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Research Article

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Access to knowledge in the context of Open Science: exploring the popularity of Sci-Hub in Brazil

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ABSTRACT

Introduction: Sci-Hub is a channel for accessing scientific texts completely free of charge and without the need for registration, which retrieves documents by title or persistent identifiers, even when texts are protected by copyright laws. The article presents the context in which Sci-Hub was created and how it works, informing about the barriers to scientific communication imposed by the current editorial system. Objective: The study investigated the extent of use of Sci-Hub in Brazil among stricto sensu graduate students from different areas. Methodology: The research involved a survey on the motivations for using Sci-Hub, applied with the help of Google Forms. Results: The results showed that around 20% of respondents were not aware of Sci-Hub. Among the 779 graduate students who were familiar with the tool, 88% indicated that they use it regularly, either because of its zero cost or because of its practicality (74%). Just over 14% cited intellectual disobedience as a motivation for using Sci-Hub. The results also indicated that Sci-Hub has remained a shortcut between the researcher and the essential scientific content for carrying out his research and for the evolution of science. Conclusions: It is concluded that the creation of Sci-Hub and its intense use in Brazil and around the world are a symptom of the reaction of scientists to the deteriorated scheme of scientific communication maintained by international publishers and a confirmation of the importance of the principles of Open Science.

KEYWORDS

Sci-Hub. Scholarly communication. Open access. Copyright. Intellectual disobedience.

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Acesso ao conhecimento no contexto da Ciência Aberta: explorando a popularidade do Sci-Hub no Brasil

RESUMO

Introdução: O Sci-Hub é um canal de acesso a textos científicos totalmente gratuito e sem necessidade de cadastro que recupera documentos através do título ou de identificadores persistentes, mesmo quando são textos protegidos pelas leis de direito autoral. O artigo apresenta o contexto de criação do Sci-Hub e seu funcionamento, informando sobre as barreiras à comunicação científica impostas pelo sistema editorial vigente. Objetivo: O estudo investigou a extensão do uso do Sci-Hub no Brasil entre estudantes de pós-graduação stricto sensu de diferentes áreas. Metodologia: A pesquisa envolveu um survey sobre as motivações para o uso do Sci-Hub, aplicado com o auxílio do Google Formulários. Resultados: Os resultados mostraram que cerca de 20% dos respondentes não conheciam o Sci-Hub. Entre os 779 pós-graduandos que conheciam a ferramenta, 88% indicaram usá-la

regularmente, seja pelo custo zero ou pela praticidade (74%). Pouco mais de 14% assinalaram desobediência intelectual como motivação para usar o Sci-Hub. Os resultados indicaram também que o Sci-Hub tem se mantido como um atalho entre o pesquisador e o conteúdo científico indispensável para a realização de sua pesquisa e para a evolução da ciência. Conclusões: Conclui-se que a criação do Sci-Hub e sua intensa utilização no Brasil e ao redor do mundo são um sintoma da reação dos cientistas ao esquema deteriorado de comunicação científica mantido pelas editoras internacionais e uma constatação da importância dos princípios da Ciência Aberta.

PALAVRAS-CHAVE
Sci-Hub. Comunicação científica. Acesso aberto. Direito autoral. Desobediência intelectual.

CRediT

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1 INTRODUCTION

In the early 21st century, one of the most transformative movements in the scholarly communication cycle since the advent of scholarly journals gained momentum: Open Access. Advocated by communities of scholars as a result of the changes brought about by the widespread availability of communication technologies and the dissemination of information in digital media, OA had already been experimented with by researchers in physics and computer science since the early 1990s and was stimulated by insurgent attitudes such as the subversive proposal presented by Stevan Harnad at the Network Services Conference in London in 1994 (Harnard, 1994). The strengthening of these collectives and the publication in 2002 of the Budapest Initiative, which introduced the term "open access" (Boai, 2002), gave rise to the international movement for open access to scientific information, which became popular in the following years.

In the wake of this veritable revolution, whose dynamism resulted from the convergence of various factors of change and expansion affecting the practices of scientific activity, especially in developed countries, the Open Science movement was born, a name that has been used to summarize and disseminate a set of principles and standards aimed at the growth of science and its widespread availability to society and scientists from all fields, removing the barriers that hinder the dissemination of its results. Influenced by the spread of digital culture, Open Science proposes an environment in which scientific data and information are made readily available on a network, with the aim of achieving more inclusive participation by collaborators from all sectors of society, whether amateur or professional. The term also refers to the generation of openly shared research data and open peer review and publication practices, inspiring various initiatives and policies involving all actors interacting in the scientific field.

Scientific progress, as we know, is characterized by its collective nature and can only be achieved on the basis of knowledge produced and recognized by different scientific communities. The importance of access to knowledge proposed by other researchers is clear in Newton's famous phrase: "If I have seen further, it is by standing on the shoulders of giants" (Newton, 1675, p. 1). This is recognized as the strategy of science (Latour, 2000), the strategy that "has influenced humanity for centuries, creating and changing beliefs, changing habits, generating laws, provoking events, permanently and continuously expanding the frontiers of knowledge" (Targino, 2000, p. 2). By enabling the uninterrupted flow of human relationships, communication underpins the structure of society and scientific practice. When one considers the growing volume of scientific communication and the need to expand access to scientific knowledge in order to achieve the goals of open science, democratize knowledge, and extend its benefits to the entire human contingent, one realizes that this is a mission of gigantic proportions.

It is estimated that there are currently more than ten thousand scientific publishers on the planet, regularly publishing more than sixty thousand scientific journal titles (Johnson; Watkinson; Mabe, 2018). Looking at these numbers, one would imagine that they represent an abundance of production and access to scientific output. However, the traditional limitations and barriers that hindered the dissemination and transfer of scientific knowledge in the 20th century (Figueiredo, 1979) have been joined by others (Schonfeld, 2015; National, 2018), and today there is a crisis in science caused by the way the publishing industry has financially exploited the publication of scientific journals and articles. This crisis erupted after subscriptions to scientific journals increased to a level that exceeded library budgets, making it difficult to renew them and creating new obstacles for researchers (Mueller, 2006; Kuramoto, 2006; Appel; Albagli, 2019). The expansion of mechanisms for the private appropriation of scientific and intellectual production, facilitated by advanced electronic technologies, has

allowed large commercial publishers to create an "artificial scarcity" of knowledge, further limiting access to scientific information (Albagli, 2013; 2015).

Frustrated by the difficulties in retrieving and accessing literature imposed by the high cost, increasing dispersion and fragmentation that has characterized the infrastructure of international services offering scientific content (Sconfeld, 2023), Alexandra Elbakyan, a Kazakh neuroscientist, decided to create Sci-Hub in 2011. The site works as a portal for free access to scientific articles based on the title, DOI (Digital Object Identifier) or URL (Uniform Resource Locator) of the text. According to Sci-Hub itself, the portal offers access to almost 89 million articles and other documents, with the aim of meeting the demand of millions of researchers, among other possible users, such as journalists and other professionals. According to its own statistics, Sci-Hub receives millions of visits a month. Brazil is the portal's fourth largest user. China is in first place, followed by the United States (Owens, 2022). The data shows that Sci-Hub offers a solution to a demand that is real in many parts of the world, exploiting a gap in the traditional means of accessing scientific literature (Bohannon, 2016; Machin-mastromatteo; Uribe-tirado; Romero-ortiz, 2016).

This scenario reveals the need to deepen what is known about the subject, particularly when considering that the use of this tool in Brazil may be related to overcoming barriers to full access to the results of international scientific activity, one of the most powerful arguments of Open Science. The aim of this research, therefore, was to assess whether stricto sensu postgraduate students from Brazilian institutions in different areas of knowledge know about and use Sci-Hub and, if they confirm that they use the tool to access documents and publications rather than regular and traditional means, what the reasons are for this and what their feelings are about the possible harmful consequences of Sci-Hub.

The unequivocal success of Sci-Hub, proven by its high usage, demonstrates the relevance that the tool has taken on for researchers all over the world. In order to contextualize the problem, an attempt is made to present the commercial publishing model that has crystallized in contemporary scientific communication and how this model has created obstacles to obtaining and using scientific publications, leading to the emergence of mechanisms to challenge these obstacles. By citing the options offered to Brazilian researchers, the limits of Brazilian laws on intellectual property and the answers to their usage habits, as well as their opinions on some scientific communication issues, this research seeks to gain a better understanding of the difficulties affecting researchers in Brazil and any differences found within the country itself.

2 HISTORICAL CONTEXT AND CURRENT SITUATION

Gutenberg's invention of the printing press and its subsequent popularization were fundamental to the expansion of the production and dissemination of scientific knowledge from the 15th century onward, as well as to the dissemination of philosophical and religious ideas introduced during the Renaissance (Eisenstein, 1998). Prior to the printing press, the processing and dissemination of information among members of society was cumbersome. Printed works, on the other hand, presented information that had been carefully collected and organized with the intention of "describing scientific and technical advances, recording important legal decisions, and generally covering all topics of interest to literate men" (Meadows, 1999, p. 7).

These processes underlie the editorial model used to this day. In the context of science, the introduction of journals in the seventeenth century was a logical step, but it had notable consequences for the formalization of communication between researchers, since the communities for whom these journals were intended began to demand a methodology based on observation and experience of phenomena in order to consider the scientific content to be published legitimate, which later culminated in the principle of peer review, which standardized

the evaluation of the content produced by scientists (Meadows, 1999).

For at least a hundred years, this model of communication seemed efficient for the volume of material produced by scientists. However, after World War I and especially World War II, several factors contributed to an increase in scientific production and ultimately necessitated changes in the industrial and commercial processes of publishing and distributing documents. The growth of the population and its education, the realization that the development and acquisition of technology were essential for competitive industrialization, among other aspects, led to an increase in the resources invested, as well as to the valorization and professionalization of research, including better remuneration, job security, funding and other types of rewards for those who dedicated themselves to scientific work (Le Coadic, 1996). Following this rhythm, it can be said that since the last decades of the twentieth century, science has been producing knowledge at an even faster rate, thanks to the innovative leap of electronic technologies, which have ensured a reduction in the time needed to collect, process and analyze scientific data (Le Coadic, 1996; Meadows, 1999; Targino, 2000).

In relation to the editorial production costs observed in the period of printed journals, the modernization introduced by digital production equipment and tools, resulting in greater storage capacity and faster distribution of documents, has allowed publishers to achieve ever greater control over the scientific production system at much lower costs, they have become extremely profitable businesses whose control over the flow of communication and information exchange among scientists has grown exponentially, ensuring greater power over the documentary heritage accumulated by science and creating arguments to impose additional costs on those who need to access this heritage (Kapczynski, 2010; Lariviére, 2016; Chen; Posada; Chan, 2019). Thus, despite the enormous amount of knowledge produced in recent decades and the introduction of much more advanced methods and systems dedicated to the production, storage, indexing and availability of scientific content in digital media, the amount charged for scientific articles and journals published by international publishers has turned scientific information into an expensive and scarce commodity, revealing a subliminal strategy of "artificial scarcity" generated and managed by the publishing industry, which continues to limit access to information despite the possibilities of dissemination and access made possible by electronic technologies (Albagli, 2015; Weitzel, 2022).

Unlike other industries, the scholarly publishing market does not operate on the basis of supply and demand. The large workforce, which is essentially voluntary, is made up of highly qualified people who provide the product of their work, as well as the quality control of that product, without financial compensation. On the other hand, the fluctuating cost of journals and articles does not affect production and consumption because there is no direct link between the acquisition and use of documents. The academic pressure to publish and access publications, in turn, activates and increases the chances of obtaining funding for new research and achieving career success through institutional promotion (Apt, 2001; Kapczynski, 2010; Larivière et al., 2015). Beyond the strictly economic perspective, the major scientific publishers have seen advantages in maintaining their dominance over traditional patterns of editorial production and even in expanding the perception of their prestige, broadening the "bases of their hegemony and protagonism [...] throughout the cycle of production and communication of science" (Appel; Albagli, 2019, p. 188). Thus, they have strengthened their influence not only through the acquisition of smaller publishers (Weitzel, 2022), but also through the incorporation and control of tools and resources that have become part of the scientific communication chain, such as reference managers, open thematic archives, and various other support systems for researchers and managers-including the Scopus and Web of Science databases, which belong to these large conglomerates and have become powerful indexing mechanisms used to evaluate the performance of scientists and institutions (Neubert; Rodrigues, 2021).

With regard to the issue of copyright, while on the one hand authors maintain the integrity of the moral rights over their intellectual production - attribution and citation rights -

in order to have their research published, they must cede to publishers or their intermediaries their property rights, which refer to the prerogative to commercially exploit the content they have authored or to cede it to third parties. However, most authors are not interested in this, since the advantages of assigning property rights to publishers are considerable: the interest in publishing in titles with a higher impact factor makes researchers take the assignment of these rights for granted, even if they don't always agree with the conditions proposed. Ensuring that their work is accepted by their peers and published in these journals is one of the main drivers of science, guaranteeing researchers academic and professional prestige, as well as financial support and benefits to continue their research (Souto; Oppenheim, 2008). It has also been argued that property rights are excessive, especially given the reduction in the cost of producing and distributing scientific publications as a result of technological advances in recent decades. Nevertheless, publishing oligopolies have been successful in securing stricter copyright laws to protect their intellectual property rights (Nowak, 2016). In this sense, it can be seen that the legal basis and symbolic value of copyright protection laws - aimed at encouraging creators to continue innovating and disseminating their works - is no longer the most relevant aspect (Samuelson, 2016).

By creating an environment conducive to the propagation of texts in digital form, electronic technologies and the growing dissatisfaction of the academic community have led to the creation of innovative solutions aimed at avoiding the barriers that prevent access to knowledge. To put the concept of open access into context, we can mention the Budapest Open Access Initiative (BOAI) in 2002, the forerunner of the Open Access (OA) action, which means:

> [...] the making freely available to the public on the Internet, in such a way as to allow any user to read, download, copy, distribute, print, search or create links to the full texts of articles, as well as capture them for indexing or use them for any other legal purpose. The assumption of support for open access requires that there are no financial, legal or technical barriers, other than those inherent to Internet access. The only restriction on reproduction and distribution and the only function of copyright in this context should be the authors' control over the integrity of their work and the right to be properly acknowledged and cited (BOAI, 2002, p. 1).

It should be noted that open access to information favours scientific production on a global scale, as production is networked and can be accessed worldwide, which generates more impact and visibility with the dissemination of information, also cooperating with the democratization of information beyond the physical medium. According to the volume of information that is currently produced, especially scientific production, it can be seen that with the advance of technologies and open access, the reach of this information is becoming increasingly wider. Kuramoto (2008a, p. 154) states that:

> [...] the facilities provided by the new information and communication technologies, combined with the worldwide movement for free access to scientific literature, are giving rise to an optimistic scenario. A scenario in which the barriers that hinder access to scientific literature are beginning to be broken down through the strategic actions proposed by this worldwide movement.

like Alexandra Elbakyan. The activist states that it is surprising that so many people see Sci-Hub as a method to an end, when she believes that the right thing to do would be to change the system so that the platform is not a pirate resource. In this case, Sci-Hub would be ahead of its time, enabling open access even when the laws and processes of scientific communication do not yet support its existence (Elbakyan, 2016).

With no costs or registrations, it is clear that Sci-Hub's slogan is emblematic, as it presents itself as a solution to a problem, and there is definitely an audience looking for this resource. In a study using the database provided by Elbakyan himself (Bohannon; Elbakyan,

2016, cited by Machin-Mastromatteo; Uribe-Tirado; Romero-Ortiz, 2016), the authors showed that it is precisely the articles from the largest publishers that top the list of documents with the highest number of downloads in Latin America: more than 1. 3 million articles were downloaded from Elsevier between September 2015 and February 2016 (38% of the total), followed by Springer, Wiley Blackwell, Nature Publishing Group, and the American Chemical Society.

Priego (2016) argues that Sci-Hub should be seen as a signal, rather than a solution, to the barriers to accessing scientific information. He says that the praise given to Sci-Hub for solving the access problem is just another indication that the Open Access movement - 20 years after the publication of its first manifesto, the Budapest Manifesto - has not yet made the progress it had hoped for. The author believes that Sci-Hub does not address the root of the problem, which is the publishing agreements that benefit publishers and the scientific system itself. In other words, the "owners" of information remain the same: publishing oligopolies, while authors are still obliged to publish in relevant journals in order to have their research published and thus receive resources to continue doing science. Without cultural change, the Open Science movement will have no real impact.

Maddi and Sapinho (2022) also point to a possible negative effect on OA publications. Given the citation advantage, open access journals have more citations than non-open access journals as long as the latter are not on Sci-Hub. When the non-open access article appears on the platform, it is accessed more frequently than its twin in an open access journal - causing the number of citations of the open access articles to fall. The authors conclude that there are two possible causes for this bias: selection - hybrid OA journals are more prestigious, so authors submit their best research to them, while the perception of OA journals is the opposite, that they are less selective about what they publish; and reputation - simply the fact that closed access or hybrid journals have a long recognized track record. With these biases at work, and with a tool that offers closed access articles, researchers choose to read and cite them to the detriment of open access articles, so the authors conclude that the open science movement may also be a victim of Sci-Hub.

The Open Access Movement itself arose from the discomfort of scientists, as a way of combating the growing restrictions caused primarily by monetary barriers. The artificial increase in the cost of journal subscriptions, in excess of what libraries and collections could afford, made it difficult to acquire journals and created another step between the researcher and scientific knowledge (Appel, Albagli, 2019; Kuramoto, 2006). By creating mechanisms to broaden access, the Movement was quite successful, but not enough to be considered a success against the commodification of knowledge, which was itself cannibalized by the system - such as charging fees for article processing (Appel, Albagli, 2019).

In a study carried out by the International Association of Scientific, Technical and Medical Publishers (STM, 2018), the barrier to access most reported by scientists was, of course, monetary, caused by the high prices that articles and journal subscriptions can cost, but these were not the only barriers declared. The report pointed out other obstacles in the researcher's path such as "lack of knowledge about sources, tiresome acquisition process, [...] problems with file formats and software, lack of links with libraries and conflict between copyright rules and the desired use of the content" (STM, 2018, p. 92).

Darat and Tello (2016) propose that the term intellectual disobedience should be used to refer to civil disobedience in the face of intellectual property and copyright laws. Sci-Hub is one of the initiatives that has openly declared that it is intellectual disobedience and for this reason Elbakyan does not believe that it is punishable, as it is simply giving back to society what should never have been restricted.

3 METHODOLOGY

The purpose of this study was to evaluate if and why Sci-Hub is used by stricto sensu postgraduate students in Brazilian institutions in different fields of knowledge. The choice of a population of researchers still in their formative years was due to the inference that they are more vulnerable in terms of the means of producing science. To collect the data, a questionnaire was created with the help of Google Forms, to be answered voluntarily on the web. The questionnaire, which used an informed consent form, sought to preserve the privacy of the respondents by talking about a tool that is considered illegal because it violates the copyrights of major international scientific publishers.

The population selected to respond to the survey was made up of students regularly enrolled in postgraduate programs with a concept equal to or higher than four, according to the Capes Quadrennial Evaluation for 2013-2016. The profile of the sample was characterized by students from courses in all fields of knowledge offered by 219 public and private universities located in all regions of Brazil, with a total potential population of 22,332 students.

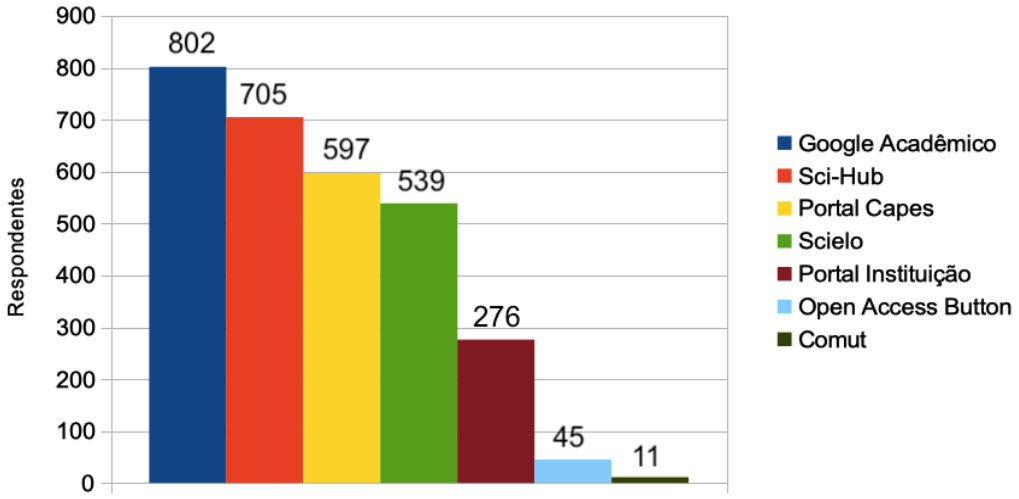
The adoption of the criterion related to the concept of the program sought to ensure that the students belonged to programs recognized for their scientific production, since this is one of the criteria considered preponderant in the evaluation of Capes. It was considered that this criterion would ensure that the respondents, defined as researchers in the context of this research, had at least one scientific research project underway. In addition to being a minimum requirement for the approval of new doctoral programs, the four-concept criterion also allowed for the observation of all regions of the country with a balanced number of programs.

Students were contacted via email by the coordinators or secretaries of the doctoral programs, who then forwarded the message to their students. The data was tabulated using Google Forms and analyzed using Microsoft Excel. The questionnaire received responses between 05/08/2021 and 05/01/2022. At the end of the survey, there were a total of 966 responses. The fields of knowledge were distributed as follows: Human Sciences (236), Biological Sciences (273), and Exact and Earth Sciences (261) had the highest number of respondents, accounting for 24.5%, 28.3%, and 27.1% of the total, respectively. Because it has the fewest postgraduate programs accredited by CAPES, Agricultural Sciences had a correspondingly smaller participation in the survey, with 84 respondents.

4 RESULTS

The results showed that the main source of information used by respondents to search for and access scientific content was Google Scholar: 802 participants (83.1%) reported using the tool. As can be seen in Graph 1, Sci-Hub was mentioned by 705 students (73%), while the Capes Periodicals Portal and the SciELO platform accounted for 61.9% and 55.8% of the total, respectively. When compared to the indicators achieved by the Capes Portal and SciELO, initiatives that receive significant public investment, Sci-Hub reveals the extent of its importance in the academic routine of Brazilian master's and doctoral students.

Graph 1. Use of channels to access scientific information

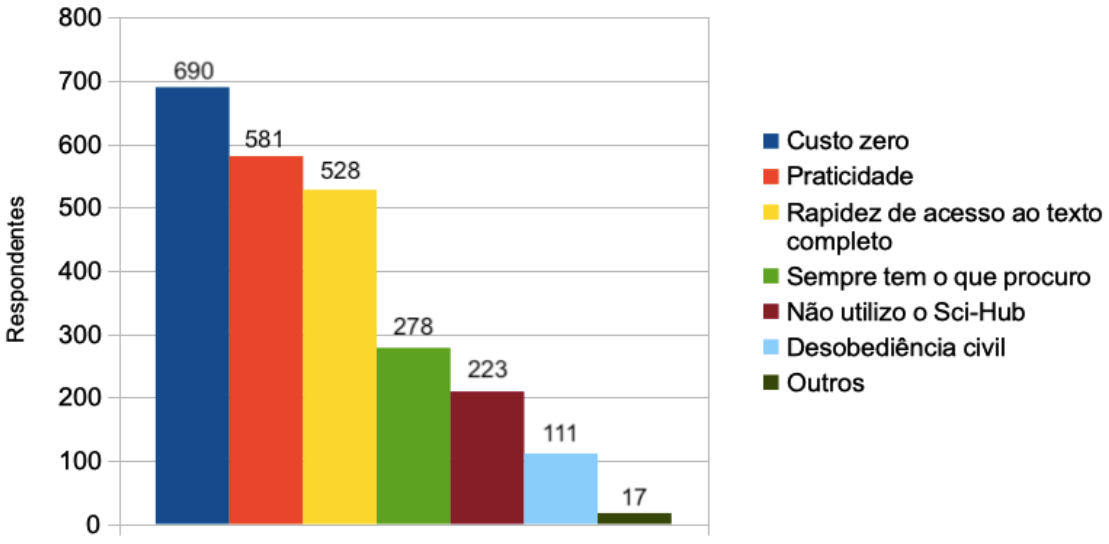


Source: Research data.

Representing 19.4% of the participants, 187 students reported not knowing about Sci-Hub until the moment they received the questionnaire for this survey. Of the 779 postgraduate students who were familiar with the tool, 528 (67.4%) said they had learned about the portal through colleagues, 19% through the internet and 10% through teachers. Only two students reported having been informed about Sci-Hub by a librarian, a figure which may indicate a distance between the professional and the information needs of postgraduates at their institution.

When asked about their motivations for using the tool, 88% of the students who knew about Sci-Hub cited the zero cost, demonstrating the importance that the monetization of knowledge has on the behaviour of this group of Brazilian researchers. The practicality of access - which means there is no need to register or be connected to the educational institution's network in order to have full access to the texts - was cited by 74% of the postgraduate students who used the tool. Intellectual disobedience, on the other hand, was only mentioned by 14.2% of the participants, demonstrating that choosing Sci-Hub is much more a matter of necessity than personal deliberation (Graph 2).

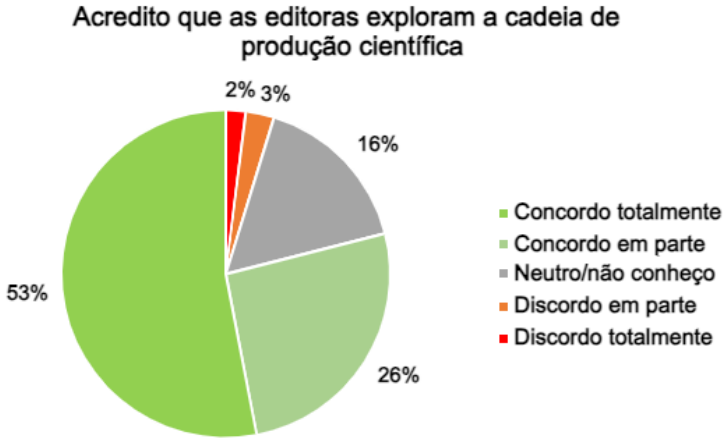
Graph 2. Motivations for using Sci-Hub



Source: Research data.

Regarding the statement that publishers exploit the scientific production chain, the students were aware of this, with 512 (53% of respondents) agreeing totally and 251 (26%) agreeing in part, which adds up to 79% of the sample. Only 46 people totally or partially disagreed with this premise and 157 declared themselves neutral on the subject. High adherence to this premise may correspond to greater popularity of the subject in the academic environment, which may stimulate the engagement of producers and consumers of science throughout the scientific communication cycle, making the process more balanced - whether through intellectual disobedience, boycotts or support for Open Access initiatives.

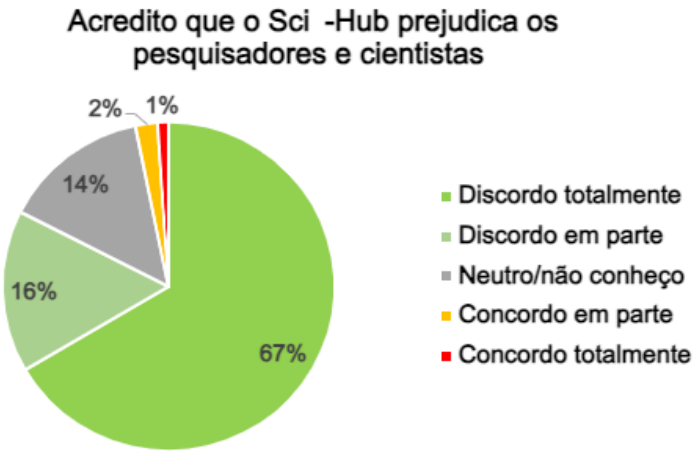
Graph 3. On the exploitation of publishers in the scientific production chain



Source: Research data.

Considering that 88% of respondents said they totally or partially agreed with the statement that Sci-Hub helps them in their scientific production process and 83% totally or partially disagreed with the statement that Sci-Hub's operation harms them, it can be seen that the opinion of the participants follows the trend of believing that access to knowledge is more important than intellectual property laws exerted by pressure from large publishing groups..

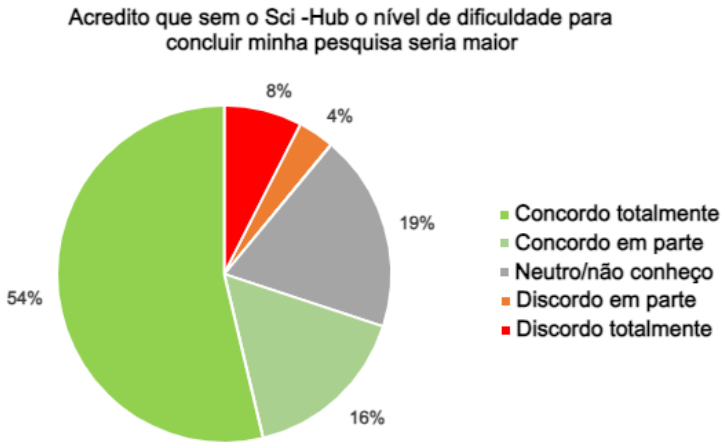
Graph 4. About Sci-Hub harming scientists.



Source: Research data.

When asked whether or not they agreed with the statement that without Sci-Hub it would be more difficult to complete their research, 54% of respondents totally agreed with the statement and 16% partially agreed - a total of 676 respondents. However, 107 totally or partially disagreed with this statement and 183 said they were neutral or couldn't answer. As a result, 70% of students said that Sci-Hub represents a vital or at least basic resource for their research, making it possible to deduce, therefore, that they do not consider its use problematic when they are unable to access information in other ways.

Graph 5. How difficult it would be for researchers to complete their research without the service provided by Sci-Hub.



Source: Research data.

DISCUSSION

Despite its limitations in terms of the low percentage of responses obtained, the results presented by this survey showed significant use of Sci-Hub among Brazilian postgraduate students, who recognized that their difficulties would be even greater without Sci-Hub. This result strengthens the hypothesis that the barriers imposed by the commodification of knowledge, practiced by the large publishing oligopolies that have become the protagonists of scientific communication (Lariviére; Haustein; Mongeon, 2015), harm the primary users of science, i.e. researchers and their peers. This conclusion is corroborated by the finding that cost is the main barrier preventing students from obtaining the scientific information they need, followed by practicality of access.

When the problem of publishing oligopolies and their control over scientific knowledge became untenable, various initiatives arose to try to combat it. The principles of Open Access and Open Science have proven successful in this regard, with greater reach in some areas of knowledge (Piwowar et al., 2018). However, as this survey found, more than half of the respondents (53%) admit that open access journals do not fully meet their information needs. It is natural, therefore, that criticism of the Movement should arise, especially with regard to the slowness with which it is moving towards a wider adoption of the open model, since many of the issues to be adapted come up against the dominant role that commercial publishers still play (Weitzel, 2022).

While the dominance of publishers grows and the Open Science Movement does not reach the desired level, other revolutionary initiatives have emerged, in a scenario that has become fertile ground for the spread of various initiatives that seek to circumvent the growing restrictions, among which are preprint repositories, institutional and thematic open access

repositories, initiatives such as Open Access Button and #ICanHazPDF, as well as the object of study of this research: Sci-Hub, created precisely by a student unhappy with the barriers to accessing scientific information.

The more traditional forms of access cited in the research - such as the SciElo platform, Capes' journal portal, institutional portals, among others - along with innovations that bring author and user closer together vary in efficiency and extent. STM (2019, p.92) reports that the main barriers researchers encounter when searching traditional sources are "lack of knowledge about available sources, a tiresome acquisition process, [...] file format and software problems, lack of links with libraries and conflict between the intellectual property rights of authors or publishers and the desired use of the content". When the user encounters any of these - or many others - difficulties in accessing through the usual means, they turn to the next easiest, cheapest and most uncomplicated option - thus creating space for Sci-Hub.

It was also observed that although Sci-Hub is an illegal tool from the point of view of Brazilian and international copyright laws, students consider that they need this shortcut to guarantee access to the scientific content of their choice, although they are also aware that, for the time being, it is these same intermediaries that allow them to accumulate prestige and achieve benefits in their academic careers.

As we have seen, Sci-Hub is not a solution but a symptom of the current problems of scientific communication - which, corrupted by commercialization, has made intermediaries the protagonists in the process of doing science. The survey showed that most researchers don't see Sci-Hub as harming them, but the big publishers do - they conclude that the right to access supersedes property (non-intellectual) rights.

Therefore, the strategies for changing this paradigm are to demystify and dismantle the structure of hierarchy between publications - this system requires researchers to give away their intellectual work in exchange for prestige driven by artificial scarcity of knowledge and historical recognition. As well as promoting open access scientific journals and highlighting their quality, reliability and relevance, so that more and more authors choose to publish in this way.

Such practices have another extremely important consequence: the democratization of science, studies and their results. All of society stands to gain from democratic access to knowledge, especially developing countries, which, thanks to the centralization of research in the US-Europe axis, have locally focused studies that are underestimated or ignored due to the lack of interest from hegemonic journals. The economic barrier imposed by those who hold the knowledge already produced must not prevent the progress of science in marginal areas, as this harms not only the academic environment, but also the social, environmental and political spheres.

6 CONCLUSION

As a result of the current model of scientific communication - which no longer seems to be led by scientists fighting for the progress of science - Sci-Hub and its extensive use in Brazil and around the world highlight the need to overcome the dominance of international publishers and remove the numerous barriers to accessing scientific knowledge, strengthening the principles of Open Access and Open Science in the search for greater transparency and accountability.

FEBAB's Guide for Libraries - which guides librarians on issues concerning copyright and access to knowledge - does not fail to inform that the right to access is as fundamental as the guarantee of copyright and property rights. The Guide states that access is a necessary condition for the development of creativity, the fostering of cultural experiences and, consequently, the emergence of authors, works and interested audiences. Limiting access

spaces with rules and impediments that favor publishing oligopolies to the detriment of authors and researchers threatens library activities and therefore research activities.

It is believed that this is a movement that library professionals should align themselves with, seeking to find a balance between the demands for scientific information brought by their users and the different alternatives for meeting them, serving the broad democratization of the results of science and the extension of its benefits to all human beings, especially in developing countries.

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