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### Who needs access to research? Exploring the societal impact of open access

*Qui a besoin d'accès à la recherche ? Explorer l'impact sociétal de l'open access*

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# Who needs access to research? Exploring the societal impact of open access

*Qui a besoin d'accès à la recherche ? Explorer l'impact sociétal de l'open access*

ElHassan ElSabry

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*I would like to express my gratitude to several professors whom I have not (yet) met but where kind enough to provide some useful insights to my study over email. These professors are John Willinsky from Stanford university, Martin Eve from the University of London and Bo-Christer Björk from the Hanken School of Economics. Special thanks are due to Mike Taylor from the University of Bristol for offering me space of his website ([whoneedsaccess.org](http://whoneedsaccess.org)) to publicize an early version of the bibliography I collected.*

## Introduction

- 1 For over two decades, many studies have investigated the impact of Open Access (OA) on research papers in different contexts. Most studies have focused on the impact OA has on communication within the scholarly community. For example, many studies were published on what is called the “Open Access Citation Advantage (OACA)”, examining the claim that making an article openly available online results in more citations of that article, than in pay-to-read articles. It is to be expected that the number of studies about OACA has been constantly increasing given the extreme importance of citation counts for academic careers. Several bibliographies have tried to gather these studies and consolidate their findings (Swan, 2010; Hitchcock, 2013). The general understanding is that OA papers do in fact gain more citations than those behind paywalls. To some, this has already become an established fact (SPARC-Europe, 2016).
- 2 On the other hand, implications of OA in non-academic contexts (e.g. medical practice, policymaking, patient advocacy and citizen science) have been the subject of many

discussions and indeed was the basis for a lot of the advocacy work and many funding agencies' OA policies (ElSabry, 2017a), but rarely so in formal published studies. In fact, several researchers have specifically pointed to the lack of research in this area. They make statements like “little is known about the impact that free scholarly research literature might have on the knowledge and interests of laypeople” (Zuccala, 2010) or “almost no studies have evaluated whether free access to the scientific literature has had an impact [...] in non-research contexts” (Davis & Walters, 2011). A recent study aiming to describe the Open Access evidence base (i.e. research done about Open Access) has emphasized that the societal impact of open access “still needs to be systematically investigated and documented” (Pinfield, 2015). A recent report has also asserted the existence of “a gap between the hypothetical societal good of open access and the minutiae of usage and interest measurements” (Bankier & Chatterji, 2016). The Research Information Network (RIN) report of 2014 has speculated the reason for this to be the inability to gather data on user demographics from currently available information sources (e.g. repositories and publisher platforms) (Research Information Network (RIN), 2014).

- 3 This study is the first attempt to collect and synthesis the available evidence on the societal impact of open access. It further builds on it by introducing a typology of the various science/society interfaces where access to research papers is needed. The proposed scheme is anticipated to provide guidance for future research on the issue. The study then concludes with a discussion of the implications of non-academic usage of research on the open access debate as well as on the question of who should bear the cost of scholarly publishing.

## Available Studies

- 4 A total of 53 papers about the societal impact of Open Access were collected for the purpose of this study. The collection was based on a combination of relevant keyword search as well as citation tracking (both forward and backward) using Scopus database and Google Scholar. Table 1 below provides some descriptive statistics on the collected literature.

Table 1. General characteristics of papers about the societal impact of OA

Property	Category	Count
<b>Publication Year</b>	2001-2005	5
	2006-2010	11
	2011-2015	29
	2016-2017	8
<b>Document Type</b>	journal/conference paper	30
	dissertation/book chapter	3

	report	12
	opinion article (in academic journal)	8
<b>Methodology</b>	multiple methodologies	8
	theoretical analysis (including review studies)	8
	survey	10
	interviews/focus group	3
	bibliometric analysis	8
	experiment	2
	case study	3
	anecdotal evidence	11

- 5 In what follows, findings from these studies are briefly summarized, grouped by the target group of research users.

## General Population

- 6 The two most detailed attempts to assess the wider impact of Open Access were Alperin's dissertation on the "The Public Impact of Latin America's Approach to Open Access" (Pablo-Alperin, 2015) and the "Citizens Demand for OA to Academic Papers" by Sato and colleagues (Sato *et al.*, 2011) in Japan. As obvious from the title, Alperin's dissertation was mainly focused on Latin America and used its two most prominent Open Access portals, SciELO and RedALyC. The idea was to collect article-level metrics from these portals (along with other altmetric sources) and combine this with demographic data of the person who reads the article. Demographic data was collected using pop-up surveys at the time of download in addition to a small scale survey of those who shared Latin American research articles via Twitter. Results show that students (40% undergraduate, 60% graduate) are the primary user group of Latin American research, accounting for 44.5% of survey respondents. This is followed by university employees (including faculty) at 20%. Users who are unaffiliated with university (i.e. from outside academia) make up the rest of the survey sample at about 35%. Roughly 40% of these were public sector employees, 40% from the private sector and 20% from nonprofits. In a different context, with the aim of identifying their perceptions and experiences with Open Access, Sato and colleagues surveyed 800 Japanese adults (Sato *et al.*, 2011). Respondents were a balanced group of people with higher education degrees (50%) and those without (50%, including university students). The majority of respondents (55%) claimed that Open Access is useful or slightly useful to them. The top two reasons they give for their need for access are "satisfying curiosity" and "research articles being a credible source of information". Those who did not find OA useful ranked "the gap between academic research and daily life" and "the difficulty to comprehend academic jargon" as their top reasons.

- 7 Both studies document the persistent interest in health-related research by non-academic users. This is in agreement with results from a smaller scale (focus group) study of 23 Dutch citizens reported by Zuccala (Zuccala, 2010). Participants argued that access to medical research can be of more value to lay readers as it relates more to people's lives (more than other types research e.g. mathematics). Echoing the Japanese survey participants, this Dutch group voiced concerns about the layperson's ability to comprehend academic jargon and showed preference for "human sources of information", but still appreciated research papers as a credible source of information within the flood of other sources on the web. A different group of lay people (in the United States, as surveyed by Harris Interactive in back in 2006 (Krane, 2006)) offer a different line of reasoning by claiming that, by virtue of being mostly tax-payer funded, medical research has to be freely available online to doctors and to those with special medical conditions. Over 80% of 2,501 respondents made this claim. Also in the United States (in a Pew survey (Duggan, 2013)), 26% of those who search for online health information claimed to have hit some sort of a paywall. Only 2% of those faced by the paywall decided to actually pay.
- 8 Other than medicine, it is not clear what other disciplines could be considered "people-related". Nonetheless, the assumption (Smith, 2015) that an Open Access political science journal will enhance public engagement with the discipline, indeed deserves consideration. Willinsky has also made the case for the importance of Open Access to philosophical literature based on Derrida's notion of the right to philosophy (Willinsky, 2009).
- 9 Using access logs of the Kyoto University website, another study in Japan aimed to identify external links that refer to papers deposited in the university repository (Sato & Itsumura, 2011). It was discovered that, although not huge in number, a remarkable variety of websites linked to these OA papers including blogs about personal hobbies, websites by patients or their families, Q&A website and Wikipedia. The impact of Open Access to research on Wikipedia (as an intermediary supporting research diffusion to society) has itself been the main subject of two studies. In the first one (Willinsky, 2007), Willinsky randomly selected 100 Wikipedia entries to analyze the external references cited in them. The objective was to identify how many of these references were open access and later (for a subset of 20 entries) whether other open access references could be found online to cite for each entry. The second study (by Teplitskiy and colleagues) offers a more detailed analysis of the relationship of paper's accessibility and being cited in Wikipedia (Teplitskiy *et al.*, 2016). By the statistical analysis of data matched from the Scopus database and citations in the English Wikipedia, they find that a journal being open access increased its odds of being cited by Wikipedia by 47%. It is worth noting however that their choice of journals as their units of analysis (as opposed to individual articles) underestimates the impact open access can have on diffusing science through Wikipedia because it neglects articles that are openly available through the green or the hybrid routes.
- 10 Other researchers, attempting to cover the whole range of impact Open Access has, provided a somewhat superfluous treatment of societal impact in particular. Tennant and colleagues (Tennant, *et al.*, 2016) provided several examples of societal groups that could benefit from Open Access (including patients, NGOs, businesses and citizen scientists). On the other hand, the "100 Stories of Impact" report by bepress showcased 34 stories (collected from university repositories using their Digital Commons software) where

access to research had significant impact on non-academic readers, although 19 of these were not about open access to than research papers (e.g. a database of tractor testing reports or local community volunteering to digitize a historic newspaper) (Bankier & Chatterji, 2016).

## Industry Researchers

- 11 Companies, large or small, run the most active research facilities outside the traditional centers of research (i.e. universities and research institutes), sometimes even with much larger budgets. This probably entails a huge need for access to research. Accessing literature in the form of journal subscription might not be ideal for companies, given that they frequently change interests according to technological and market changes in their business. Still, 15-17% of publisher revenues come from corporate subscriptions (Ware & Mabe, 2015). Indeed, different companies have different information needs. They also have different levels of absorptive capacity (Cohen & Levinthal, 1990) in dealing with knowledge sources from outside the company. Such differentiation results from the variation in sector, size and management style. The variation in sectors is probably the most influential, especially with the rise of the so-called “knowledge-intensive” industries in the past few decades. According to Prosser the movement towards the knowledge economy have been one of the main drivers behind OA policies adopted by different governments (Prosser, 2007). Previous research shows that supporting industrial development and innovation was mentioned in around half of OA policies issued by public funders (ElSabry, 2017a). Picarra explained this impact of open access on the economy in terms of “spillover effects in all sectors of society” which drive “economic, social and technological progress” and laid down different arguments on why it is very essential for Europe’s SMEs (Picarra, 2015). Small and Medium Enterprises (SMEs) in particular are thought to be at a disadvantage given the huge expenses they need to spend if they want to ensure access to all the literature they need (Lyman, 2011).
- 12 Five of the studies that dealt with access for industry researchers were based on company surveys, using questionnaires, interviews or a combination of both. Three studies surveyed British companies, one in Denmark and one in Japan.
- 13 The UK’s Publishing Research Consortium (alone in 2009 and in collaboration with UK’s Joint Information Systems Committee (JISC) and Research Information Network (RIN) in 2011) commissioned two of the British studies. They were broad in nature aiming to compare access to research in four distinct groups: universities and colleges, medical schools and health providers, industry and commerce, and research institutes. However, both reports gave special attention to companies, especially SMEs. In the first study (Mark Ware Consulting, 2009) data was collected from several sources, e.g. lists of industrial/trade magazine subscribers as well as those who purchased papers through pay-per-view schemes. The respondents (1130 in total) represented different groups including 186 SMEs and 111 large companies. While 71% of SMEs (of those who need access) claimed to have easy access to the research literature, the number was much higher for large companies (86%) and universities (94%). They were also more likely (55%) to report facing access difficulties than large companies (34%) or universities (24%). They ranked Open Access as their third most common way to access literature, following personal and corporate subscriptions. Open Access was ranked similarly by large companies, except that corporate subscriptions were more common than personal ones

(unlike SMEs). Visits to local public library were the least common means of access, however 38% of SMEs and 35% of large companies reported using them.

- 14 The second study in the UK also confirmed the severity of the problem for SMEs, based on 2,645 survey responses from different types of institutions (CIBER, 2011). While no difference was found between the importance of research papers to SMEs compared to large companies, a larger proportion of the latter (78%) claimed to have easy access to the literature they need (compared with 69% of SMEs). Compared with only 44% of researchers in universities and colleges, 85% of industry and commerce researchers reported a recent access problem “that was not eventually resolved”.
- 15 The third study in Britain was commissioned by JISC and draws on extensive interviews with representatives of 44 UK businesses, including 9 detailed case studies (Parsons *et al.*, 2011). Authors admitted that these types of benefits are difficult to identify. This is partly because they couldn’t find cases of systematic OA usage by company researchers, i.e. OA was encountered “accidentally” in the researchers’ attempts to access literature. The study offered a useful typology of the different kinds of companies in relation to OA usage. It maintained that “research-oriented SMEs” would probably benefit from increased Open Access than other companies. However, it appears that for companies in general, the mere prevalence of OA literature is not enough to make use of them. Many lack “the skills and knowledge to develop and employ coping strategies when encountering paywalls”. Also, some study participants claimed that any benefits for OA to industry are limited by the general irrelevance of academic research to industrial needs. For others, the benefits of OA were not in it being a knowledge transfer mechanism, but in being an efficient way to scan the large amounts of literature in order to identify potential collaborators from academia. This idea that companies use academic literature for purposes other than product development has been also discussed by Martin and Tang. They argued that humanities and social science research plays a role in providing companies with social knowledge necessary to solve “non-technical challenges that involve social choices” (Martin & Tang, 2007).
- 16 The Danish study also focused on SMEs, albeit on a smaller scale (Houghton, *et al.*, 2011). In addition to the online survey (which had 98 valid response), 23 interviews were conducted in attempt to provide a deeper analysis. Over half of the respondents claimed to experience difficulties accessing research papers. However, the importance they ascribe to such access is relative. Only 48% rated research papers as essential for their business, although the percentage was higher (64%) when only respondents in research roles are taken into account. Open Access journals and repositories as a means of access were rated above inter-library loans, local public libraries and pay-per-view, but still below in-house and personal subscriptions.
- 17 In Japan, two surveys conducted in 2008 and (a follow up) in 2011 showed an increase of the percentage of companies that could not introduce electronic journals citing budgetary constraints (Abe *et al.*, 2011). This might have been only because of rising journal prices. It is also possible that it resulted from the massive budgetary strains endured by Japanese companies after the Lehman Shock. It appears though that the problem might actually be more severe for smaller companies given that the number of those subscribing to 100 or more titles has increased to 16% from only 7% in 2008.
- 18 Two other studies sought to establish new indicators for the impact of Open Access outside academic circles. Both focused on biomedical research because of the strong relation it has with the biomedical industries in general and the pharmaceutical industry

in particular. Also, both studies used patent analysis which to some extent eliminated the bias of self-report generally experienced in surveys. In one study, Bryan and Ozcan (2016) tried to see if being open access enhanced an article's chance to be cited in patents. They matched close to three million patent applications with a set 132,872 papers published between 2005 and 2012 by 43 prominent biomedical journals. About half of the articles (54%) were freely available online (either through PubMed Central or publisher websites). Statistical analysis showed that open access articles received 28-59% more patent citations, although the authors warned that more investigation is needed to establish causality.

- 19 Building on evidence about the negative impact of high journal prices on SMEs (as discussed earlier), ElSabry and Sumikura adopted a slightly different approach by attempting to understand the relationship between the company's size and the ratio of open access papers cited by its patents (ElSabry & Sumikura, 2016). In their preliminary analysis, no statistically significant correlation was found, except in the case where the company co-owns a patent with university. In this case citations to open access journals in the patent decrease by about 6%, which might suggest that companies resort to freely available literature online, in absence of access to the university library resources. Another interesting trend found by the study was that patent citations to Open Access papers have increased over the period of 2005-2013 by an average annual increase of 38%, compared to only 16% for journal citations in general. However, it is worth noting however that ElSabry and Sumikura only considered articles published in open access journals in their analysis, which would naturally result in an underestimation of the impact of open access (i.e. because of neglecting green and hybrid OA).

## Policymakers

- 20 Evidence-based policymaking has been growing both as a field of research and in practice. Presumably, policy research units (usually operating on scarce funding) and individual policymakers can make good use of access to the widest range of academic literature relevant to their work. In fact, it is surprising that the earliest two studies in the set collected for this project sought to investigate the promise of open access in supporting evidence-based policymaking. Both studies were conducted by Willinsky in 2003 and 2004 with participation from Canadian policymakers. In the first one (Willinsky, 2003), 29 interviews were conducted with Canadian policymakers to better understand how they interact with research and what impact online (and open) access can have of this interaction. The study also offered a detailed discussion of the relevance of social science research to policymakers and the intricacies of the so-called evidence-based policy. Nwagwu and Iheanetu contributed a similar discussion in the context of their much broader survey of 121 Nigerian policymakers (Nwagwu & Iheanetu, 2011). According to their analysis, the availability of journals was not a good predictor of their usage. On the other hand, journal usage was significantly correlated to policymakers' educational qualification. In their conclusion, they emphasized the important role "meta sources" (e.g. bibliographic indexes) can play in enhancing policymakers' usage of different information sources. In this regard, and based on findings from his first study, Willinsky had developed a "Research Support Tool", which was meant to act as a companion to policymakers while they read policy-relevant research papers online. He



tested the tool with 13 policymakers (also from Canada) and reported their views in his second study (Willinsky, 2004).

- 21 Later, a more extensive study was commissioned by JISC to investigate the possible benefits of open access for the public sector in the UK (Look & Marsh, 2012). It attempted to estimate the direct and indirect benefits from Open Access to the public sector. Direct benefits were estimated in terms of cost savings. Based on survey data and other sources, they estimated that the existence of Open Access (both through gold and green routes) saves the UK public sector about 17% of what it annually pays to access its needed literature. One tenth of the saved amount is attributed to the more efficient use of time. The study concluded with a discussion of the indirect benefits of OA to the public sector (e.g. more informed decision making) recognizing the difficulties in quantifying such benefits.

## Non-Profit Sector

- 22 The first of two studies to assess the needs and attitudes of NGOs regarding open access to research was a report commissioned by UK's JISC (Beddoes *et al.*, 2012). The survey included 101 British NGOs with different sizes (with income ranging between less than £10K to over £10m). The majority of NGOs in the study (78%) reported that government-produced reports are the source of information they use most often, compared with 14% who claimed to use scholarly research most frequently. Still, 73% reported using journal articles and 54% used conference proceedings. While the response rate was small compared to the target sample of the survey (1,983 NGOs), the results align with findings from the interviews and case studies.
- 23 The majority of respondents (80%) cited the high cost as the major barrier to access research and 95% claimed that having research available for free online is the best enabling mechanism to increase their research use. It is also true that some reported asking student volunteers to provide them with papers using their university subscriptions. However, even in the case of larger NGOs (whose in-house libraries can afford subscriptions), the issue is further complicated by the fact that journals and academic databases are structured according to discipline. That might decrease the value of their subscriptions. For example, an NGO serving people with a particular disability, "might be interested in research across a very wide range of disciplines, from health to sociology to engineering" (Beddoes *et al.*, 2012).
- 24 In the second study (Moorhead *et al.*, 2015), Moorhead and colleagues conducted an experiment with 92 researchers from a diverse set of nonprofits in the US. Two thirds (67%) of those given complete access (to the Stanford University Library collection of over 9000 health journals) have used it to view the full text of at least one article. On average, they viewed 2.2 articles per week and 3.7 abstracts for each viewed article.

## Practitioners

- 25 Among different groups of practitioners, those in medical professions are thought to benefit most from open access to research publications. Medical practitioners are usually a standard example of OA beneficiaries outside academia (ElSabry, 2017a). It is also true, however, that the information needs of medical practitioners do not always align with

what health researchers read (Davies, 2007) nor what they produce (Hardisty & Haaga, 2008). This is further complicated by the fact that in some cases (even when access is generally good) practitioners might not be aware of the opportunities offered to them (Bryant, 2015). The inability to locate information also poses the threat of assuming that it does not exist at all (Davies, 2007).

- 26 Although recently published (Spedding, 2016), Spedding's review of evidence on whether "open access publishing facilitate the translation of research into health policy and practice" is based on publications listed in Bailey's 2010 bibliography (Bailey, 2010) of literature on Open Access. This suggests that it might have missed important research on the topic published after 2010. Of the ten studies collected for this project (about the impact of OA on medical practice), only three were published before 2010. Nonetheless, the review offers very interesting insights into the issue. He suggested that the reason why benefits to end users (e.g. practitioners) have been left out of the debate on OA is the fact that the OA movement itself has risen out of frustration with expensive journal prices. This consequently shifted everyone's focus to the issue of business models (Spedding, 2016), which (among concerns about vanity publishing) has furthered the debate on the quality of OA publications.
- 27 Information-seeking behavior of medical practitioners has been a topic of interest for many researchers (Davies, 2007). Of relevance here are those relevant to access to primary research literature. Based on a survey of 90 health personnel in the US, primary research was among their least common sources of information (used by 32% of respondents). They were motivated by the need to help a particular patient (35%) or a general interest in increasing their knowledge (31%) (O'Keefe *et al.*, 2011). In Ireland, a survey of health and social care professionals (HSCPs) showed a general lack of awareness about open access, which was mainly attributed to lack of time and institutional incentive to do research altogether. However, about 80% of them showed interest in doing research if given enough time and motivation (Lawton & Flynn, 2015). The study also reported that over half of HSCPs who used documents from the Irish health repository (Lenus) have done so in practice for patient care, which supports the idea that Open Access to research can still have a great impact for those who are not generally active researchers. The problem seems to have existed for a long time because, as far back as 2005, 33% of family doctors surveyed by Andrews and colleagues claimed cost to be a barrier for the accessing literature they find relevant (Andrews *et al.*, 2005).
- 28 Being a well-defined group of people coupled with the relatively easy ways to reach them, health workers were the target of two experiments to study their relationship with Open Access. In the first experiment (Hardisty & Haaga, 2008), Hardisty and Haaga showed that practitioners given a full-text article were twice more likely to read it (and to some extent apply knowledge from it to a hypothetical patient) than those who were given only the citation. However, they also concluded that OA is a necessary (though not sufficient) reason for the diffusion of knowledge to the community of practitioners. This is a further proof of the importance of OA in the "chain of communication in health science" from researchers to health workers, especially in developing countries (Chan *et al.*, 2009). The other experiment (Moorhead *et al.*, 2015) involved 336 practicing physicians from the United States (including a control group). The main conclusion was that practitioners consult the full text of the articles when given the chance. The experiment also suggests that OA-embargoes hinder the diffusion of research to practice given that about half (49.9%) of the articles consulted by physicians were published within the previous year.

The researchers conducted interviews for a subset of 38 physicians to gain more insight into the context in which these articles were used. The report for these interviews was published separately (Maggio *et al.*, 2016). Regarding the importance of immediate access, Maggio and colleagues (who analyzed web log data of over 5000 health personnel working in the Stanford University Hospitals), that 20% of the research papers consulted by practitioners in 2011 where themselves published in 2011 (Maggio *et al.*, 2013).

- 29 Immediacy of access might also prove useful for another group of professionals. That is journalists. Although no formal study investigated this issue, preliminary analysis (reported recently in a blog post (Maggio *et al.*, 2017)) provides the interesting result that 60% of 11,523 research papers cited in news stories about cancer were behind a paywall, while 50% of the news stories were published within 2 weeks of publishing the research paper (25% within one day only).
- 30 Lawyers and Judges are another group that can make good use of access research (i.e. legal scholarship). Two studies tried to outline the efforts in this direction and provided and framework to understand the role legal scholarship can play in legal practice. Danner maintained that legal scholarship is more important for practitioners in civil law countries (Danner, 2012). However, he cited another study that document cases where the Supreme Court in the United States (a common law country) resorted to citing academic literature in some difficult cases (Schwartz, 2010). In the second study (Scherlen & Robinson, 2008), Scherlen and Robinson provided a very sophisticated theoretical framework to make the case for Open Access based on principles of social justice theory. In general, open access to legal research is still limited compared to other fields, despite the existence of initiatives like “The Durham Statement on Open Access to Legal Scholarship” (Danner, *et al.*, 2008) or the “Science Commons Open Access law Project” (Science Commons, 2013).

## Patient Groups

- 31 Patients and patient groups have been frequently mentioned as an example of those who have a “right” to access research. In some countries, patient groups are very active organizations. Not only do they conduct advocacy and awareness-raising activities, but also fund and sometimes run research projects. One prominent example in this regard is PXE International, which was co-founded by a parents of children with a rare genetic condition called pseudoxanthoma elasticum (PXE). Sharon Terry, the nonprofit’s founding executive director has explained (Terry, 2005) how she had to resort to illegitimate means to access enough literature to understand her children’s condition, and how the existence of PubMed made it much easier later. Other than anecdotal evidence (like in Terry’s case), there has been no formal investigation of the role open access can play in supporting the efforts of patient groups. A good starting point is papers like this one (Terry, 2013), signaling the different activities these organizations pursue and the extent to which they are supportive of open access research. Some even actively advocate Open Access. Close to one third of the 104 members of the Alliance of Taxpayer Access (Alliance for Taxpayer Access, 2004) are patient groups.

## Independent Researchers

- 32 Independent (unaffiliated) researchers perhaps need open access research the most. This is not because of their intensive research activities (unlike commercial researchers, who are probably the top beneficiaries of OA outside academia) but because they lack the means to get access to research otherwise (Line, 2011). Although still insignificant in absolute numbers, data from ElSabry (ElSabry, 2017b) suggests that the number of publications who list affiliated researchers has been rising over the past decade. Analysis of the number of references they cite shows that it is not much different from patterns in scholarly publications in general (ElSabry, 2017b). This raises interesting questions about the ways they access previous literature and the possible benefits OA can have in this case. It is also expected that in some fields, which have been historically pioneered by amateur researchers (e.g. anthropology, paleontology, etc.), the massive increase of freely available museum and archive collections on the internet can give momentum to for the return of the “armchair researcher” (Roff, 2005). That is a researcher (like those prevalent in the 18th and 19th century), who without any professional credentials can conduct research based on their extensive library collections. Independent researchers also include those whose interest (or hobby) outside employment leads their research efforts (CIBER, 2011).
- 33 In general, there are some ways independent researchers can access the research they need. For example, in 2010 16% of the requests handled by the document supply service of the British Library came from individuals (in addition to 55% from academic sector, 17% from professional sources and 11% from businesses) (CIBER, 2011). These “hobbyists” can also visit public libraries or subscribe to an academic library as an external user. However, such schemes tend to be costly or at best impractical. They might need to travel for a long distance to reach a library with the needed resources, which can be challenging, especially for retired researchers. Also, these schemes do not always allow access to all resource because of library license restrictions (Line, 2011).

## OA Societal Benefit Model

### Previous Attempts

- 34 The question of the impact of Open Access on society (outside academia) is almost inseparable from the issue of how society uses research outcomes in general. This is why in this section a brief review of the models for general impact of research on society will be provided followed by more specific models that aimed at open access research in particular. Studies of the societal impact of research have mostly come in the context of justifying the increasing public funding for university research in the second half of the twentieth century. There have been several efforts to measure this impact with the aim of informing policymakers on how to better utilize public funds. Bornmann’s comprehensive review (Bornmann, 2012) provides a good summary of these efforts and the several challenges that lie ahead.
- 35 In the context of Open Access, there has been three attempts to model the process through which the benefits of Open Access can flow to the wider society. The work of Zuccala (Zuccala, 2010; Zuccala, 2009) has assumes that any discussion on societal benefits

from Open Access has to happen based on what we already know from other fields operating at the science/society interface. These are information-seeking behavior, public understanding of science and science communication. In her model, she proposes that open access to research provides a more just and efficient way to communicate scientific knowledge to the general public: more just than the public education model (where self-selected intermediaries take on the mission of “simplifying science” to the public) and more efficient than the co-production model (Callon, 1999 ) which actively involves people in the scientific production process. In an Open Access world, laypeople have the freedom to directly engage with the scientific literature as part of their information-seeking activities. She maintains that it is still not clear the extent to whether many people will appreciate this freedom or whether there will be a need for new mechanisms for mediation (Zuccala, 2009).

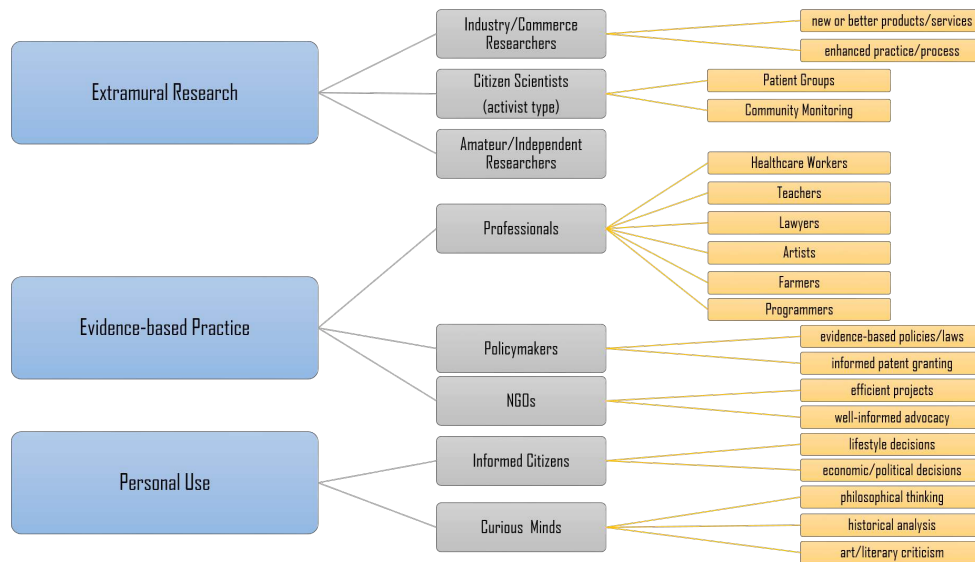
- 36 In his attempt to describe the scholarly communication system in terms of an IDEFO process model (Björk, 2007), Björk five groups whose main interest is in applying the knowledge found in research papers (as opposed to producing it). These are universities (who use them to educate students), governments (by applying research findings in defining standards, granting patents and designing policies), companies (for product and process development), physicians (in treatment of patients) and private individuals (who use them to enhance their understanding of the world or their lifestyle. Houghton and colleagues further developed the model (Houghton *et al.*, 2009) and added NGOs (including lobby groups) as well as other groups of practitioners by giving the example of law and engineering professionals. They also added another type of usage for research papers. That is the production of secondary sources (e.g. blogs, textbooks and stories in popular media).
- 37 The most recent attempt to address the issue of Open Access societal implications was that by Bankier and Chatterji (Bankier & Chatterji, 2016) in the bepress report. Based on the 100 stories selected for the report, they created a framework “to serve as a tool for stakeholders who are interested in advocating for open access on their campus yet lack the specific vocabulary and suitable examples”. The highest level of the framework proposes three categories of benefits for Open Access: benefits to readers, authors and institutions. Of relevance here is the first category where 9 sub-categories for impact where presented. These are affecting public policy, advancing innovation, improving access to education, linking global experts, connecting cultures, building local community, informing patients & caregivers, updating practitioners and informing prospective (university) applicants.

## Suggested Model

- 38 This paper presents a typology of impacts of Open Access on society. It identifies three main contexts of usage of research papers outside of credentialed research establishments. First, as is the case in academic research, non-academic researchers can require reading journal papers as a typical step in their research activities. Second, professionals occasionally need to consult recent research papers, not to build on them with further research, but mainly to update their own information and enhance their practice. Third, some individual citizens might satisfy personal needs through reading research papers. The typology is presented graphically in Figure-1. Below, a justification for each of the diagram components will be presented along with the argument for how

this typology can act as a framework for future research on the societal impact of open access.

Figure 1. Suggested typology for classifying Open Access impact on society



### Extramural Research

- 39 The term “extramural knowledge production” was explained as all knowledge-producing activities that are conducted outside the university (Lave, 2012). Three groups (of those mentioned earlier) stand out as examples of extramural researchers: industry researchers, patient groups and independent researchers.
- 40 In the diagram, industry researchers are represented as a separate group of beneficiaries, albeit with the assumption that the category also includes non-manufacturing companies (e.g. financial sector companies). Patient groups are included under the larger group of citizen scientists. There have been many attempts to characterize citizen science (Kullenberg & Kasperowski, 2016). However, there is at least some consensus that citizen science projects are either driven by professional researchers (where citizens volunteer to collect or process data) or designed and conducted by lay people (sometimes in cooperation with scientists). In the first case (volunteer type of citizen science) participation of lay people would normally be limited to the tasks assigned to them by the lead researchers. In the second case (activist type), lay people take the lead in designing and running the research process. One example of this second type is patient groups that conduct (as well as fund) research projects with the participation of patients or their families. Another example is community monitoring activities that are geared towards environmental science research. The third group of beneficiaries under this category are unaffiliated researchers. As mentioned above, both the phenomena of citizen science and unaffiliated researchers are much less well understood than that of industry research. The growing literature on both topics should be extended to include studies of the impact of open access on these groups.

## Evidence-based Practice

- 41 Aside from the ongoing debate on whether OA articles get more citations than their pay-walled counterparts, we know that OA articles at least get more downloads (Davis, 2011). That is to say, some people, not necessarily authors or researchers themselves, find OA articles to be useful sources of information. Zuccala (Zuccala, 2009) suggests that the literature on information-seeking behavior is pivotal in understanding the impact of access to research outside academic contexts. Evidence of the impact of open access research on society can be gathered from information-seeking behavior studies of different occupations. The typology presented here distinguishes three types of practitioners: The first group is people in different professions who require access to cutting edge information in their respective fields. For this group, the focus of interest is to study the extent to which access to primary research is essential for these professionals and the development of techniques to measure it.
- 42 The second type of practitioners are policymakers (including both bureaucrats and decision makers). It is important to note that this argument assumes a direct link between acquiring policy relevant information and utilizing/applying that information in the design or evaluation of policies. This notion is seen as controversial in the literature on evidence-based policymaking. While rational choice theory requires that decision-makers need information about all available policy alternatives before choosing the optimum course of action, evidence has been building that this is not the full picture. It has been argued that bureaucratic (formal) structure and (informal) culture play keys role in determining how (or whether at all) such information makes its way to the decision-making level of government (Rich, 1981).
- 43 The third group of practitioners in this typology consists of those working for the nonprofit sector. Access to scholarly research can be of value to non-profit organizations for two main reasons. One reason is the need for sound information for use in NPO advocacy activities, ranging from lobbying in government to awareness campaigns on the street. This need is felt by organizations such as environmental advocacy groups. The other value of research results is for the design and implementation of projects and initiatives. An NPO that is well-informed about current studies and reports in its field is in a better position to design relevant projects and to successfully implement them. For example, an NPO in the field of social work might use the results of studies on homelessness in the creation of facilities or services that cater for the real needs of homeless people.
- 44 In any case, discussion of evidence-based practice should take into account factors other than the availability of the required information. For example, there is a need to frame problems encountered in practice in terms of research questions. The same applies to the ability to judge the quality of the consulted research papers and the ability to draw practical implications from their findings (Bryant, 2015).

## Personal Development

- 45 Common sense would suggest that lay people would have neither the interest, nor the skills to consult scholarly research papers to meet their information needs. This suggests that the impact of Open Access in this case is either nonexistent or negligible. This claim can be contested based on studies from the field of Public Understanding of Science

(PUS), where a general increase in lay people's comprehension of and engagement with scientific issues has been observed over the past few decades (Bauer, 2009). While PUS statistics are mainly concerned with natural sciences, it is not difficult to assume that similar effects are present for the arts, humanities and the social sciences (AHSS). It is also important to keep in mind that researchers from many AHSS disciplines (more than natural science researchers) have historically been able to engage lay people with their work by authoring books. Zuccala and colleagues (Zuccala *et al.*, 2014) have shown that some widely cited history monographs also appeal to many lay readers, as measured by the reviews given on the Goodreads platform. On the other hand, the unprecedented growth in the availability of MOOCs and other Open Educational Resources (OER) can to prepare interested lay people to decipher research papers whenever the need arises.

- 46 Personal use is probably the least understood category of research paper usage. This study assumes that attempting to classify the different types of this usage will provide much-needed guidance to future research efforts. Two types of personal use can be distinguished. First, people consult research papers to inform their behavior, either in private (lifestyle) matters (e.g. parenting, nutrition, coping with illness) or in public matters (e.g. following economics or public policy research) in order to actively fulfill their role as informed citizens. Second, some people read research (e.g. history, philosophy, art, religion) with the aim of satisfying their curiosity. The impact of this second type on society is two-fold. It provides personal enrichment and helps people to fulfill their higher aims in life. It also has an indirect effect on the development of cultural industries (e.g. galleries, tourism, book publishing) and the promotion of other cultural activities.

## Important Remarks

- 47 In essence, these three categories (extramural research, evidence-based practice and personal use) all assume that research papers are “sought” by members of society who need them. This study argues that an Open Access mode of scholarly publishing could make the task of consulting research easier for everyone (not just those in the academic community). Indeed, some have argued that unlocking the body of scholarly literature is in itself a virtue, regardless of what utility it holds for society. Such position assumes that new “uses” of research would arise if we just focus on making it available. However, this study chose to emphasize already existing needs and lay out the framework to better understand them.
- 48 While it appears that the model is built on the assumption that Open Access to research a good thing, it is important to note that main purpose of it is to classify the available studies and set the future agenda for further investigation of the issue. Benefits mentioned in the model are nothing but potential outcomes. It was established at the beginning of this study that the available evidence is very scarce and more research is needed to support the existence of any real benefits. The study also sought to outline some of the limitations associated with the consumption of research papers by outside the academic community. This is another reason to assume that benefits mentioned in the model are not to be taken for granted.



## Conclusion and Future Outlook

- 49 How Open Access research impacts people outside the academic community is a complex and versatile issue. It is important to approach this issue creatively given the difficulty in quantifying any of these societal impacts. Studies cited here (as examples of usage of research outside academia) come from a variety of fields. Therefore, any future research efforts should take this diversity of approaches into account. A research program would ideally consider the different examples cited in the framework proposed in this study and would include more groups of research users. For each group (e.g. SMEs, NGOs, patient organizations and parents) one or two indicators should be developed. While an indicator for one group of users can inform the development of that of a different group, attempts to generalize the use of the same indicator for many groups will probably yield inaccurate results. In essence, doing so would be similar to using number of citations as a measure of journals quality (i.e. impact factor), which proved to an inadequate quality indicator in a number of research fields. It is imperative to accept that the definition of “impact” varies depending on context and that one-size-fits-all indicators compromise the quality of any analysis (Bornmann, 2012). Consequently, flexibility should be exercised in developing indicators for different types of impact.
- 50 The other important issue raised by this study is that the Open Access movement has many more stakeholders than those currently involved in the debate. This is important in two ways. First, the debate can be improved by introducing the views and concerns of other groups of people who are affected by cost of accessing literature. Second, regardless of the extent to which excessive publisher profits contribute to rising cost of journals, the controversy as to who should fund “fair” Open Access could be easily resolved if more beneficiaries were involved in sharing the cost, especially those who extensively consume literature they contribute very little to (e.g. industry researchers). There is no reason for industries that bear 15-17% of subscription costs (Ware & Mabe, 2015) to be excluded from contributing to the cost of Open Access provision. It has already been suggested that industry associations (e.g. the Biotechnology Industry Organization) manage schemes of group subscriptions to remedy the difficulties experiences by SMEs in accessing research (Lyman, 2011). It is not difficult to imagine similar arrangements taking place in an open access world. A good example already exists where government organizations (with a stake in the accessibility of research) support Open Access. A mutual agreement with the European Observatory on Health Systems and Policies (an intergovernmental organization) made it possible for the journal Health Policy to provide free access to selected policy-relevant articles for the benefit of all users (Busse, 2013). Indeed, the more such collaborations take place, the easier the transition to Open Access.

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## ABSTRACTS

Studies about open access (OA) have predominantly focused its impact on communication within the scholarly community. For example, many studies have been published on what is called the "Open Access Citation Advantage (OACA)". On the other hand, implications of OA in non-academic contexts (e.g. medical practice, policymaking, patient advocacy and citizen science) have been the subject of and the basis for a lot of the advocacy work and many funding agencies' OA policies, but not so much the subject of original research studies. To date, this study is the first attempt to collect and synthesize the available evidence on the societal impact of open access. It further builds on this evidence base by introducing a typology of the various science-society interfaces where demand for access to research potentially exists. The proposed scheme is anticipated to provide guidance for future research on the issue of OA's societal impact. The paper concludes with a discussion of the implications of non-academic usage of research on the open access debate, especially on the question of who should bear the cost of scholarly publishing.

Les études sur le libre accès ont souvent porté sur l'impact sur le système de communication scientifique. Par exemple, beaucoup d'études ont été publiées sur ce qu'on appelle l'« Open Access Citation Advantage (OACA) ». Par ailleurs, les implications du libre accès dans des domaines non-académiques (praticiens, décideurs, patients, citoyens concernés, etc.) ont fait l'objet de nombreuses discussions. Elles ont également alimenté également de nombreux plaidoyers et de nombreuses politiques pour le libre accès conduites par les agences de financement, mais ont rarement fait l'objet d'études scientifiques approfondies. Cette étude jette les jalons d'une première tentative de collecte et de synthèse de travaux apportant des éléments de preuves de l'impact sociétal du libre accès. Il introduit, à l'appui de l'état de la littérature trouvée, une typologie des diverses interfaces sciences-société pour lesquelles existe un besoin d'accès aux résultats de la recherche. Le modèle proposé dans cet article pourra aider à définir un cadre à de futures recherches dans ce domaine. Une discussion sur les implications de l'usage non-académique de la recherche et sur la prise en charge des coûts d'édition conclue cette étude.

## INDEX

**Keywords:** open access, societal impact of research, extramural research, evidence-based practice, public understanding of science

**Mots-clés:** libre accès, impact social de la recherche, recherche extra-muros, méthode basée sur les faits, compréhension publique de la science

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