'Is the Library Open?': Correlating Unaffiliated Access to Academic Libraries with Open Access Support

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Abstract

In the context of a growing international focus on open access publishing options and mandates, this paper explores the extent to which the ideals of 'openness' are also being applied to physical knowledge resources and research spaces. This study, which forms part of the larger Curtin Open Knowledge Initiative project, investigates the relationship between academic library access policies and institutional positions on open access or open science publishing. Analysis of library access policies and related documents from twenty academic institutions in Asia, Australia, Europe, North America, Africa and the United Kingdom shows that physical access to libraries for members of the public who are not affiliated with a university is often the most restricted category of access. Many libraries impose financial and sometimes security barriers on entry to buildings, limiting access to collections in print and other non-digital formats. The limits placed on physical access to libraries contrast strongly with the central role that these institutions play in facilitating open access in digital form for research outputs through institutional repositories and open access publishing policies. We compared library access policies and practices with open access publishing and research sharing policies for the same institutions and found limited correlation between both sets of policies. Comparing the two assessments using Spearman's rank correlation coefficient confirmed open access policies have a direct association with the narrow aspects of public access provided through online availability of formal publications, but are not necessarily associated (in the universities in this study) with delivering on a broader commitment to public access to knowledge. The results suggest that while institutional mission statements and academic library policies may refer to sharing of knowledge and research and community collaboration, multiple layers of library user categories, levels of privilege and fees charged can inhibit the realisation of these goals. As open access publishing options and mandates expand, physical entry to academic libraries and access to print and electronic resources has contracted.

This varies within and across countries, but it conflicts with global library and information commitments to open access to knowledge.

Keywords: open knowledge; library access; open access; academic libraries

1. Introduction

1.1. Context

The Curtin Open Knowledge Initiative is a strategic research project based in the Centre for Culture and Technology at Curtin University, Western Australia, and supported by the Curtin Institute for Computation. Within the project we are exploring mechanisms that will allow universities to work more effectively with local and global communities in the production and sharing of knowledge. Our ultimate goal is to create a shift in the ways in which university performance is evaluated: promoting a collective goal of more open and effective universities. We are investigating key aspects of open research culture and practice within higher education and research institutions (HERIs) globally using qualitative and quantitative approaches, with the goal of helping HERIs to better understand their progress, as well as the changes that might be needed to ensure that they operate as successful open knowledge institutions. Areas of focus include policies (intentions); effort (investment and resource allocation); and outcomes (evaluation). Extended analysis of institutional open access publication output performance, research collaboration, diversity in research output and staffing and collaboration building are important components of the project (Montgomery et al., 2018). Communication regarding actions such as open access (OA) research output and sharing research data contribute to an institution's profile. Coordinating policy, communication and evaluation actions, and interaction between diverse groups within institutions is critical to the objectives of an *open knowledge institution*. Achieving this involves cultural change at an institutional level, including the practices and policies in academic libraries.

Access to knowledge and engagement with external communities by institutions are important dimensions of openness. Academic libraries play a key role in facilitating and promoting institutional research and knowledge

openness, contributing to and often driving OA policy development, establishing and maintaining institutional repositories, and coordinating deposit of OA research output. This aligns with the underlying principles of commitment to intellectual freedom and access to information embraced by the library and information profession (IFLA, 2015). However, the Lyon Declaration on Access to Information and Development (with over 600 library, education and information signatories) estimates, '*Half of the world's population lacks access to information online'* (cited in International Federation of Library Associations and Institutions (IFLA), 2018). Openness is not embedded throughout all academic library workflows and practices. For example, book acquisition processes often still focus on "closed content" (Ball & Stone, 2019). Further, competing demands for access to academic library physical spaces, facilities and collections have led to exclusive policies and practices that may be seen to conflict with open access publication positions.

1.2. Aims of the Study

The access policies of academic libraries provide insight into the ways in which a university views its role within the knowledge landscape of a wider community. Arguably, library access policies reflect the extent to which a university views its knowledge resources as assets to be managed on behalf of an exclusive group of staff or students; or as resources to benefit both the community and the institution if they are shared beyond the university. Increasingly research output is published electronically, sometimes exclusively, but the bulk of academic library collections still include archival and print resources. For example, the Massachusetts Institute of Technology Libraries spent almost 90 percent of the 2016 budget on electronic materials. However, the majority of the collection is in physical formats: only 8% of the 1.3 million book titles, 1% of archival collections and 38% of theses or dissertations were available online (Massachusetts Institute of Technology Libraries, 2016, pp. 10–11). Retrospective deposit of legacy material such as print books and journal literature is complicated by copyright and policy considerations and the practicalities of motivating researchers to deposit.

Since the 1990s, budget restraints, competing demands for space, security of materials and users have challenged institutional missions of openness in some parts of the world. Institutional online vendor subscriptions

to electronic materials impose restrictions on access to research output produced within the same institutions and others, thereby limiting the sharing of knowledge outside universities. As libraries cancel print journals in favour of electronic versions, research material once available on academic library shelves becomes inaccessible to many who are not registered institutional faculty, students or staff. The open access movement aims to counter these paywall limitations by disseminating research to society through online repository deposit or green OA and through open journals or gold OA (Berlin Declaration, 2003–2019; Budapest Open Access Initiative, 2012). An initiative such as Impact Story's Unpaywall (https://unpaywall.org/) harvests and shares open access content legally from repositories, open access journals and publishers. The Unpaywall browser extension indicates the OA status of a research item opened on a researcher's computer screen, and provides a weblink where appropriate. A searchable database is also in development. But open access to research published electronically continues to be a challenge. In countries outside the "dominant Anglophone research community" (Liang, 2018, p. 187), restricted access to research has led to the emergence of "shadow libraries" such as Sci Hub, Library Genesis and others (Karaganis, 2018).

1.3. How Open are University Campuses?

Within the Curtin Open Knowledge Initiative project, we are exploring the extent to which physical access to university campuses impacts on relationships between research producers inside universities and external knowledge communities. This study focuses on the contribution of library access policies and current practices to institutional openness, and their correlation with institutional open access publication policies. The current research builds on an initial pilot study undertaken in 2018 (Wilson, Neylon, Montgomery, & Huang, 2019), extending the number of libraries and the geographical scope. The study explores the intersection of open access to research published online and open access to academic libraries. It probes the availability of public data, the feasibility of locating and obtaining documents for analysis, and the appropriateness of library access as an indicator or proxy for institutional openness. The scope at this stage is small, but global in nature, and also examines geographic patterns.

The research questions at the foundation of the study are as follows:

- How do academic library access policies reflect their institutions' positions on open knowledge?
- Do academic library access or use policies specify conditions of access for external, unaffiliated members of the public?
- How do academic library access policies correlate with institutional open access policies and open access publishing practices?
- What do academic library access policies suggest to the wider community about institutional openness?

1.4. Structure of this Article

The first section in the article discusses related studies and reviews in the literature regarding changes to academic library access policies. The second section presents an analysis of access and use policies from twenty academic libraries across five continents, viewing them in relation to institutional open access policies and percentages of open access publishing. The final section discusses the coordination and correlation of the two dimensions of openness (library access and open access) and comments on geographical differences.

2. Background

2.1. Policy Changes and Challenges

A review of the literature identifies analyses of academic library access policies and unaffiliated access to libraries using online and telephone surveys. Several articles examine the effects of policy changes and restrictions on library and institutional mission statements or intentions. The level of unaffiliated access to academic libraries varies globally. In Australia, the concept of national library resource sharing within which academic libraries participated was encouraged in the 1980s. In a review of external access to the University of Western Australia Library, Melanie Harris (1989, p. 219) noted that "[o]peness to external use is one way in which university libraries fulfill their role as part of the national library resource."

Many studies are located in the United States, with a long and varied history of academic library community engagement (Dunne, 2009). Publication

requirements for tenured professional academic librarians in the United States may also account for the larger contribution. There is a predominance of English language and locations in the north Atlantic in the literature. Studies in the 1990s and 2000s reflect changes in practices and issues around public access to academic and research libraries (primarily Canada, the United Kingdom, the United States) resulting from budget restraints and electronic subscription licensing (Barsun, 2003; Burclaff & Britz, 2011; Creaser, 2011; Shires, 2006; Weare & Stephenson, 2012; Whitehead, Gutierrez, & Miller, 2014). The studies discuss variations in external access policies and conditions, and the presence of differing fee structures. During the 1960s, increases in population, higher education institutions and secondary school curriculum changes in the United States, and the growth in publications led to greater demand for access, borrowing privileges and study space. The provision of such services to unaffiliated, external users such as high school students, members of the public, local businesses and industries became difficult for academic libraries to sustain. They began to prioritise servicing their primary users: students and faculty (Courtney, 2001). Courtney correctly predicted "the possibility of diminished access" for external users, rather than expansion, as a result of the growth in electronic resources (2001, p. 478). Many academic libraries have implemented "tiered access policies" (Burclaff & Britz, 2011, p. 3), charging fees to external users. Within the multi-levelled and multi-dimensional access incorporating agreements, coalitions and consortia with other research institutions and organisations, the individual or unaffiliated researcher appears to have the least, or most restricted, access. At the same time, public desires for access are reflected in the tiered policies, indicating a growing need for wide access to research knowledge contained in university libraries.

Library access policies and practices in Europe vary. In some countries, the tradition in academic libraries has not always facilitated unaffiliated access to collections. Closed stacks with material organised by accession number and size restricted open or free access to shelf browsing. However, some now have implemented shelf organisation by classification schemes. For example, in 1989, as Eastern Europe underwent economic and political changes, the University of Warsaw in Poland opened a new library and implemented more open and accessible practices (Dzurak, 2008). In Finland, university libraries are open to all (Lehto, Toivonen, & Iivonen, 2012). Academic libraries in Norway traditionally are open and accessible to all (Anderson & Fagerlid,

2016). In Sweden they are "in principle…open to the public, and not exclusive to the members of the academic community" (Thomas, 2010, p. 112). In Italy, a focus on the "so-called 'open library'" incorporates social inclusion and the role of academic libraries in the national infrastructure (Simane, 2017).

Is access to academic libraries for the unaffiliated considered to be a public right? If an institution receives public funding that contributes to the material and digital collections found within academic libraries, does the public have a right to access such knowledge? A similar argument forms the basis of OA mandates, with governments, funding bodies and institutions wishing to maximise the return to taxpayers on their investment in funding research and counter the rising costs of subscriptions to commercial online research journals (Vincent-Lamarre, Boivin, Gargouri, Larivière, & Harnad, 2016). This is a challenge to the predominant control of access to knowledge by commercial publishers.

In North America, university mission statements and policies from the nineteenth century reflected a history of provision of access to libraries. Amy Kaufman (2011) reviews and documents challenges to academic library access in the United States and Canada, including several legal contests of restrictions. One major challenge overturned the 1972 policy for the new University of Toronto Library that excluded undergraduate students and members of the public. However, based on her review of legal cases, Kaufman concludes that access to publicly funded institutions is not necessarily a public right. Instead, it depends on individual characteristics — "the university's mission, their patrons' needs, their financial circumstances, and the place they see for their academic library in the larger community" (p. 393).

2.2. Costs of Open Library Access

Impact on budgets from the costs of providing access to libraries, including staff support for external users and costs of material replacement, is often a reason given in the literature for restricting access (Courtney, 2001). Academic libraries in many countries have implemented fees to external users, presumably intended to offset administrative and staff costs of providing access and services. Harris' (1989) analysis of the service costs of external users at the University of Western Australia libraries, concluded the impact was not large

and did not disadvantage internal users. She also noted the analysis did not take into account reciprocal savings for the university's staff and students using other libraries. Regional, national and international reciprocal borrowing, co-operative and consortial agreements enabling the sharing of print materials among members grew in the 1980s and 1990s to supplement shortfalls in library budgets as purchase costs increased (Duy & Larivière, 2013). These schemes extended globally and continue to provide access to shared resources (print and digital) but within set boundaries. They do not necessarily extend to users who are external to member institutions, although some academic consortial lending schemes do include public libraries.

In 1998 the Library Council of Ireland acknowledged additional financial costs of public access for university libraries (Dunne, 2009). In a goodwill move and hoping to attract donations, the University of Arkansas at Little Rock Library removed membership fees in 2007. The results were increased community use, with minimal impact in terms of extra cost to the library, although the authors acknowledged economic impact is difficult to assess (Dole & Hill, 2011). Investigating public access to academic libraries in the United Kingdom, David Williams contacted several academic libraries to inquire about their membership fees. He concluded "[b]orrowing rights for members of the public are up for sale" but that the costs varied considerably by geography and location (Williams, 2002, p. 14).

However, aside from these examples, analysis of costs and reasons for restricting access through fee-charging, or evaluation of the economic impact of external users and the outcomes of fees is limited. Charging fees may be caught up in reduced budgets and neoliberal requirements for justification of spending, but while the fees charged are openly available, the reasons for leveraging such charges are not. As Judith Butler notes in a discussion of the effects of budget cuts on humanities programmes in universities, "decision-making processes…invariably rely on broader schemes of values…for which no persuasive justification is available" (Butler, 2014, p. 18). Costs to an institution of external library access can be difficult to assess, quantify and justify. For example, how to measure the opportunity for an institution of providing library services to high school students and forging links with them as potential university students? Balancing service and support costs with marketing opportunities and related income is an institutional level concern. While acknowledging the costs of information access, the limited economic analysis

raises questions about understanding the role and outcomes of fee-charging for external users of academic libraries.

2.3. Commercial Electronic Publishing

To extend teaching and research access to published knowledge, to manage collections and to free up study space, academic libraries are adopting purchasing models with a preference for electronic formats. Maintaining a balance between declining physical loan circulations and the changing needs of students for computer access and study facilities have pushed academic libraries to justify physical shelving space (Duy & Larivière, 2013). Print only journals and newspapers may be discarded in favour of electronic versions through aggregating vendors who impose restrictions based on subscriptions and licensing. This limits access to registered, authenticated institutional members. Institutions are moving to a leasing model, relinquishing ownership of and narrowing access to knowledge. The content of onsite access to electronic resources differs for categories such as core users, alumni, visitors and external, unaffiliated users. Remote access to electronic resources is rarely available for external users. Thus, while open access to electronically available research output is expanding, access to commercially paywalled knowledge is shrinking for populations not affiliated with universities or research institutions.

Access to research and knowledge has become complex. The self-archiving policies of journal publishers are more restrictive, and since 2004, gold or paid OA options for commercial publishers have "increased at a similar rate to the volume of self-archiving restrictions" (Gadd, 2017, p. 103). Negotiating the ownership of copyright in scholarly publications falls largely to academic authors, funders and publishers. Gadd suggests universities implementing joint copyright ownership could benefit institutions, academics and open scholarship, although this is at odds with the Budapest Open Access Initiative (Chan et al., 2002) statement regarding authors' control over the integrity of their work. Access to scholarly publications through "shadow libraries" (Karaganis, 2018, p. 1) and "black open access" (Björk, 2017, p. 173) developed in response to an access need, but in bypassing copyright these systems threaten the role of academic libraries in this space.

3. Methodology

3.1. Methods

In this study we set out to explore, through publicly available policy documents and institutional websites, how university library access or use policies reflect and project institutional positions of knowledge openness. Using qualitative data analysis, we examined the content of web-based library access policies and documents, identifying user types, levels of institutional and external library membership and privileges. The terminology used to describe library access is not standardised and varies geographically and linguistically. Thus, to locate more detailed data relating to access, membership and fees charged for all library users required further manual searching and following of weblinks. Through iterative reviews of the documents and web pages retrieved we elicited comparable data for each institution (Bowen, 2009). With the information gathered we identified shared and variant patterns in the data, classified library patron type groupings to create a model of user categories, and counted the retrieved data across the institutions.

We asked the following questions of the data: (1) who had access to the libraries; (2) under what conditions (such as payment or entry requirements); and (3) to which services and collections people had access. Although the answers to these questions are not consistent and vary across continents, countries and languages we were able to develop a classification of library user types according to their proximity to the university: internal or adjacent (within a community with specific links to the university such as alumni, collaborators, spouses/families of academics, organisations), or unaffiliated (general or community members without a specific connection to the university). We identified a set of descriptive categories to include most of the terms for user types we observed. Following the same method, we collected information about conditions of library access and eligibility for privileges by user categorisation. This is less complex as the requirements to gain access generally are applied to multiple categories in a simpler way. Similarly, the accessible resources and services are more consistent across multiple groups and can be categorised broadly.

Similarly, we identified institutional OA policies with requirements or recommendations for gold and/or green OA publication practices. Here the terminology was more consistent, even across languages. We created spreadsheets

and tabulated the data collected in order to compare content from institutional documents and to categorise patterns of library access, open access policies and practices. These iterative and comparative processes enabled us to understand the dimensions of library access and open access to research, and to distill points of difference on institutional openness.

3.2. Selection of Institutions

The initial study analysed a selection of twelve academic libraries medium to large research universities in Africa, Asia, Australia, the United Kingdom and the United States (Wilson et al., 2019). We extended the selection for this study to twenty academic libraries, adding eight institutions from the United Kingdom and Europe. The selection includes universities with a mix of open access publication policies, institutional repositories, university presses, high profile research output and smaller research output. Overall, the selection from a range of countries across four continents aims to provide a spread of languages and cultural practices. We have anonymised the data and information, although they are publicly available, and used regions or countries to name the institutions.

3.3. Retrieving Documents

We gathered documents from university public websites supplemented by directories and collections such as the Directory of Open Access Repositories (DOAR) (http://v2.sherpa.ac.uk/opendoar/), the Registry of Open Access Repository Mandates and Policies (ROARMAP) (https://roarmap.eprints.org/) and Politicas MELIBEA (https://www.accesoabierto.net/politicas/), a directory and estimator of OA policies for institutional repositories and practices. We developed a user-assisted tool to automate the search, retrieval and downloading of library access or use policy documents, and OA policy documents from university websites. The tool consists of a Jupyter notebook supported by a small library of Python code. Using the Bing search engine API it executes a search against the URL for a specific university website recorded in the Global Research Identifier Database — GRID (https://www.grid.ac/). The search returns five pages for each website from which we select, view and download relevant documents. The code and an example notebook are

available at Github (https://github.com/ccat-lab/doc_search) and Zenodo (Neylon, 2018). Website and directory searches took place from May to July 2018 and February to April 2019.

To assist with constructing searches and to incorporate terminological and linguistic variations across countries and regions, we created a multilingual scholarly communication lexicon and invited contributions from the open scholarship community. This is available in Zenodo (Lexicon Contributors, 2018).

3.4. Analysis of Data

The content retrieved from institutional websites includes documents related to library access policies and procedures, open access policies, open access information and publishing. From the library access policy documents, we categorise groups of library users and membership together with eligibility for privileges, fees charged for external user access and membership (see Figure 1). In addition, we document physical access restrictions to library collections and buildings, where available. Tabulated, these data show the extent of their presence across the sample libraries. We consider the presence or absence of an open access policy, a statement of institutional support for open access funding, and the presence of an open access institutional repository as indicative of institutional support for open access publishing.

The two datasets (library access and open access) are compared with percentages of 2017 institutional publications with an OA status as calculated by the Curtin Open Knowledge Initiative project team. Finally, we applied a correlation analysis to examine the association between these three variables.

4. Dimensions of Library Access

4.1. Categories of User

In addition to institutional registered members, external users may be granted membership to access university libraries. However, the multiple

Fig. 1: Categories of users from library access policy documents.
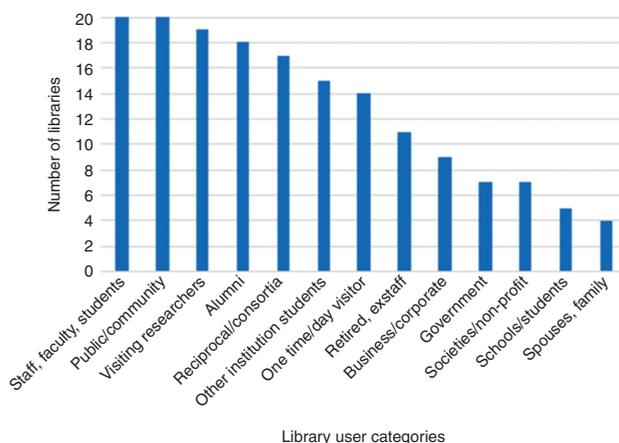
categories identified from the documents retrieved reflect differing levels of eligibility for privileges, joining or membership fees and restrictions on physical access. Grouping the categories into three concentric positions indicates their relationship to the core business of the university: the academic community; individuals and organisations who have prior, established relationships adjacent to the university; and the unaffiliated members of the public who have specific research or other information needs:

Core: faculty, staff, students of an institution.

Adjacent: retired, former, ex-staff; spouses; alumni; visiting researchers, scholars; reciprocal scheme borrowers; business and/or industry; societies, non-profit organisations; government departments and agencies; cultural organisations.

General public: unaffiliated community or public members, independent or private researchers, visiting readers, visitors, commercial researchers, other university students, school students, one-time or day visitors.

Comparing the extent of user types across the libraries shows the core categories are consistent, but the extent of adjacent and unaffiliated category types varies across the institutions selected (see Figure 1).

The variations in user types in Figure 1 show some geographical idiosyncrasies. For example, the category of spouses and family members of staff is prevalent mostly in the United States. Membership categories are often more structured and granular in the selected universities in Australia, Africa, the United States and the United Kingdom than in other countries. The presence of a user category suggests a library has identified and responded to high demand from a particular group of users, sometimes to exclude them. For example, restrictions on school students and other universities' students within the category of external users appear in larger university libraries in highly populated areas. Many such libraries also require members of the public, independent researchers, and in some cases other institutional students to provide documented evidence of the unavailability in any other library of material they are seeking to access. Applicants may need to be interviewed by library staff to ascertain their research needs are legitimate. At some universities membership applications from external users require sponsorship or guarantees from academic staff. Larger academic libraries often have agreements with local organisations to provide access for employees, presumably for an organisational based fee. Age limitations of 15 or 18 years usually restrict school students at and below secondary school (unless accompanying an adult).

4.2. Library Privileges

To extend the analysis of the access policies retrieved, we extrapolated from membership and privileges data the following services that selected libraries may or may not extend to external users:

- Physical access to library buildings and stacks and collections
- Read and/or consult materials onsite
- Membership borrowing privileges for external, unaffiliated users
- Onsite and remote access to subsets of electronic resources
- Use of onsite computers, Wi-Fi and printing
- Staff assistance for external users
- Access to government documents (for repository libraries)
- Interlibrary loan

Figure 2 provides numbers of libraries offering these privileges to external users. Variations may include exceptions for certain user types, for example,

Fig. 2: Library privileges for external or unaffiliated users.
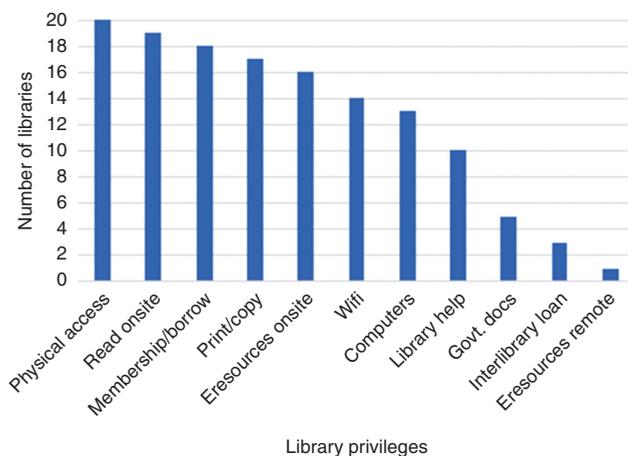
students from universities that are not part of a reciprocal borrowing scheme may not be eligible for borrowing library material. Physical building entry is available to external users in all twenty libraries, but sometimes with restrictions or conditions. These include no access to specific collections, particularly during exam times, or access only on weekends (e.g. for other higher education students). An ID card is required for entry to library buildings in at least four libraries (this information can be difficult to ascertain). Some libraries may not allow the general public access for study purposes only, in other words, for the use of desk space or computers. All but one library do not allow remote access to electronic resources because of licensing restrictions. On site access is available for external users in the majority of libraries but is usually limited to a subset of free and specific negotiated databases. Interlibrary loan is extended to external users in three libraries. External visitors in two libraries do not have the option of borrowing privileges, but are able to read and browse material onsite.

4.3. Fees and Unaffiliated Access Restrictions

In order to distill more granular distinctions relating to openness in terms of fees for access and physical access we identified and analysed further

available data relating to user categories and fees and the presence of access restrictions. This led to the following additional questions:

- Are fees charged to all unaffiliated persons?
- Are any members of the public excluded from access?
- Do restrictions on physical access to libraries exist?

This greater focus on access for the unaffiliated public highlights three key points of difference that separate the libraries' positions on openness:

- access or membership is available for the general public or community
- membership is provided free of charge to the general public or community
- physical access to library buildings and/or collections is not restricted

Figure 3 shows how the libraries perform in relation to the above points: the number of libraries offering public access; specific types identified within the category of external users, and if fees were charged for each of these categories. The final bar in the chart represents libraries with physical restrictions in place, such as ID card requirements.

Fig. 3: External, public membership categories and fees charged; physical access restrictions.

Public membership categories, fees charged; physical access restrictions
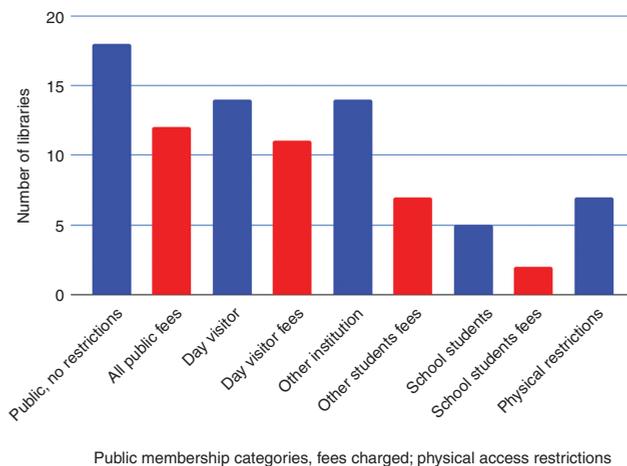
Some libraries charge multiple fees by category type. For example, two charge separate fees for both annual membership and for day visitors. Several libraries restrict membership to state or national residents. School students are excluded through under-eighteen restrictions at four libraries, and access is limited to senior high school students only (for a fee) at another.

As highlighted in the literature review discussed above, reasons for fee charging are not provided, raising questions about such practices, such as:

- Are fees for access and membership levied for cost recovery or to supplement income?
- Do fees act as a deterrent or a means of managing demand?
- In countries where free, open access is extended to the unaffiliated public are academic libraries better funded?

Only one library is open to the public with no exceptions, does not charge fees and has no stated physical access restrictions. Two other libraries have the same conditions but with age restrictions. From the selection of twenty universities these three present the most open library access policies, suggesting a commitment to community access and knowledge openness. They are in medium to large publicly funded research universities located in three separate countries.

5. Open Access

5.1. Institutional OA Positions

To further explore the library access policy as a proxy for institutional openness we correlated institutional library access policies with institutional positions on OA publishing. We identified three policies or practices that indicate a commitment to facilitating open access to research publications. From university websites and directories, we retrieved OA policies, confirmed the presence of institutional repositories, and the availability of OA publishing funds for researchers at each of the selected institutions. Institutional OA funding assists researchers to publish openly and is an example of commitment to OA publishing, although some universities observe green only OA policies and do not support providing OA funding for article or book processing charges (APCs, BPCs).

Fig. 4: Open access and library access features present at each institution.
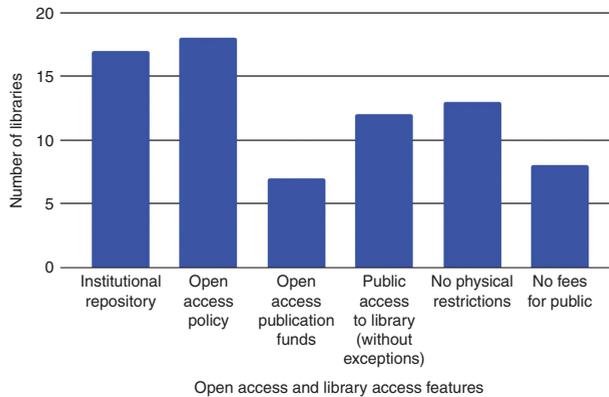
Across all institutions, the presence of OA features is slightly higher than library access features for the selected universities, as shown in Figure 4.

The majority of institutions (17) in the study maintains an institutional repository for the deposit of scholarly output, including manuscripts for book and journal publications, conference papers, technical reports, learning objects, theses, datasets, media and creative works. Eighteen universities provide details of an OA policy specifying an institutional position that may:

- recommend or require repository deposit;
- recommend where to deposit;
- recommend a green (self-archiving) or gold (publication) route; and
- specify the length of time to deposit after publication.

Seven universities offer some funding support for researchers to publish in peer reviewed open access journals and books.

In terms of open library access, twelve libraries potentially offer unaffiliated access without specified exceptions, although some have qualifying conditions such as requiring individuals to provide details of intended research. Eight libraries do not charge fees for access and/or use by members of the public who are not affiliated with the university (or do not publicise such fees). As shown in Figure 1 above, some libraries have institutional access agreements with external organisations such as government departments, local businesses,

cultural organisations, and many participate in reciprocal borrowing schemes with institutional libraries within the same state, region or country.

5.2. Open Access and Library Access Correlation

To extend the OA analysis further, we include a publication data dimension in addition to open access and library access policy features. This component is the percentage of open access publications for the selected institutions published in 2017, as calculated by the Curtin Open Knowledge Initiative team. In our analysis, items with DOIs from the Microsoft Academic, Scopus and Web of Science databases are cross-referenced with the same DOIs in ImpactStory's Unpaywall and Crossref databases to determine OA statuses of green, gold, bronze and hybrid. Using these different sources, we aim to provide a broad disciplinary and geographic coverage of research publications and mitigate the biases of single sources of data.

We established a scoring system whereby each institution receives one point for each of the open access policy features (a policy document, statement on open access publishing funds, presence of an institutional repository), and one point for each of the library access policy features (public access, no fees, no physical restrictions), giving a possible score of 0–3 for each university. Table 1 shows the results of this scoring; table entries are sorted by percentage of open access publications (rounded to whole numbers). Although the scores report on a limited set of features, the data reveal some insights about institutional positions on openness.

Across the twenty institutions, library access scores are lower than the OA policy scores, with only four libraries attaining a score of three for library access. Seven libraries score three for overall OA features. As may be expected, the four libraries with the highest percentage of OA publications (72%, 70%, 56%, 55%) also reach a score of three for OA policy features indicating coordinated support for OA publishing. In contrast, the library access scores are lower, suggesting limited correlation between OA publishing and open library access.

To further understand the interactions between library and open access we graphed the correlations between the three data elements for each library.

Table 1: Percentage of open access publishing (2017), open access policy features and open library access features scores by institution.

Institution by country/continent	% Open access publications 2017	Open access policy features	Library access policy features
UK 1	72	3	0
UK 2	70	3	2
Europe 3	56	3	2
North America 3	55	3	2
Europe 5	53	2	2
Europe 7	53	3	1
Europe 2	52	2	3
Europe 4	52	2	3
Africa	51	3	0
North America 2	50	3	1
Europe 1	46	2	2
Europe 6	45	2	2
Australia 1	41	2	2
Australia 2	40	2	3
Asia 1	38	1	1
North America 1	37	1	1
Asia 2	36	1	0
Asia 3	35	2	1
Asia 4	25	2	1
Asia 5	22	0	2

The limited correlation between library access, OA policies and OA publishing is illustrated in Figure 5.

Although on two different scales, the top two graphs in Figure 5 show the percentages of OA publications and the OA policy scores are reasonably consistent in terms of shape/size for each institution. In the bottom graph, the Library access scores show more variation in contrast to both the OA scores and the OA publication percentages in the top two graphs. Figure 6 further illustrates the scope of variation among institutional OA publications, in the middle, Library access policies on the left, and Open Access policies on the right. This suggests inconsistent coordination between OA investments by universities and library access, and the intentions expressed by the two policy actions have not been applied in similar directions, in other words to reach the same ends. In the context of institutional openness, this presents opportunities for universities to examine and bring together aspirations in

Fig. 5: Percentage of 2017 OA publications, Open access scores and Library access scores for each university. Source of OA publications data: Microsoft Academic, Scopus, Web of Science, Unpaywall, Crossref. Curtin Open Knowledge Initiative, 2019.
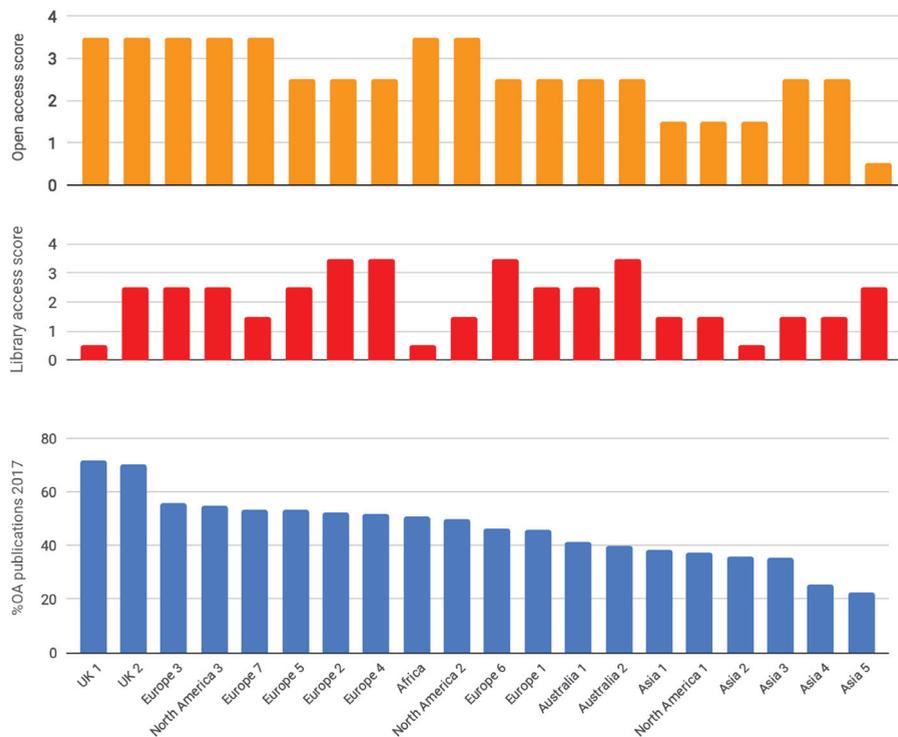
the knowledge sharing space. OA output performance is affected by factors such as national policies, research funder mandates and the nature of institutional policies (recommend or require), but both OA and library public access contribute to the progress of an open knowledge institution. The correlation of OA policy intentions with OA performance is the subject of further research by the Curtin Open Knowledge Initiative.

A statistical analysis using Spearman's rank correlation coefficient examines the predictive association between each of the variables of OA policy, library access policy scores and the percentage of OA publications, for each institution. As expected, OA policy has a positive relationship with OA publications ($\rho = 0.76$), whereas the library access policies show a lower correlation with the percentage of OA publications ($\rho = 0.16$). Although the dataset is small,

Fig. 6: Library access scores, institutions by percentage of 2017 OA publications, Open Access scores. Source of OA publications data: Microsoft Academic, Scopus, Web of Science, Unpaywall, Crossref. Curtin Open Knowledge Initiative, 2019.
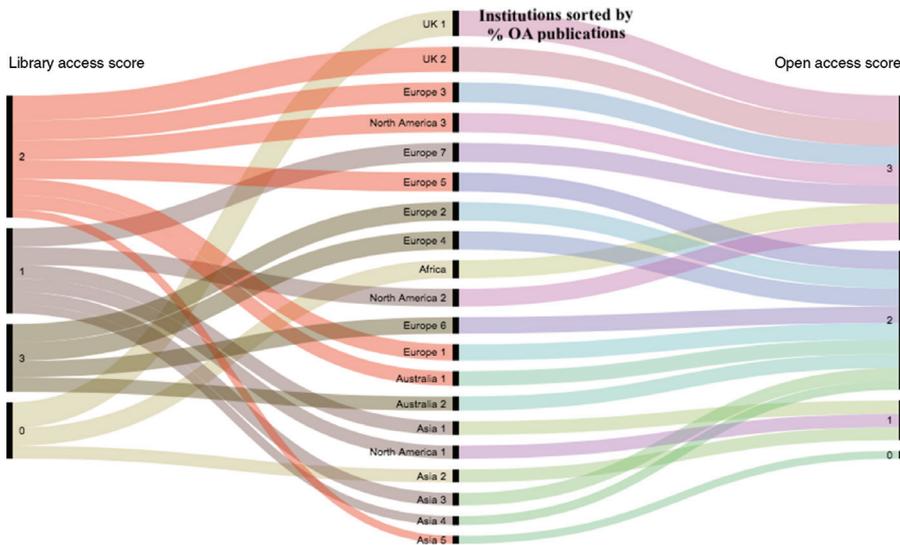
the analysis confirms that OA policies are more predictive of OA publications than library access policies. This indicates that OA policies do have a direct effect on the narrow aspects of public, unaffiliated access provided through online availability of formal publications, but are not necessarily associated (within the universities in this selection) with delivering on a commitment to broader access to knowledge.

6. Discussion

6.1. Openness of Libraries

In undertaking this study, we sought to explore and understand the openness commitments of academic libraries to members of local unaffiliated communities and to wider, global research communities. This aims to facilitate conversations about universities and openness as part of the Curtin Open Knowledge Initiative. Acknowledging the key role of academic and research libraries in promoting and enabling institutional OA publishing we have

explored the relationship between a university's support for open access and a library's capacity to invite the unaffiliated public to use its resources.

All libraries selected for this study specify a range of external users who may or may not visit, use and read library resources, apply for membership and join the library, with a scale of annual, monthly, weekly or daily fees. Some libraries have service level agreements extending privileges to other institutions, local cultural organisations, businesses and members of local, regional, national and global research communities. However, variations in the extent of access emerge. Restrictions for external users may reflect a number of factors. These include: the nature, extent and value of library research material collections; available study space and equipment; the exclusivity or privacy of institutions; the local population size; geographic location and neighbourhood (urban, highly populated, regional): and the volume of requests for access from organisations and individuals. Details about external membership or access on library websites is sometimes difficult to locate, or limited. This can be interpreted in three ways: 1) access is not an issue (libraries are open to all); 2) libraries are not open to the public and this is an established and well-known practice; or 3) the library does not wish to display such information or has not needed to formulate levels of access.

We can only surmise the reasons academic libraries choose to implement access restrictions, as this information is not provided, except in broad terms of priority given to institutional users expressed in mission statements. Some reasons are discussed in the literature. Changes to access policies and user categories may develop in response to particular problems or situations. Campus unrest, theft, damage to buildings, material and personal belongings, and security incidents can lead to physical building access restrictions (Ajayi, 2007; Leuzinger & Marnane, 2004). Libraries have valid reasons for enforcing physical restrictions, and most offer options for users in acceptable categories to obtain library or ID cards enabling entry to the library. However, the security requirement for ID cards to enter library buildings at some universities was often difficult to locate on web pages, buried in a news item if recently implemented. High demand for access may lead to the exclusion of the unaffiliated from particular collections in order to ensure access by the primary clientele (for example, law and health), and in peak use periods such as during exams. Influxes of certain population groups, for instance, high school students, may result in their exclusion. Lack of clear notification and policy detail on public websites with links to access options; inconsistencies

in terminology, and difficult to find information on websites can be a deterrent to potential external users with research needs.

Economic or financial impact on shrinking budgets is a key reason for imposing access and joining fees for external users, as discussed in the literature, particularly in the 1990s. However, with limited detail and evidence of such costs in studies this is difficult to assess. Community access to university libraries came under pressure as scholarly communication made a shift into digital formats. Libraries grappling with rising journal subscription costs began to place greater focus on their core communities, prioritising access to resources for academic faculty. staff and students. Electronic resource subscriptions make distinctions and place restrictions on unaffiliated users. At the same time, the OA movement offers alternatives to high journal costs for institutional libraries through extending open access to publicly funded research.

This study suggests a disparity between the dimensions of institutional positions on open access and library access for the unaffiliated. Open policies and concomitant funding do not always appear to flow through and coordinate across an institution. Restrictions on library access for people without institutional affiliation through the delineation of levels of user categories, practices and privileges emerged as a key differential factor within the academic libraries, i.e., as an indicator of openness. This may reveal an issue of access on a physical scale, whereby managing multi-dimensional human access is perceived to entail more in terms of support and associated costs than technological open access. A cost-benefit analysis could provide more insight. While the OA scores and OA publication levels reflect some consistency geographically, we see greater variation in the library access scores (see Figure 5).

### 6.2. Geographic Differences

In the first iteration of this study, we began investigating the notion of open academic library access as a proxy for institutional openness with twelve libraries. We expanded the current study to select more institutions globally in order to explore geographic patterns of similarity or difference in library and OA policies and practices. Table 1 above shows the differences between open library access, OA policies and OA publishing percentages for the selected institutions. For open library access the results are scattered

geographically. One European and one Australian university library scored three for library access; the others are in the middle, with some Asian, North American and United Kingdom libraries scoring in the lower range of one to zero. This suggests more variation at the country level, reflecting local and national imperatives and conditions. Countries with smaller populations, or national policies supporting equal library access more widely, may provide funding in support. Within larger populated countries, wider library access may not be a national priority or a tradition. Policy decisions about access may be made at the level of individual institutions in response to local conditions. Drivers such as cultural traditions and national approaches to learning compete with budgetary priorities geographically.

In terms of OA publishing practices and policy support, the United Kingdom, Europe and North America are highest, followed by Australia and four countries in Asia. A similar geographic pattern emerges from the analysis of OA publications for 150 institutions undertaken by the Curtin Open Knowledge Initiative group. Figure 7 shows the percentages of green and gold OA publications by regional groupings.

The higher green OA percentages in Europe reflect the policies in this region. Europe and the United Kingdom have promoted green open access, open science policies through programs such as the UK Research Excellence

Fig. 7: Global percentages of green versus gold OA publications by region, 2017. Data collected by Curtin Open Knowledge Initiative, 2019.
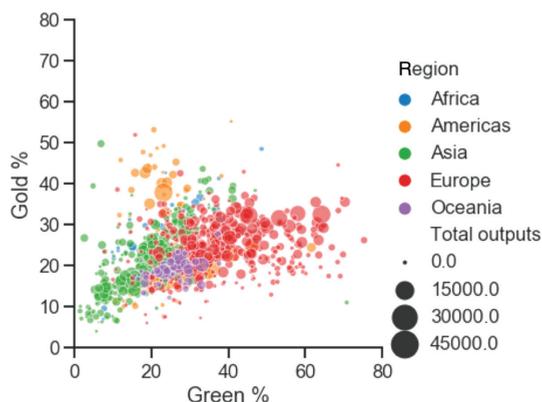
Framework (REF), and Open Science in Europe. The higher gold percentage points in the Americas are from Latin America, reflecting the success of the Scientific Electronic Library Online (SciELO) network, in operation since 1998, with a high level of independently published open access journals (Packer, Cop, Luccisano, Ramalho, & Spinak (Eds.), 2014). The majority of institutions in Asia, Australia and New Zealand (Oceania) are grouped in the lower to middle ranges. In China, where the "serials crisis" is less evident than in the West, the open knowledge model focuses more on national than institutional open access repositories (Montgomery & Ren, 2018). In Australia, the two major funders, the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC) have OA mandates for publications reporting on publicly funded research, but OA percentages are low. The Australasian Open Access Strategy Group (AOASG, 2019) advocates for Open and F.A.I.R. Australia and New Zealand research and for national strategies, but currently both countries lack such strategies at the policy levels of all universities or government.

6.3. Limitations and Challenges

In this study we investigate library access to twenty academic libraries in fifteen countries as a potential indicator or proxy of institutional openness to knowledge. To understand the coordination between university approaches we correlate library access positions with OA policies and percentages of OA publications. The intention is to explore the usefulness of unaffiliated library access as an indicator for universities to evaluate overall levels of openness. The study does not judge or compare universities' library access and membership policies, but points out the impact, intentional or not, policy restrictions can have on access to knowledge and institutional positions on openness. Similarly, reasons for universities adopting measures in support of OA publishing are complex and we do not imply judgement on institutional choices.

Understanding the institutional positions on library access involves textual analysis of policy and related documents. The language and terminology used in library policy documents and websites varies by country and region, particularly in relation to academic library access and membership. In library terminology, the term 'access,' in multiple languages, has a more

technological meaning in terms of accessibility (Wätjen, 1999), and not necessarily in relation to using a university's library. The information is often expressed in library regulations and rules documents, webpages, and documents outlining membership and borrowing. Similarly, academic library policies adopt a range of terminology to identify users who are external to institutions and not registered as faculty, staff or students. Terms include unaffiliated or non-affiliated users, external users, non-institutional borrowers, community members, members of the public, visitors, day visitors, visiting researchers, visiting readers, external readers, individuals. Open access terminology is more straightforward: either open access or open science (in translation and sometimes in English).

Linguistic and terminological variations in the cross-categorisation of textual data are challenging but not insurmountable. We continue to enhance the multilingual scholarly communication lexicon, benefitting from the contributions of others in the scholarly communication field (Lexicon Contributors, 2018). This is helpful in constructing web searches and addressing institutional and linguistic variations, together with translation services and sources. The availability, accessibility and comprehensiveness of sources contribute to the understanding of institutional intentions.

7. Conclusion

7.1. Is the Library Open?

Accessibility to research is growing through open access scholarly institutional and disciplinary repositories globally. However, this represents only a small proportion of the research output held physically in academic libraries (books, archives, manuscripts, print journals). Constraints on unaffiliated access to libraries through membership, fee-charging and visitor policies can restrict usage of non-open access current and older material in which research interest may persist. A large amount of legacy, pre-open access research output held in academic libraries may be restricted through multi-layered library access policies. Fee-charging for physical access to libraries and for borrowing privileges applied to unaffiliated users suggests economic barriers to knowledge. This is in contrast to funded institutional OA publishing, and to the OA movement's principles of removing barriers (Chan et al., 2002).

Fig. 8: Curtin Open Knowledge Initiative theoretical model of change through coordination, communication and diversity.
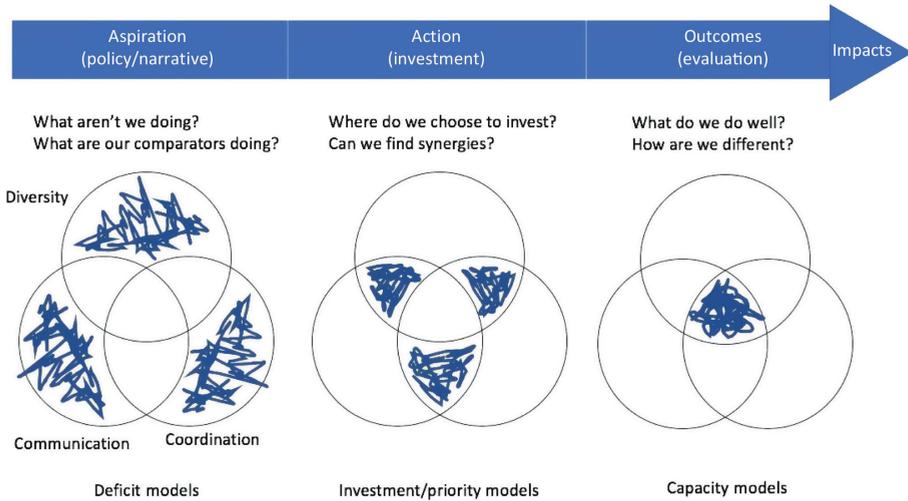
The impacts on academic library budgets and usage from electronic resources subscriptions have driven a wedge into the accessibility to knowledge. The OA movement and individual universities challenge publisher controls over who can read published research. However, as this study finds, library access policies do not necessarily correlate with institutional positions on open access to research publishing, expressed through policies, institutional repositories and the extent of open access scholarly publications. In terms of the larger Curtin Open Knowledge Initiative project, this research contributes to understanding the process of institutions moving towards openness through cultural change (see Figure 8).

7.2. Ongoing Research

As the Curtin Open Knowledge Initiative project continues, we are extending the library access analysis to include more institutions worldwide using the types of openly available data identified in undertaking this research. This involves retrieving on a larger scale relevant documents relating to unaffiliated access to academic libraries and open access publishing policies and

practices. Ultimately this can present opportunities for institutions to develop holistic narratives of investment by coordinating policies and practices about what knowledge openness means for universities. One aim of this study is to investigate the availability and the feasibility of obtaining information relating to the openness of academic libraries. We acknowledge the challenges of undertaking such an exercise internationally, and we invite collaboration, contributions and comment on the research. Further, we plan to share data with individual institutions to review to ensure the quality and accuracy of the data. This is consistent with the project's principles of sharing analysis of open access performance with institutions.

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