Antonio & Packer, 1998). From the start, it included a basic platform for online publishing and an indexing scheme.

Since 1998, SciELO's funding has been renewed every year by FAPESP, after being reviewed by independent experts. It is important to note here that,

in parallel to the SciELO project, FAPESP pioneered the *Projeto de Biblioteca Eletrônica* (Electronic Library Project), which the Government of Brazil later took over and transformed into the most important national Web portal in the developing world for accessing international scientific information (Almeida, 2006). In short, the financial support granted to SciELO (to improve scientific communication) was also part of a broader FAPESP strategy aimed at democratizing the access to both national and international journals.

Chile's National Science Council played an important and pioneering role in the evolution of SciELO when, early in 1998, it adopted its model to publish the best Chilean journals online. The successful implementation of SciELO Chile greatly stimulated the adoption of SciELO by other countries, as well as the rapid expansion of its international network.

The conception, design, and implementation of the SciELO project was assisted by the Latin American and Caribbean Center on Health Sciences Information, a specialized centre of the Pan-American Health Organization (PAHO), and itself the Americas' regional office of the World Health Organization (WHO). The center, best known by the acronym BIREME (*Biblioteca Regional de Medicina*), was established in 1967 on the campus of the Universidade Federal de São Paulo, with the agreement of the Brazilian government. BIREME was able to pool a high degree of managerial and technical expertise in the field of librarianship and information science, particularly in networking institutions around information products, services, and events. Initially, BIREME was able to develop and operate automated storage and retrieval systems thanks to the direct assistance of the United States National Library of Medicine; later, the center developed these systems further by keeping abreast of state-of-the-art progress at the international level. This expertise left BIREME in a good position to co-operate with FAPESP on the design and technical development of SciELO. BIREME also contributed to the deployment and expansion of the network of national and thematic collections. In fact, a special unit was set up within Brazil´s SciELO project to overlook its deployment and to coordinate the network operations.

The expertise and institutional stability provided by BIREME were crucial for meeting the complex problems associated with online publishing and indexing, including the pioneering use of a text markup language and a full-text database. Indeed, right from its beginning in 1997, SciELO made use of the Standard Generalized Markup Language (SGML). SGML is much more complex than the eXtensible Markup Language (XML) that was later derived from it for Web usage; however, although XML was recommended by the World Wide Web Consortium (W3c) in 1998, XML was not widely adopted until several years later. Also, it took time before Web browsers began to integrate tools such as Extensible Stylesheet Language (XSL) and Cascading Stylesheets (CCS). Nonetheless, SciELO managed to overcome all the challenges that lay in its path, thanks in part to the development of the Virtual Health Library (VHL), a technical co-operation program involving a much more complex Web-based technological platform, which BIREME also began to develop in 1998 (Packer, 2005).

SciELO's birth was graced by an institutional silver spoon, so to speak, which provided the political, managerial, financial, and technical foundations for its sustainable development. It benefited from a form of central control and political resilience that was rare in a region where long-term common-good projects often have a difficult time surviving. Eleven years after its launch, SciELO is still promoted and supported by FAPESP and CONICYT Chile

Beyond Brazil and Chile, the same pattern of national SciELO coordinator institutions has been repeated. Each of the 15 national collections presently in existence is funded and operated by some kind of public institution: eight are directly managed or funded by science and technology ministries or agencies (Argentina, Brazil, Chile, Peru, Portugal, Spain, South Africa, Venezuela), five are supported by universities (Colombia, Jamaica, Mexico, Paraguay, Uruguay), and two are linked to scientific information centres reporting to ministries of health (Costa Rica and Cuba).

Clearly, SciELO has enjoyed a high degree of support, but it has also faced some resistance from various research institutions and authorities in Brazil and in other countries. Although opposition to SciELO has often been based on either personal or political circumstances – as could be expected – it also stems from an attitude that can only be described as "dependent" and translates into an exclusive reliance on journals and indices from developed countries that tend to bias judgments.

The rate of expansion of the SciELO network has been constant over the last 11 years, with an average of at least one new collection per year. The process takes place through the establishment of unique national collections, whose management must be headed by a recognized national scientific research organization capable of supporting the variety of tasks that need to be completed to publish scientific journals online. This condition has been set as a way to improve the chances of sustainability at the national level. These national organizations know that they will have to overcome critical moments in the political, managerial, operational, and technical issues related to the development of a SciELO collection, and they have the resources to do so. Some of the salient elements required of a managing institution follow:

- The establishment of a SciELO-compliant collection of the best national journals requires a degree authority not only to line up and coordinate the relevant players involved in scientific publishing but also to develop a long-term policy for the progress and promotion of these national journals. When the national context is hostile to a national policy aimed at strengthening scientific journals, attempts to develop SciELO collections fail or take a long time. In such cases, the national evaluation process relies too much on the prestige of journals coming from developed countries and, as a result, creates a truncated and biased perspective on the national research scene.
- Setting up SciELO collections, to this day, requires a deep change in editorial culture on the part of most science editors. They have to mas-

ter all the complexities of state-of-the-art online publishing; they have to professionalize the editorial work flow; and they have to get used to quality control through systematic performance evaluation. Any form of parochialism on the part of editors, institutions, and scientific societies is deeply challenged by SciELO's quality-control standards. In order to facilitate this process, the establishment and operation of a collection follow a well-defined program:

1. advocacy and negotiations for the selection of a national coordination institution, including the elaboration of a project with the minimal conditions needed for a SciELO collection, for example, an action plan and a viable budget;
2. the implementation of a pilot project, including three to five journals, in order to learn and acquire the know-how needed to manage a collection;
3. the inclusion of the collection within the SciELO portal at a probation level, called "in development"; and
4. regular and timely publications to achieve full certified SciELO status.

The entire process is assisted and followed up by the SciELO central unit. This incremental, step-wise approach is a distinctive feature of SciELO, particularly as it applies to an international co-operation program. There are two major aspects to this approach.

• The development of each SciELO collection is assisted by an independent scientific advisory committee, which enforces standard criteria for the selection of permanent journals in the collection. The national institution in charge of coordinating the national collection acts as the secretariat of the committee and, therefore, guarantees its regular operation. The scientific committee has a critical function: to help the collection reach and then maintain its certification and to follow up the monitoring of the collection in subsequent years. Well-led collections can reach certification in one year; other collections can remain in probation for many years if the right political, managerial, and scientific conditions are not met.

• To be fully sustainable, a SciELO collection requires the provision of an operational budget that increases over several years. It also requires high-quality managerial and technical human resources in scientific information and librarianship to ensure the quality of the work. Timely and regular publishing of new issues is crucial. The technical infrastructure must be constantly updated, as must software, if only to accommodate the growing number of access requests to the collection.

The SciELO network structures of governance replicate this approach at the level of each national collection, while taking into account the national context and its specificities. In general, the actual editorial production of an online journal is achieved through the co-operative effort of the journal editors, vari-

ous private companies, and the SciELO coordinator. What differs from country to country is the particular mix of these three categories of players.

Thematic collections are conceived with the goal of reaching either regional or global coverage and rest mainly on sets of journals already selected by national collections. The coordination of a thematic collection is attended to by an internationally recognized institution; otherwise, it follows the same management and operational methodologies and procedures as a national collection.

Meta-Publisher Public Services to Advance the Quality of Individual Journals

The successful development of a national SciELO collection depends on the presence of an integrated approach to improve the quality of its individual journals. It involves the application of well-defined criteria, such as selection for indexing, and then using these criteria to increase the visibility, accessibility, usage, impact, and credibility of these journals. From that point on, the journals are accompanied by specific metrics and indicators.

A SciELO collection, as described below, is conceived as embodying an environment that is quality driven, that is self-reinforcing, and that provides the opportunity for further learning. All this is achieved within a context that includes common principles, objectives, rules, processes, and technologies. This common superstructure drives scientific publishing across the entire SciELO network of collections and, as a result, SciELO takes on the role of a meta-publisher.

The most critical feature of a SciELO collection is its attention to the continuing quality of the journals it indexes and publishes. As a consequence of the emergence of the SciELO standards of quality, scientific editors and publishers of Latin American and Caribbean journals have markedly progressed in quality and professionalism. The next challenge will be to diffuse concerns about quality standards at all levels. The quality criteria do nothing less than follow international standards, including

    i. the flow of publications as measured by the number and timely publishing of original articles in any given year;

    ii. the relevance and quality of the research published;

    iii. peer review and editing processes; and

    iv. compliance with the bibliographic publishing standard of each thematic area.

A number of journals have had to go through several evaluations before satisfying the required SciELO indexing criteria. A critical point in the evaluation process is the scientific quality of a journal; so, too, is the question of whether the fact of being indexed by SciELO will translate into further improvements for a given journal. In many ways, being accepted into a SciELO collection is not the end point in the quest for quality. Rather, it is simply a new stage where seeking quality will be performed under the watchful eyes of the larger audience provided by the SciELO platform. Indeed, it must not be forgotten that

from that point on, the journal performance is closely followed by the number of access and citations monitored by the SciELO platform.

The main contribution of SciELO to a journal is an increased visibility that is sustainable. Visibility is defined by the number of citations garnered by the journal under observation among other journals within its thematic area. From the point of view of submissions, visibility is also measured by the rejection rate, since, after being indexed in SciELO, most journals enjoy an increase in the total number of submissions until they reach a new level of stability. This result can be further improved if the journal is indexed in an international database and/or if its impact factor rises. What is critical here is that the editorial process becomes part of a virtuous circle: the rising visibility attracts more submissions, which in turn allows for better selection and thus produces better quality, and the process repeats itself.

Visibility can also be measured by the extent to which a journal is indexed in various bibliographic tools, be they regional, thematic, or even multidisciplinary. Indexing exposes journal articles not only to bibliographic searches but also to bibliometric studies. For example, a SciELO journal related to health sciences should also seek to be indexed in the LILACS, MEDLINE, SCOPUS, Google Scholar, and Web of Science indices. However, because international indices practice different selection policies, SciELO journals are not equally indexed among them. Nevertheless, SciELO collections provide access and citation indicators of performance for their journals and thus can be used to calibrate and benchmark international indices. Finally, the visibility of SciELO journals, like other online journals, has been enhanced by Google, and more specifically by Google Scholar. Nowadays, Google is the most important search engine on the Web, and its presence is generating a kind of even playing field for all scientific journals.

SciELO also improves the accessibility of journals, and this too contributes to raising their quality. Today, accessibility refers specifically to the pervasive and ubiquitous availability of the full text. SciELO provides accessibility, first, by publishing online, then by publishing in open-access mode, and, lastly, by maximizing the indexing, linking, and interoperability of the journals, their articles, and their constituent elements. Each SciELO text, be it an article or some other form of information, is linked to a journal issue, to a SciELO collection, and to the network portal. As a result, it is possible to browse through the entire network of collections of journals, through one individual collection of journals within it, through the collection of issues within a specific journal, and through the articles and other texts within an issue. A key feature of the SciELO platform is the provision of articles and other kinds of texts with an autonomous presence, thus permitting the full text to be reached through back linking. This interesting functionality is provided by SciELO through a service that is almost automated, is managed collectively, and is scalable. For example, the daily or weekly update of SciELO journals implies the immediate transfer of metadata to other systems, including harvesting facilities, so they can be exposed to user searches without delay. Consequently, each SciELO collection acts like an open-access repository of

articles. In fact, in the case of "ahead-of-print" publications, it incorporates functionalities similar to those of a repository powered by a platform such as eprint.

SciELO also intends to increase the actual use of journal content. Use here primarily refers to the reading of articles, which in most cases is the ultimate objective of the authors, editors, and publishers. However, actual acts of reading are very difficult to monitor, except through indirect means that are not entirely reliable. Consequently, SciELO does not try to estimate the number of readings enjoyed by a journal article; rather, it limits itself to providing the number of times an article is accessed and downloaded. More sophisticated forms of tracking are expected to be available in the future, such as keeping track of the duration of a specific connection corresponding to someone actually browsing or recording the number of downloaded articles so that each time an article is called again, a central accounting system is notified.

Other uses of SciELO articles can be envisioned: as a source for bibliometric, informetric, and scientometric calculations and studies, including planned or ad-hoc tabulations, indexing, or data-mining processing. Already, SciELO offers personalized services intended to facilitate the usage of journal contents. These include building personalized user collections that can be shared, alerts for newly published issues, sending articles to friends, and looking for "similar" materials within SciELO.

In rough terms, usage can be monitored by the number of times an article is accessed. In this regard, the figures obtained are quite impressive. For example, in the first semester of 2009, articles from the Brazilian collection were accessed about 9 million times per month, and those in the Chilean collection, 6 million times. Moreover, access increases from one year to the next, following the growth of the collections. In the case of the Brazilian collection, the average rate of access in the first semester of 2009 increased by 25% over the same period in 2008.

SciELO provides one further advantage to its journals: it seeks to increase their impact. Impact here is understood as the number of citations received by articles and other forms of communication. As measured by the Thomson Reuters JCR formula, an impact factor calculates the average number of citations a journal receives in a given year based on the articles published in the previous two (or sometimes five) years. Being indexed in SciELO contributes to an increase in the impact factor, and although the increase in the number of citations varies with each collection, this increase is mainly due to the maximizing of visibility and accessibility that SciELO provides. The majority of journals within the collections have undoubtedly benefited from their exposure to the world through the SciELO platform. (Being indexed in the Web of Science is also beneficial, of course, and all SciELO journals aspire to be listed in that index as well.) SciELO uses its own resources to calculate and then publish online the impact factor and other related indicators for each of its journals.

The impact factor has been progressively adopted by the international research community and is now the reference for ranking journals. Its use for

the evaluation of research and researchers has led authors everywhere to seek publishing in journals with the highest impact factors in their areas. However, this quest for the largest number of citations has also created a new kind of handicap for developing countries (Meneghini, Calò, & Packer, 2008). The question of whether the impact factor adequately measures the quality of journals or merely reflects its visibility has been a point of contention for some time; yet, many research agencies in just as many countries have adopted this metric to evaluate scientific production to the exclusion of any other indicator, which, in turn, affects the behaviour of publishing scientists everywhere. Although this issue lies beyond the scope of this article, enough has been said to recognize the central importance of the impact factor in the development of SciELO collections and to explain why improving the impact factor of journals is one of the main objectives of SciELO.

De facto, SciELO has established itself as a new reference for the evaluation of scientific production. It has enriched a quantitative process that, hitherto, was solely dependent on the journal citation reports (JCR) listed by Thomson Reuters. As a result, several national evaluation systems have begun not only to grant credibility to research journals that had been previously ignored because they did not appear in the JCR but also to rank some journals higher because they are indexed in SciELO. However, other national evaluation systems persist in focusing exclusively on the JCR as the unique source of credible metrics, despite the fact that the expansion of titles in the JCR points to problems with earlier lists and may even indicate a certain degree of bias in earlier choices of titles. Research councils limiting themselves to JCR titles are using a clearly inadequate evaluation technique: it penalizes research published and cited in national journals without paying attention to its intrinsic quality, and it inhibits the development of a national capacity in the area of scientific communication by steering many good scientists into submitting their articles only to foreign journals. More fundamentally, it goes against the need to adopt a broad view of science, one that is not limited to a few rich countries. However, advocating for a more comprehensive approach needs to be complemented by a proper ranking of the journals, and this can be done by integrating the WoS and SciELO citation databases to encompass both nationally and internationally oriented journals that live together in SciELO collections (Meneghini, Mugnaini, & Packer, 2006).

As a further positive contribution to its journals, SciELO increases their credibility, not only throughout the research community but throughout the whole of society. Nonetheless, a legacy of misperceptions and even stigmas continues to plague journals from the Third World; indeed, such journals are often viewed as second rate and may even be condemned as second rate forever. Of course, such perceptions reinforce the belief that first-level journals can be published only in developed countries.

Increasing credibility is both possible and necessary. It has been achieved by the improved positioning and acceptance of SciELO as a reference for the evaluation of quality, and demonstrated by the constant improvements in the perfor-

mance of SciELO collections and individual journals. Editors as well as authors have quickly noticed the role of SciELO in the growing publishing competence of its journals, along with their increased ability to compete in the international market of ideas. However, credibility will be fully achieved only when research institutions seriously begin to consider that national journals can play a critical role in the global publication system. To this end, the presence of SciELO is increasing the need for the elaboration of new evaluation policies. At the same time, professionalizing the publishing of journals and making the editorial process as transparent as possible are crucial to overcoming a vitiated situation generated by isolation and intellectual "endogamy." Some distance must be established between authors and editors in order to create the conditions needed to establish objective judgment and quality control. In this regard, the editorial process of SciELO journals must rest on participants that extend well beyond the institutional, state, association, and even national borders. The publishing process itself, in short, must rest on globalized pillars (Gevers, 2009).

These editorial and publishing improvements cannot be achieved through isolated efforts, however. In fact, this is one of the fundamental roles of what is called here the meta-publisher function exerted by SciELO. In short, SciELO strives to help strengthen capacities and infrastructures and to make them rise to the highest international levels. At the same time, SciELO must respond to the conditions, needs, and specificities of national and regional scientific contexts.

The following services highlight SciELO's response role:

- an ahead-of-print option that allows articles approved in the review and editorial process to be published online before the issue is closed. In addition, these articles are immediately indexed by indices that accept ahead-of-print documents (e.g., MEDLINE, LILACS, Google). This procedure accelerates updating, thereby improving visibility, use, and number of citations.
- multilingual English, Spanish, and Portuguese publications that allow journals to address international, regional, and national publics, particularly those with research focused on national and regional topics, such as agriculture, public health, and social sciences. The globalization of publishing has increased the role of English as the lingua franca of scientific communication in a multilingual world, but it has not entirely displaced regional languages in specific situations. Multilingualism is a central feature of SciELO's integrated approach (Meneghini & Packer, 2007; Momen, 2009).
- the whole editorial flow, including submission, peer review, and online publication, done online. This allows a work flow to be designed with advanced controls that can be modified on the fly, while maintaining a historical archive.
- personalized services for registered users. These include such services as "my collection," alerts (new journal, new issues, new article, citations), and sharing of articles.

- maximal interoperability with international and national information systems. SciELO interoperates with the main international, regional, and national scientific information indices and services (such as CROSS-REF, WoS, PubMED, Scopus, Google Scholar, DOAJ, DOAR, LILACS, and AGRIS).
- improved management of intellectual property within an open-access context. This is done through the use of a Creative Commons attribution structure.
- introduction of new public services to widen the visibility of SciELO journals among the general public. These services include the publication and distribution of press releases on this topic.

The SciELO meta-publishing functions are carried out as public services delivered through the collections and the network as a whole. In essence, SciELO is governed and operated as a global public good — both as a publishing system and as a scientific knowledge base. In this regard, it is aligned with the basic principles of the international open-access movement but with an emphasis on the specific needs of the developing countries, as spelled out in the Salvador Declaration (2005). In short, SciELO strictly follows the "gold road" to open access, and it does so without any time embargo. As a result, the database of SciELO articles acts like an open-access repository.

Treating SciELO as a global public good follows directly from the understanding that the communication of research results is an integral and essential part of the research cycle. Therefore, the financing and long-term sustainability of SciELO are seen as part of the publicly funded research infrastructure. This argument is particularly important in developing countries where nationally published journals rarely succeed financially through the selling of subscriptions. In fact, almost all of the quality journals indexed by SciELO are published by non-profit institutions, such as scientific societies, universities, research institutes, and other public institutions. In addition, several countries run programs that support journals, even though, in most cases, the allocated resources fall short of fully covering the costs of professional editing. Often, the publishing of journals is sustained by unpaid work and dedicated researchers making use of institutional infrastructures. For its part, the public services and scalability provided by SciELO create economies of scale that together lessen the costs. In the coming years, journals are expected to phase out paper and printing, thus reducing costs further.

It is difficult to calculate the precise costs of publishing with the SciELO platform, especially in view of the increasing variety of contexts encountered in each country involved in SciELO. In some cases, the SciELO coordinating organization takes full responsibility for all the online publishing after receiving the text files from their journals. In other cases, journals do the markup and then send the files to SciELO ready for publishing. In both cases, private companies can be hired to prepare and mark up the files according to the SciELO method. Costs can vary from journal to journal, even within a single collection, due to

the different editorial processes, article contents, and formats; the presence of tables, graphics, and images, as well as the number of references to be marked up, also contribute to cost differentials. Considering the overall operation of the SciELO Brazilian collection, including the costs related to technical co-operation for the development and interoperation of the other national and thematic collections, the online up-to-date publication of the entire collection averages about US$90 per each new article. This estimate includes the actual publishing of the new article ($56 per article, or 62% of the total cost); the operation of the SciELO network portal ($4.20, or 5%), which provides access and retrieval to all of the collections, journals, and articles; SciELO governance, management, and technical co-operation ($2.90, or 3%); the development and maintenance of the technological platform ($22.70, or 25%); and the marketing, dissemination, and expansion of the network ($4.20, or 5%). Alternatively, if the complete editorial flow, from the reception of manuscripts, the peer-review process, editing, and the online SciELO publication, is taken into account, the total cost for each new SciELO Brazilian collection article is estimated to be between US$200 and $600. The costs associated with the other national collections are generally much lower. In any case, the SciELO costs remain significantly lower than those quoted in studies emanating from developed countries (Wellcome Trust, 2004).

CONCLUSION

Latin American and Caribbean countries are clearly developing a significant capacity to publish science through national and regional journals, and the 11-year operation of SciELO has been a critical factor in this growing and important trend. The SciELO experience has also revealed two main objectives related to the evolution of scientific communication, particularly in developing countries. The first is the inexorable globalizing of scientific communication. This means that the divide between mainstream and regional journals is being gradually erased and replaced by a continuous quality gradient. The emergence of this continuum is evidenced by the expansion of the coverage of the international multidisciplinary indices, with Google Scholar providing nearly universal coverage of scientific contents on the Web, followed by Scopus, with its comprehensive coverage of about 15,000 journal titles, and the expansion of the journal lists used by Web of Science.

The successful establishment of a publishing continuum, however, cannot be led by publishers and indexing companies that are exclusively located in developed countries; it also requires the proactive participation of developing countries seeking to improve the position of their own journals within a globalized system of scientific communication. For various reasons, developing countries were not able to develop their editorial capacity in the 20th century, when international scientific communication came to be dominated by commercial publishers or scientific societies (Packer & Meneghini, 2007). Consequently, the SciELO network of national collections seeks to strengthen national infrastructures and their capacity to publish online quality journals while increasing

their interoperability with related systems and services already present on the international scene.

SciELO's second objective is to consolidate a model of publishing based on the open-access "gold road" model, with the publishing of online collections of journals conceived as public goods. These are collectively built through a form of organization (including financing and management) that is decentralized at the national and thematic levels. SciELO has successfully implemented these collections by deploying scalable and affordable technological and service platforms that gradually push the editorial and indexing processes toward the level of the best international standards. This success is particularly visible in the case of the eight countries that hold certified collections, which implies the direct involvement of more than 500 institutions and journal editors. The networked open-access publishing approach supported by SciELO has also undergone a high degree of rationalization aimed at minimizing the costs of the development and operation of online publishing. And because it does not impose any restrictions on individual journal editorial policies and production patterns, SciELO's approach, thanks to its clear focus on online publishing and indexing, does not interfere with the autonomy of editorial processes.

Although the globalization of publishing through the open-access model as implemented by SciELO does represent a state-of-the-art and affordable solution for the publishing of national and thematic collections of journals, its sustainability requires fulfilling three basic conditions:

1. the active presence of an authoritative and international approach, including an institution responsible for setting the standards of operation. It is especially important when these standards conflict with national traditions, habits, or customs that can interfere with the quest for quality. To achieve this goal, SciELO provides a network operation that follows a common managerial and operational methodology, and whose coordination is assisted by the technical co-operation of BIREME.

2. the presence of national research and scientific communication policies that include nationally published journals for both the communication and evaluation of research. SciELO provides an internationally recognized framework for the development and implementation of such policies while respecting national contexts.

3. the professionalization of the editorial process and its progressive internationalization through the inclusion of recognized foreign scientists as editors or co-editors, associated editors, and reviewers (Gevers, 2009). For many journals, the current major challenge lies in daring to expand their editorial team as a necessary condition for an eventual place among the core journals of their discipline or specialty.

With SciELO, a new publishing modus operandi has emerged. It incorporates two main themes: globalization and open access. If developing countries want to play a proactive role in world science, they must consider the urgency

of the situation; for the longer they wait, the more difficult it will be and soon, it will simply be impossible. ❧

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